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Chapter XX. OXCART Program

Xeroxed copies of the following documents forwarded through SS/OSA to DDS&T Management Staff for Mr. Colby's review re Victor L. Marchetti book on 14 January 1974:

1. Comparison of SR 71 and A-12 Aircraft; COMIREX-D-12.1/1, dated 26 Sep 67, (BYE-5658-67)

2. DCI Briefing for Rivers Subcommittee. 20 Jul 67.

3. DCI Briefing for Russell Subcommittee. 17 Nov 67.

4. DCI Briefing for Mahon Subcommittee. 19 Sep 67.

5. 303 Minutes; 13 Mar 69, (BYE-12,126-69).

6. 303 Minutes dated 20 Dec 67 (BYE-82,190/67 Series B).

7. Exerpt from 303 Minutes dated 17 Nov 67 (BYE-82,189/67 Series B).

8. Exerpt from 303 Minutes dated 6 Oct 67.

9. Exerpt from 303 Minutes dated 31 May 67 (BYE 66738/67 Series C).

10. 303 Minutes dated 18 May 67 (BYE-66,736/67 Series C).

11. 303 Minutes dated 27 Jun 66 (BYE-67,018/66 Series B).

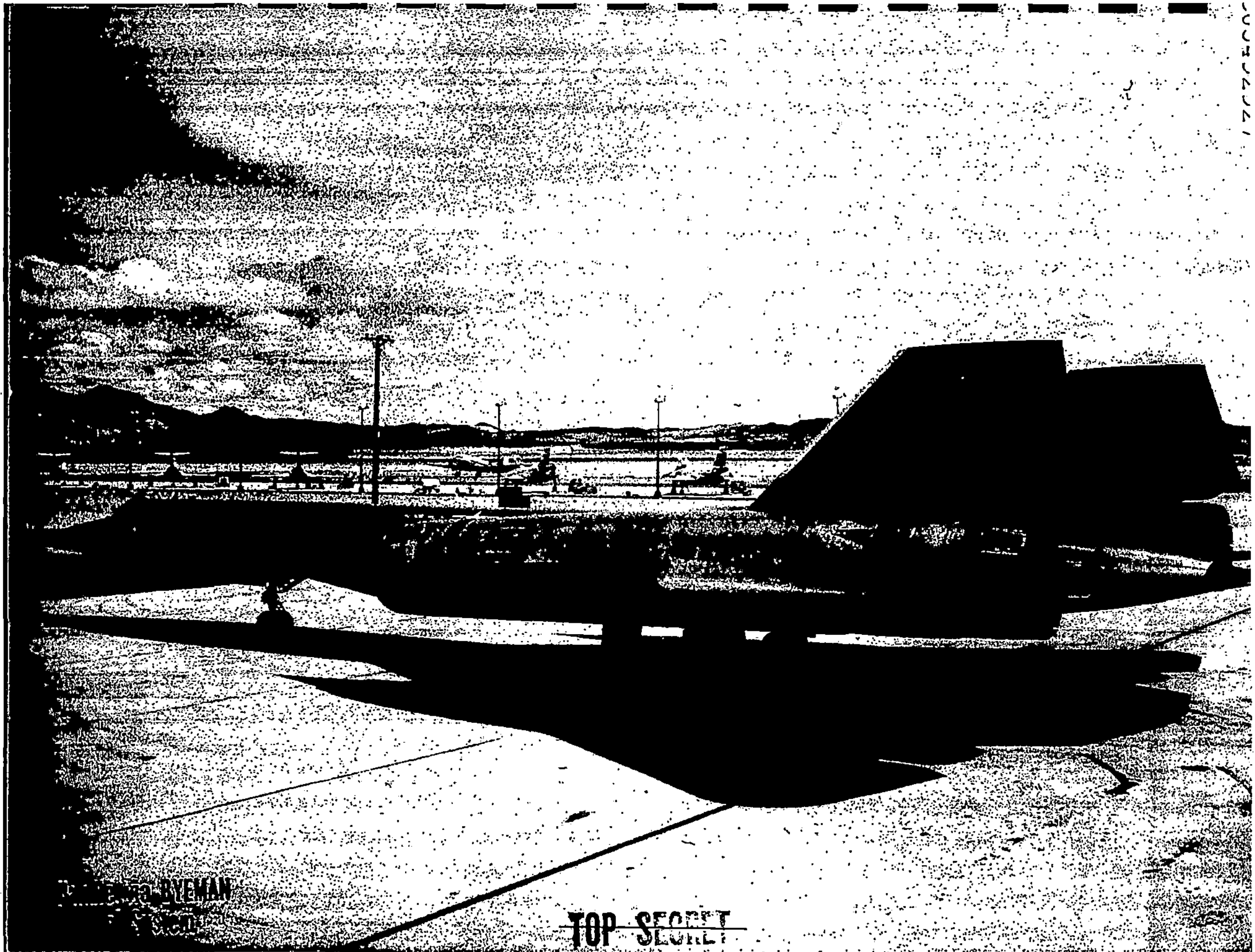
12. 303 Minutes dated 12 May 66 (BYE-66,704 Series C).

13. 303 Minutes dated 29 Mar 66 (BYE-66,703/66 Series C).

14. 303 Minutes dated 21 Feb 66 (BYE-66,701/66 Series C).

15. 303 Minutes dated 25 Jan 66 (BYE-63,003/66 Series C).

Withheld under statutory authority of the Central Intelligence Agency Act of 1949 (50 U.S.C., section 403g)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CHAPTER XX. PROJECT OXCART

Introduction to U-2 Follow-on Vehicle

Shortly after the operational commitment of the U-2 in June 1956, research was begun to improve its survivability and extend the program's lifetime. The outgrowth of the early studies became a sub-project of AQUATONE and was called Project RAINBOW. Early estimates of a high probability of success in U-2 overflights were based on the U-2's operating altitude. Its high penetration and operating altitude was expected to diminish the possibility of detection and accurate tracking by hostile defense systems. Unfortunately, the Soviet air defense warning system proved up to the challenge. The U-2 was not only detected by radar as it penetrated denied territory, but was tracked quite accurately in its earliest flights over Satellite and Soviet areas. This state of affairs could only lead to intensification of Soviet defensive efforts, and the consequent shortening of the U-2's usefulness as a reconnaissance aircraft.

Thus in July 1956, attention turned to anti-radar research. Dr. Edward M. Purcell of Harvard University had discovered a possible means of countering or absorbing radar emanations. His discovery led to laboratory work in techniques to blanket portions of the aircraft with radar absorptive materials in order to reduce radar detection. If fruitful, the technique would greatly enhance the U-2's prospects of continuing its reconnaissance role beyond the current predictions which were from eighteen months to two years.

Project RAINBOW laboratory research and testing was conducted under the auspices of the Scientific Engineering Institute (SEI), Cambridge, Massachusetts, a CIA proprietary research organization. Field testing was performed by the firm of Edgerton, Germershausen and Greer, Inc., (EG&G), at Indian Springs Air Force Base, Nevada. Flight testing results proved more promising than originally anticipated. Several RAINBOW-configured aircraft were deployed to Detachment B at Adana, Turkey, in 1957 and flown on operational missions with some degree of success in disrupting Soviet tracking of the missions.

It became apparent, however, in mid-1957 that radar camouflage of a conventionally-designed and structured aircraft had its limitations. The weight and bulk of absorptive material imposed performance penalties on the aircraft. The narrow-band limitations of the camouflage technique could not cope with the frequency spread employed by the Soviet air defense warning system. Laboratory testing and measurement continued, but operational employment terminated. The next step was taken in August 1957. Since a satisfactory solution to the radar problem could not be obtained using conventional design aircraft, a new approach appeared necessary. Focus turned to the feasibility of a reconnaissance aircraft designed to a greatly reduced radar cross-section specification as the primary objective. Exploratory work in this direction, and subsequent efforts, came to be known within the Agency as Project GUSTO.

The course of action proposed for Project GUSTO is quoted from a position paper prepared by Mr. Bissell for a meeting with the Deputy Secretary of Defense, Mr. Donald A. Quarles:

"a. The program of studies, measurement and experimentation will be carried forward with all possible speed, in conjunction with further work on the RAINBOW camouflage, looking toward the choice of a design approach for a possible new aircraft within three months' time. The work will be under the technical direction of the above-described scientific staff in Cambridge with actual systems responsibility remaining in the AQUATONE Project Headquarters in Washington, D. C.

"b. During this phase, contact will be made with certain manufacturers as appropriate in order to explore the possibilities of unconventional materials and structures and receive the benefit of their views on the general design problem.

"c. It is proposed to maintain more continuous and more intimate contact than hitherto with appropriate components in the Air Force and the Navy.

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"d. Appropriate steps should be taken to control discussion with manufacturers in the aviation and electronics industries and actions such as the issuance of formal requirements which might stimulate unusual interest in the concept of a non-radar reflective aircraft.

"e. As soon as it is possible to select the optimum design approach for a low reflectivity reconnaissance aircraft and to evaluate with reasonable reliability both its feasibility and its performance, a Governmental decision should be made as to the advisability of a crash program to produce eight to twelve such vehicles." 1/

In a memorandum to the DCI, 26 November 1957, Mr. Quarles wrote that the Defense Department was in agreement with the purpose of the activities at Cambridge, and expressed a desire to participate in a definite design project decision at the appropriate time. 2/ Thereafter, joint Agency-DOD sponsorship characterized policy and decision-making leading to the development of a follow-on reconnaissance system.

In early 1958, the President's Scientific Adviser, Dr. James R. Killian, recommended that feasibility studies get underway on an advanced manned reconnaissance vehicle.

1/ ~~TS~~-164671, 19 November 1957, Proposed Advanced Reconnaissance System. See Annex 121.

2/ ~~TS~~-164678, 26 November 1957, Memorandum for Mr. Allen Dulles from Deputy Secretary of Defense, Donald A. Quarles. See Annex 122.

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The President concurred in the recommendation, laying emphasis on the security requirements such an undertaking would impose. Mr. Bissell was requested to take action. In May 1958, Mr. Bissell formed an advisory panel composed of Dr. Edwin H. Land, Chairman, and Drs. Purcell, H. Guyford Stever, Courtland D. Perkins, and Mr. Allen F. Donovan, Mr. Richard Horner, Assistant Secretary of the Air Force for Research and Development; Mr. Garrison Norton, Assistant Secretary of the Navy for Research and Development; General Ralph P. Swofford, USAF; Colonel Norman C. Appold, ARDC; and Mr. Bissell completed the Advisory Panel membership. A series of meetings were scheduled for 1958 to consider the technical features that must be achieved in order to provide an adequate successor to the U-2. The panel was to report its findings to Dr. Killian upon completion of its examinations and make recommendations as to the type design it determined would meet the requirements for the next generation reconnaissance aircraft.

As noted earlier, technical direction of the new thrust in combating the Soviet electronic threat remained with the Cambridge facility. Principals in the redirected effort were SEI, EG&G and Lockheed Aircraft Corporation (LAC). SEI turned its energies to theoretical aerodynamic models having minimum radar cross-section characteristics. It engaged in wide-ranging experiments in shape control, model design analysis, and unconventional materials. Laboratory calibration and measurements were conducted on radical and exotic model designs to assess their effectiveness in radar cross-section reduction. EG&G continued to operate the radar testing range at Indian Springs Air Force Base, Nevada. Project Headquarters had earlier, in support of Project RAINBOW, installed a hydraulic lift, radars, antennae and associated equipment at Indian Springs. Measurements were made on scale models raised on the hydraulic lift. Lockheed proceeded to preliminary design work on a number of aircraft configurations and shapes, did wind tunnel testing, tested the effect of materials and shapes for reflective characteristics, and investigated substitute, non-metallic structures for portions of the airframe. Lockheed subcontracted to Narmco, Inc., San Diego, California, for studies of the feasibility of certain types of plastic and high-modulus fiberglass materials for possible use in the construction of the GUSTO vehicle. In addition, Lockheed was proceeding on an independent configuration design study for a new aerial reconnaissance aircraft as a replacement for the U-2.

The Convair Division, General Dynamics Corporation, Fort Worth, Texas, was approached for a proposal that would employ the B-58 as a mother aircraft capable of launching a small, manned reconnaissance aircraft.

There emerged in mid-1958 two general proposals, one from Convair and one from Lockheed. The former consisted of a high-Mach, high-altitude, small, manned vehicle, ram-jet powered, which would be launched from a B-58 aircraft. Lockheed proposed a pilot-launched, high-Mach, high-altitude, turbo-jet-powered, larger, manned aircraft. Both appeared capable of achieving desired operational specifications and within the desired development time frame.

The Land Advisory Panel met for the first time in Cambridge on 31 July 1958 to obtain preliminary views on possible successor vehicles. The group was briefed on the approaches undertaken by Project Headquarters, as well as on other advanced proposals submitted by the USAF. All military aerial reconnaissance projects in being or in study were reviewed. It was too early to make judgments on the merits of the various ideas, and no firm recommendation resulted from the first meeting. A second session was set for September 1958.

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At the second meeting of the Panel no design approach decision was made because it was felt there was need for still further investigation. One decision made by the Panel at its September 1958 meeting was to eliminate for the present any further consideration of Project CHAMPION, which was a joint Agency-Navy feasibility study (paralleling GUSTO) of a possible high performance reconnaissance aircraft. This radical departure from the conventional aircraft design proposed an inflated vehicle, ramjet-powered to Mach 3, possibly reaching 125,000 feet altitude. The study got underway after NACA strongly recommended to the Navy that it be pursued. Studies in connection with CHAMPION had been conducted by Convair, Boeing, Hughes, Marquardt, and Goodyear Aircraft Corporations. While the proposal appeared feasible, the five years estimated to develop the system made it least attractive to the Panel.

A final meeting of the Panel was held in Boston on 12 November 1958 and its findings were reported to Dr. Killian on 15 November substantially as follows:

a. The successor reconnaissance aircraft would have to achieve a substantial increase in altitude and speed; be of reduced radar detectibility; suffer no loss in range to that of the U-2; and be of minimum size and weight.

b. The Panel concluded that the small, lightweight aircraft launched from the B-58 appeared to be the most satisfactory design approach. It foresaw possible problems only in aerodynamic heating and in the air inlet system. As second and less desirable choice, the Panel selected a similar small, reasonably lightweight aircraft capable of unassisted take-off, but with slightly less speed and less than desired range.

c. The Panel recommended that system development be begun at once on an expedited and secure basis. It requested the prerogative of reviewing alternative systems should the Panel's choice prove to be unacceptable. 1/

Preliminary Presidential approval was then obtained to proceed with Project GUSTO investigations. Primary interest now centered on the supersonic, high altitude unstaged design proposal by Lockheed and the Convair design proposal parasited to the B-58 aircraft. The Convair design was especially configured to minimize radar return. The Lockheed design made no concessions in this direction which tended to compromise aerodynamic performance.

In December, 1958, Convair began work on a contract which called for initial studies, tests and preliminary design of a high altitude, supersonic reconnaissance vehicle to replace the U-2. It was to be a four-and-one-half months engineering effort and was funded in the

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1/ GUS-0070, 15 November 1958. Memorandum for Dr. James R. Killian. See Annex 123.

amount of $1,200,000. Concurrently, a contract was let with Lockheed for similar studies in the amount of $1,000,000.

The Marquardt Aircraft Company, Van Nuys, California, began preliminary engineering design studies and tests necessary to develop a ramjet engine which would be compatible with the airframe design proposed by Convair. It, too, was to be a four-and-one-half months endeavor which would result in model specifications of the engine and engine controls. The estimated cost of the contract was $2,500,000. Lockheed designing to this point had considered only turbo-jet propulsion systems, which were either in being or under development by the Air Force or Navy.

Additional studies were solicited from manufacturers of camera equipment, electronic equipment, and pilot protective assembly systems (pressure suits, oxygen sources, etc.). EG&G work at the range was extended in order to provide a testing capability for the cross-section models provided by the two airframe contractors. Continued consultant services were maintained with Narmco and SEI. This phase of Project GUSTO was expected to terminate at the end of June, 1959, and the total estimated cost was to be $5,420,000.

A comparison of the major design features of the two competing aircraft systems at this point in time follows:

	Lockheed	Convair
Aircraft designation	A-3	FISH
Speed	Mach 3.2	Mach 4.2
Range	3200 n.m.	3900 n.m.
Altitude	90,000 ft.	90,000 ft.
Launch system	Pilot-launch	From B-58
Propulsion system	2 turbojets	2 ramjets
Weight	95,000 lbs.	38,500 lbs.
Predicted first flight	January 1961	January 1961

It was difficult to compare the two vehicles from a logistics view since little was known at the time of the requirements for ground handling equipment, fuels, retrieval procedures, etc. In general, the A-3 appeared to be easier to handle on the ground; the Convair design appeared superior in meeting performance criteria.

Throughout the spring of 1959, Lockheed and Pratt & Whitney (P&W), as one team, and Convair and Marquardt as the other, continued their design, model construction and testing, structural investigations and other testing. Progress of both systems was closely monitored and reviewed by a joint Agency-USAF evaluation team. Both teams revised plans and designs frequently. By May, 1959, a summary comparison could be made of the two systems.

The Convair FISH design was a relatively small vehicle with a gross weight of roughly 40,000 pounds. The aircraft was to be staged from a B-58 mother aircraft, would fly a 4,000 mile range at a 90,000 foot altitude. It was powered by two 40-inch diameter Marquardt ramjets using JP type fuel. It was roughly 50 feet in length and 35 feet in wing span. It attempted to minimize radar reflectivity by configuration and special materials. Two small turbojets had been incorporated for the subsonic portion of flight following the ramjet powered supersonic flight segment. Its most serious deficiency was the inability of the current B-58A model to get through the transonic region of flight to get the required Mach speed for efficient ramjet operation (2.7 Mach). The next model, the B-58B, would be powered sufficiently to accomplish the task. Inlet and engine testing had not proceeded far enough at this point to surface major problems.

The Lockheed design (now designated the A-11) was powered by two J-58 P&W turbojet engines. It was 100 feet long, had a wing span of 50 feet, and would weigh 92,000 pounds at take-off. It was designed to fly 4,100 miles at 85,000 to 95,000 feet altitude. Its size made it more susceptible to radar detection, and its sonic boom effect was predicted to be more serious than the smaller Convair design. No serious aerodynamic problems were anticipated with the engine installation. There was need, however, to up-rate the J-58 engine to a Mach 3.2 performance and to develop the necessary afterburner. Lockheed by this time was proceeding to fabricate and test structural components using titanium.

On 18 May 1959, there was a CIA/USAF meeting to discuss the status and future planning with regard to Project GUSTO. General Thomas D. White, Chief of Staff, USAF; General Jacob E. Smart, Assistant Vice Chief of Staff, USAF; and Colonel Leo P. Geary sat for the Air Force, and Mr. Dulles, General Cabell, Mr. Bissell and Colonel William Burke comprised CIA representation. Mr. Bissell reviewed the status of both proposals, pointing out advantages and disadvantages of each. Mr. Bissell noted that there would be an Advisory Panel meeting in Dr. Land's office in Boston in early June, and that it would make recommendations regarding the proper course to take. The Panel's recommendations would be reviewed by the DOD, and a final system selection would result which would be taken to the

President for approval. At General White's request, a joint USAF-CIA working-level technical panel was formed. Its purpose was to provide the technical expertise in final system selection.

The Boston meeting did not result in a decision regarding the two vehicles. It was agreed that from an operational viewpoint, the A-11 with its 4100 mile range and increased altitude capability was highly desirable. It also had the advantage of conventional take-off and the ability to use a short runway. Its major design deficiency was that it would be tracked constantly. The Convair FISH, being a staged vehicle, was a much more complicated system to operate. On the other hand, the possibility of it's flying missions undetected was greater than that of the A-11. The technical experts on the Land Panel were concerned chiefly with aircraft design and radar cross section, not operational problems. The meeting ended with the conclusion that sporadic detection and tracking by radar must be expected regardless of vehicle. The Panel made no recommendations as to choice of aircraft, and the Agency/USAF briefing team returned to Washington to prepare a presentation for the President. Presidential approval was necessary to continue the GUSTO program.

The tempo of GUSTO activity quickened during the month of June, 1959. Systems selection meetings occurred with increasing frequency as the contractors submitted design changes and new approach concepts. Convair experienced a severe setback when procurement of the B-58B was cancelled by the Air Force. The small Convair design, staged from the B-58, had demonstrated success in aerodynamic testing and structural development. Radar testing had also shown good results. The cost and operational complexity of reconfiguring the older B-58A model mother aircraft now ruled out the FISH design. It would have been necessary to augment the B-58 with two additional engines in order for it to achieve the speeds for efficient ramjet engine ignition on the FISH vehicle. The small inventory of existing B-58A's further complicated matters, since the USAF was now extremely reluctant to give up any of its most advanced bomber aircraft for modification to a drone mother ship.

At a meeting in Mr. Dulles' office on 14 July 1959, attended by General Cabell, Mr. Bissell, Drs. Killian, George B. Kistiakowsky, Purcell, Land, Bruce Billings, and Franklin A. Rodgers, Project GUSTO was given a thorough review. It was decided that neither the Convair FISH design nor the Lockheed A-11 design met the

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criteria established for a successor system to U-2 reconnaissance. The group was advised that both Convair and Lockheed were interested in submitting new design proposals. Both designs were powered by Navy P&W J-58 turbojet engines and incorporated reduced radar return characteristics. It was accepted that a compromise was necessary between radar reduction attempts and maintaining good aerodynamic design. The group recommended that GUSTO be continued, but in the direction of the new design proposals by the two manufacturers. It was further recommended that the concurrence of the Secretaries of Defense and of the Air Force be obtained, and the joint view be communicated to the President.

On 15 July 1959, General Cabell and Mr. Bissell reported on GUSTO status, first to Air Force Secretary Douglas and General White, and then to Secretary of Defense McElroy and Under-Secretary Gates. Reaction was unanimous to go to the President and urge continuation of the program.

The President was briefed on 20 July 1959. Attending were Mr. Dulles, General Cabell, Mr. Bissell, General White, Secretary McElroy, Drs. Killian, Land and Kistiakowsky. The President approved the direction the study had taken, and he instructed Mr. Bissell, in consort with personnel of the Bureau of the Budget, to determine if the necessary funding arrangements could be made. Continuation now hinged on the availability of funds. A choice of contractors had yet to be made, but that would await final design proposal submissions.

Mr. Bissell reported to his staff on 21 July that a clear-cut go-ahead now awaited solution of the money problem, and that he would approach the Bureau of the Budget immediately. He also charged that highest security standards had to continue and that knowledge of future activities had to be restricted to a very limited number.

Mr. Bissell met with Bureau of the Budget personnel on 22 July 1959 to discuss financial arrangements. He indicated that approximately 90 million dollars might be needed in FY 1960 for obligation against the program. There existed 75 million dollars buried in the DOD budget which had been specifically reserved in the FY 1960 budget for continuance of Project GUSTO. Very wisely this proviso had been stipulated in a memorandum of understanding with the Bureau of the Budget on 16 December 1958.[1/] Mr. Bissell also gave estimates

1/ GUS-0073, 12 December 1958. Memorandum of Understanding, Funding of Project GUSTO, etc. See Annex 124.

of FY 1961-1962 requirements. The meeting ended with the understanding that necessary financial arrangements would be forthcoming to carry on the program.

One major step now remained before a full-scale development program could be entered. A choice had to be made as to which design proposal would be pursued. By mid-August 1959, the latest proposals from Lockheed and Convair were in hand. They were both unstaged aircraft proposals, differing only in external configuration. Both would reach an altitude of 90,000 feet, fly at Mach 3.2 and have ranges of approximately 4,000 miles. Their size, weight, and aerodynamic performance were very similar. Both had selected the P&W J-58 engine over the General Electric Corporation J-93 because the latter could not provide the high cruise altitude of the J-58. A comparison of their general characteristics follows below (data as of 17 August 1959).

	Lockheed	Convair
Aircraft designation	A-12*	KINGFISH
Speed	Mach 3.2	Mach 3.2
Range (total)	4120 n.m.	4000 n.m.
Range (at altitude)	3800 n.m.	3400 n.m.

* Designation changed to A-12 to distinguish it from the A-11 designator for the all-metal version proposed initially.

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	Lockheed	Convair
Cruise Altitudes		
Start	84,500 ft.	85,000 ft.
Mid-range	91,000 ft.	88,000 ft.
End	97,600 ft.	94,000 ft.
Dimensions		
Length	102 ft.	79.5 ft.
Span	57 ft.	56.0 ft.
Gross Weight	110,000 lbs.	101,700 lbs.
Fuel Weight	64,600 lbs.	62,000 lbs.

Radar Performance: Only limited small model testing had been conducted to this point. Predicted goals were similar with Convair appearing to be slightly better at S-Band frequencies.

Cost Summary*	Lockheed	Convair
12 Aircraft Program	96.6 million	121.6 million
First flight	22 months	22 months

On 20 August 1959, the joint DOD/USAF/CIA source selection group, upon recommendation of its technical advisers, chose the Lockheed design. Approval to proceed with initial development was

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* Exclusive of engine costs.

given to Project Headquarters under the direction of Mr. Bissell. Continuation of the Lockheed arrangement beyond initial development would depend on the success of design changes in the A-12 to reduce the radar cross-section to a satisfactory level. Two factors favored the choice of Lockheed. There was a substantial difference in costs of the two programs, Lockheed being the lower. The other was a confidence or experience factor. The experience Lockheed had gained in the "skunk works" type of operation in the U-2 program equipped it to launch into another highly classified program without attracting undue attention in the industry. Lockheed possessed a reservoir of labor that had been given security clearances and was readily available. Lastly, due to his success in developing the U-2 aircraft, much confidence reposed in Mr. Clarence L. (Kelly) Johnson and his ability to produce a new vehicle.

Notification was circulated to all persons associated with GUSTO that, effective 31 August 1959, all activities performed under that title had been terminated. This was to minimize the possibility of speculation about the creation of a follow-on program.

Early OXCART Development

Action on the decision to proceed on a conditional basis with the Lockheed design proposal was taken at once. A new operational security clearance category was established in a manner very similar to that which covered the U-2 program. The new project was called "OXCART". A demonstrated "need-to-know" requirement had to be established in order to obtain an OXCART clearance. Authority to approve clearances for military and civilian personnel was retained by the Project Director, Mr. Bissell. Clearance of industrial and supplier personnel was handled by the Project Security Staff in coordination with the technical management group. Only very highest ranking and key personnel from the Agency, DOD and elsewhere in Government who could make a direct and needed contribution were cleared and briefed in the early days of the program.

On 3 September 1959 a letter contract was issued to Lockheed Aircraft Corporation to proceed with anti-radar studies, aerodynamic structural tests, and engineering designs for the proposed A-12 aircraft. Four and one-half million dollars was obligated against FY 1960 funds. The contract called for construction of a one-eighth scale model for immediate anti-radar (AR) testing at the Indian

Springs facility; construction of required test facilities; construction of a full-scale model for follow-on AR testing; construction of an aircraft section of titanium; wind tunnel testing and so forth. Production of twelve aircraft was called for. This last item, however, was conditioned on the contractor's ability to reduce radar reflectivity, prove construction methods, and generally affirm that the design would meet the specifications desired for an advanced reconnaissance system. Production of aircraft would be subject to negotiation at a later date.

The requirement to conduct radar tests on a full-scale model raised problems. The hydraulic lift installed at Indian Springs was not capable of raising and lowering the full-scale model. Indian Springs did not afford the necessary security to prevent the model being seen by unauthorized persons. It was decided, therefore, to move the AR testing equipments from Indian Springs to another site where a heavier hydraulic lift and pole device would be installed to accommodate a full-scale model and, eventually, the aircraft itself. (See picture overleaf.) For reasons of security, access and accommodations, Watertown was selected (former U-2 training base). Since deactivation of the Watertown base in May 1957, it had remained in caretaker status.

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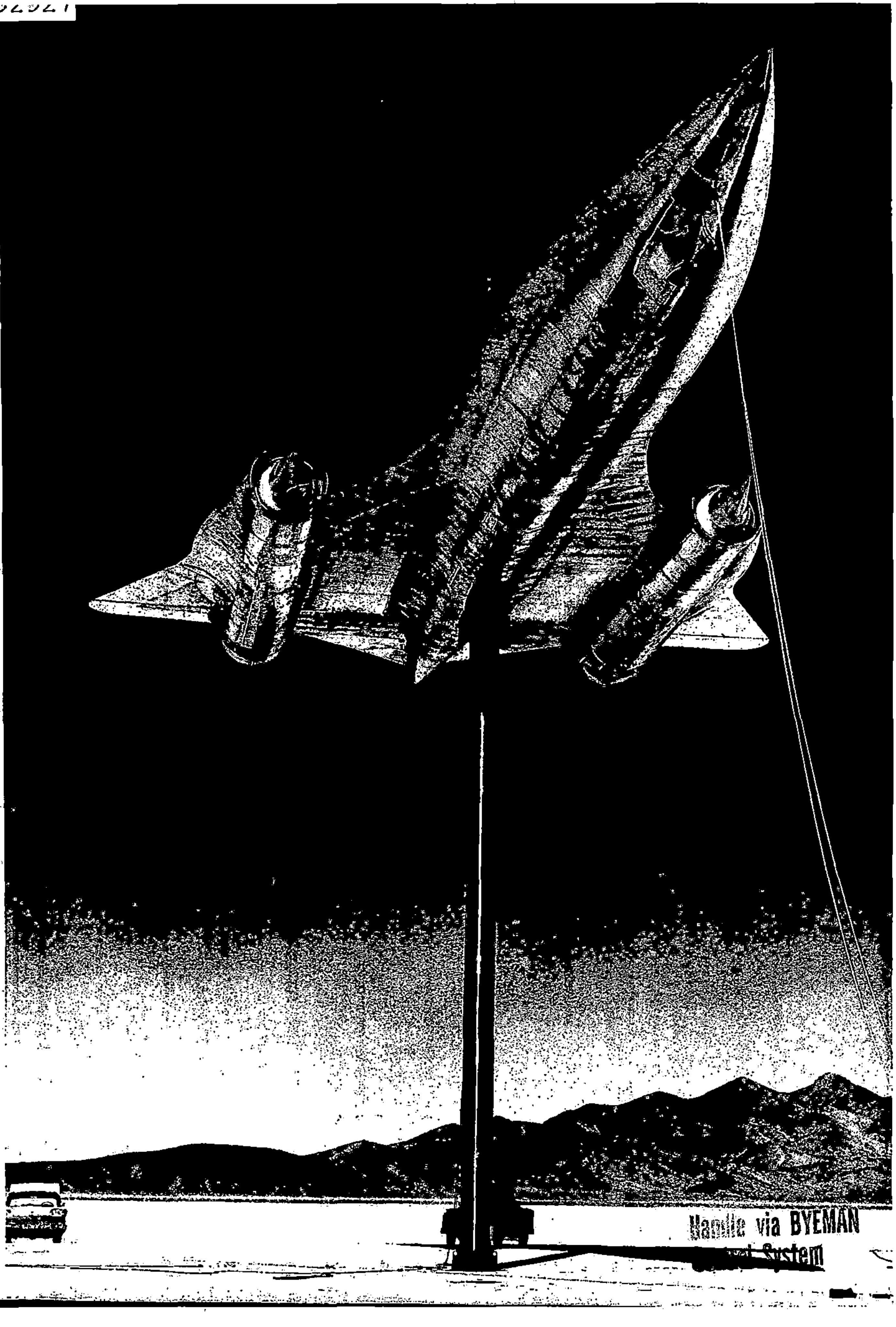
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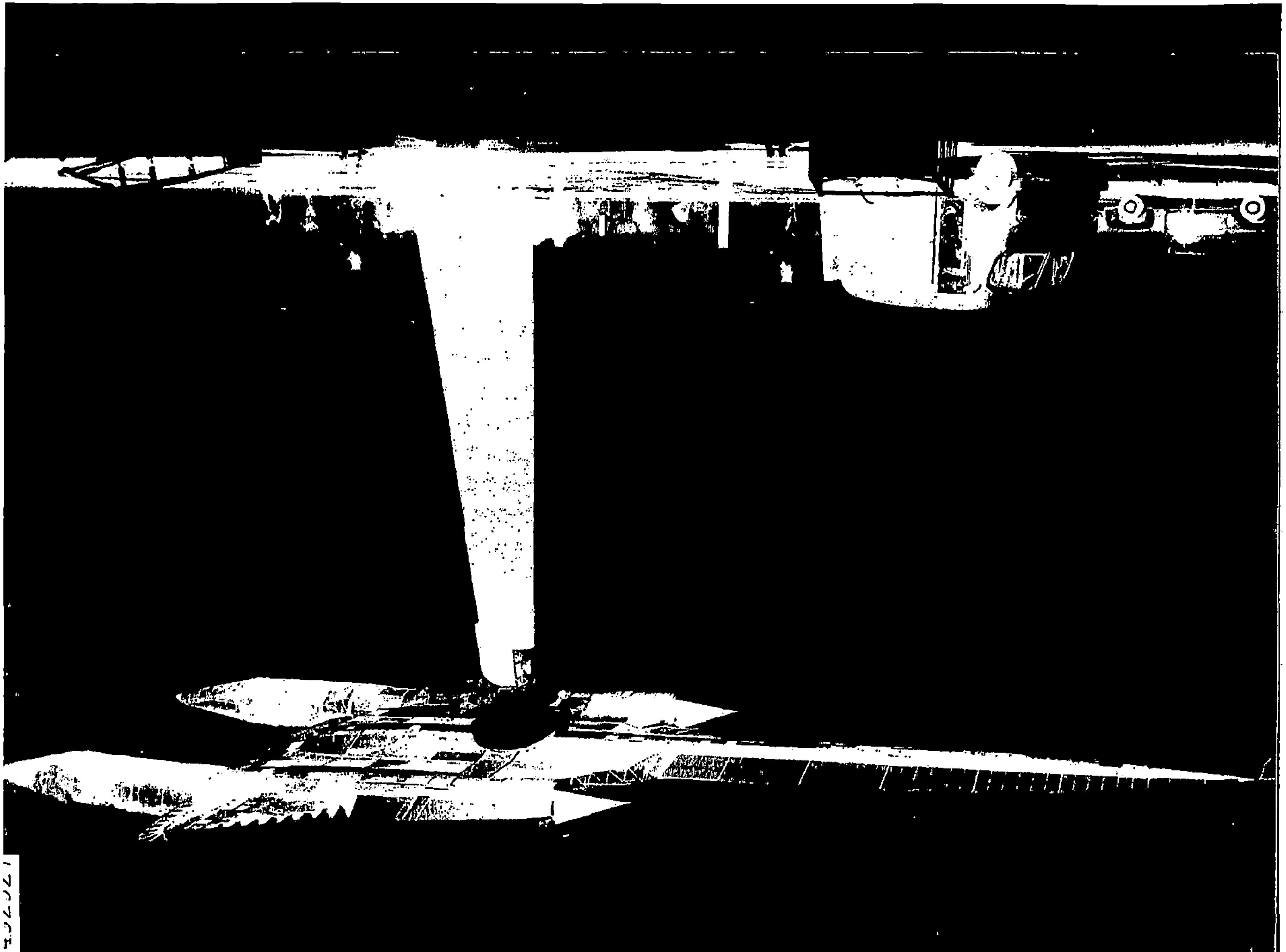

As scale-model testing continued at Indian Springs, preparations were underway to reopen Watertown. Appropriate arrangements were made with the AEC to reactivate the facility and necessary rehabilitation and construction got underway in October 1959. By late November the EG&G test range equipment had been moved from Indian Springs and the Watertown site was ready for AR tests of the full scale A-12 mock-up. The population of Watertown base approximated 75 persons, the majority being contractor personnel. The operation, under the command of an Agency staff employee, was begun on a crash basis and under austere conditions.

As the events described above were taking place, the Development Projects Division (DPD) moved forward in other areas. In addition to establishing a system of security, it was necessary to develop cover stories. The latter was no easy task as plausible stories had to be prepared, for example, to explain the new activity at Lockheed (as well as at other contractors' plants), and the reactivation of Watertown. This venture into beyond-the-state-of-the-art in aircraft development, if known in the aerospace industry, would quickly lead to speculation as to its true purpose and certain compromise of the concept.

A new memorandum of understanding was necessary with the Air Force to delineate areas of responsibility between the Agency and the USAF. In a letter to the DCI on 18 September 1959, General White, Chief of Staff, USAF, had written as follows:

"1. In view of recent events leading up to the final determination of a successor aircraft for the U-2, I am taking this opportunity to assure you of the Air Force's continuing interest in the project on the same joint basis as our participation in the U-2 program.

"2. In this regard, I refer to the original agreement of August 1955 which outlined and defined in rather broad terms the areas of responsibility of your Agency and the Air Force. I believe the intent of the basic concepts and organizational structure agreed to in this document continue to be valid. I feel, however, that after four years' experience and the somewhat altered circumstances in terms of time to the production of a suitable article and the November 1957 memorandum from Defense in terms of Air Force responsibility, that a review of this document would be profitable and insure an orderly continuation of the joint functions of the Air Force and Central Intelligence.

"3. I have directed Col. Geary to meet as soon as possible with your designated representatives to review our original document and suggest such changes or additions as would be mutually agreeable and beneficial." 1/

A classified contract was written with the Pratt & Whitney Division of United Aircraft Corporation to provide the propulsion

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1/ ~~TS~~-155247, 18 September 1959. Letter to DCI from Chief of Staff, USAF, Subject: U-2 Follow-on Program.

system for the aircraft. Development of the J-58 engine had been sponsored originally by the U.S. Navy for its own purposes. Navy interest in the J-58 development, however, was subsiding and a decision had been made by the Secretary of Defense to withdraw from the program at the end of 1959. At this point, the USAF agreed to assume sponsorship for continuing overt development, since the engine had application to certain proposed advanced USAF weapon systems. The covert contract was a necessary device under which the J-58 engine capabilities would be extended to the highly classified Mach 3.2, possibly Mach 3.5, performance at extremely high altitudes. Contract terms called for the assembly of three advanced experimental engines for durability and reliability testing, and provision of three engines for experimental flight testing in early 1961. Due to the long lead time involved in the manufacture of jet engine components, the contract with P&W actually called for delivery of hardware, whereas no decision had yet been made to proceed with the manufacture of airframes. The decision to build engines had to be made at this early date in order to meet Lockheed's projected airframe delivery schedule should a decision be made to proceed with production of A-12 aircraft.

During the GUSTO program, requests for camera systems proposals had been solicited from several camera manufacturers. Fairchild Camera, Hycon, Perkin-Elmer (P-E), and Itek had responded with design engineering proposals. An evaluation team from Project Headquarters and the Agency's Photographic Interpretation Center reviewed these and concluded in early 1959 that the P-E design was the best, and recommended it be chosen for the successor reconnaissance system. The Land Panel affirmed this view after reviewing proposals. P-E was given a new contract in October 1959 to begin engineering and design work for a photographic system for the OXCART program. The Firewel Corporation was asked to continue its studies in pilot environment requirements as was Narmco its work in plastics and other radar-absorbent materials. Eastman Kodak agreed to a feasibility study for a camera designed to OXCART operational characteristics. EG&G was performing the AR testing on the OXCART model, and SEI was providing consultant services pertaining to the radar cross-section reduction features of the A-12 system.

As the new year approached, developments in the OXCART program were reaching a stage when a final decision was required to engage in production. At an OXCART Suppliers' Meeting on 16 December 1959, Mr. Johnson stated that Lockheed needed a configuration freeze and go-ahead on a specific production figure in order to plan and implement tooling requirements effectively. Mr. Bissell agreed that such would be the principal subject, along with the radar cross-section problem, at the next such meeting in mid-January 1960.

On 20 January 1960, Mr. Bissell, in company with Agency and USAF representatives, met the Land Panel consultants to review the status of the radar cross-section of the A-12. The Panel was impressed with the progress made in the radar cross-section areas. It was predicted by Dr. Frank Rodgers of SEI that continued testing would achieve further improvement in reducing radar returns, a condition necessary to proceed toward the final design production decision.

However, at the OXCART Suppliers' progress review meeting the next day, Mr. Bissell focused on an increasing weight problem creeping into the A-12 design and the resultant altitude and range degradation. Mr. Johnson was directed to investigate the weight problem in order to provide a specified minimum range and altitude profile of the A-12. He was also asked to provide estimates of A-12 performance at Mach 3.5. He was advised that a decision concerning go-ahead would not be made until the information was in hand and evaluated. The weight reduction and minimum mission profile reported by Mr. Johnson several days later was considered acceptable. The Lockheed estimate of A-12 performance at a speed of Mach 3.5 indicated a slightly improved range and an extra 3,000 feet of altitude. On 30 January 1960 a firm go-ahead to produce 12 aircraft was communicated to Lockheed. The search for a manned vehicle successor to the U-2 reconnaissance system, begun in August of 1957, was now complete.

To this point OXCART Program Funding Approvals totaled $49,497,366 for FY 1960 ($44 million for engine development and initial production by P&W). Additional work and services resulting from the decision to build the A-12 was estimated to be approximately $44 million more for a total FY 1960 program approval of $93,780,000. When a request for the release of funds was submitted to the Bureau of the Budget, the question was raised by Budget personnel of further Presidential approval being necessary to continue the program. They were assured such was not the case. At the 20 July 1959 meeting with the President, the President had said substantially that the Agency had

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set itself certain technical goals which it was not sure it could attain. He further stated if these goals could be reached the project could proceed. Mr. Bissell had determined, at the time of the last technical reviews, that the President's guideline had been complied with, and that it would not be necessary for the Agency to return to the White House for further approval. Mr. Robert M. Macy, Chief of the International Division of the Bureau of the Budget, appeared satisfied with the information but requested a memorandum from the DCI to confirm the record. On 8 March 1960 the Director signed such a memorandum to the Director of the Budget. 1/

Lockheed's forecast schedule for delivery of A-12's called for first airframe delivery in April 1961 and the last in August of 1962. As prime contractor, Lockheed was given as much latitude as possible to insure the schedule would be met. The prime contractor was authorized, for reasons of security, timeliness in procurement, and over-all systems compatibility, to dispense with competitive bidding for airframe subsystems procurement, provided reasonable and prudent judgment was exercised in awarding such contracts. However, detailed records were to be maintained by

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1/ Attachment to OXC-0323-60, 24 February 1960. Bureau of the Budget Request for DCI Memorandum Concerning OXCART Presidential Approval. See Annex 125.

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the contractor regarding selections and evaluations. The rationale and authority for this procedure is contained in Annex 126.

The philosophy of management, developed and employed successfully in the U-2 program, was retained for the new program. The philosophy had been to select contractors carefully and to grant them maximum technical responsibility and authority to get the job done in accordance with contract terms and functional specifications. When faced with significant technical choices or changes having impact on funding, schedules or performance, the contractor would refer the matter to the Project Director for advice and/or decision. Technical progress of the contractors would be monitored by Headquarters by means of periodic reporting, supplier conferences and visits to contractor facilities. The monitoring responsibility rested in the hands of the Development Branch, DPD, who in turn reported to the Project Director, Mr. Bissell. The advantages of such a relationship between customer and contractor were several. Decisions could be made more quickly; direct channel relationship saved valuable time, and direct contacts stimulated greater effort and desire to achieve goals on the part of the contractors.

It is appropriate at this time to summarize the situation at the outset of the new program. Lockheed Aircraft Corporation (LAC) was the prime contractor for the airframe. Pratt & Whitney Aircraft Division, United Aircraft Corporation, was responsible for engine development and production. Direct contracting for certain auxiliary systems was reserved to Project Headquarters, DPD/DDP. In due course suppliers of cameras and other sensors, navigation and flight control systems, life support and pilot environment equipment, and other services were selected. The primary camera manufacturer chosen was Perkin-Elmer. Because of the extreme complexity of the design, a decision was soon made that a back-up camera system might be necessary in the event the P-E design ran into production problems. Eastman Kodak was asked to build a camera. The Minneapolis-Honeywell Corporation was selected to provide both the inertial navigation system and an automatic flight control system. The Firewel Corporation and David Clark Corporation became the prime source of pilot equipment and associated life support hardware.

The attention of the Development Branch, DPD, for the next two years would be mainly on the development, engineering and manufacturing of the airframe, engine and associated systems. It is quite impossible to detail here the many difficulties that beset the early stages of the program. The experiences of Lockheed and of Pratt & Whitney illustrate the magnitude of these problems in terms both of dollars and of effort.

Lockheed had designed an aircraft system that represented a major milestone in the field of aeronautical technology. When Lockheed turned to production, it ran into many challenges. The Mach 3.0 flight regime in which the A-12 aircraft would operate was expected to generate extremely high temperatures on the surfaces of the airframe. During the design phase, the contractor had evaluated such materials as steel honeycomb, high heat treated steel, high temperature aluminum and magnesium alloys, and titanium. A titanium alloy was chosen because of its high strength to weight ratio; it retained its strength at elevated temperatures; and tooling costs appeared to be less than for steel honeycomb, which was the nearest material to it in characteristics.

It was soon learned that tooling for titanium was considerably more sophisticated than for conventional airframe fabrication. Special furnaces and treatments had to be developed and employed to handle the metal. The supply of high quality titanium metal was limited and costly in early 1960, and the capacity of the few available suppliers to fill orders was marginal from time to time. Titanium was estimated to average cost about $21 per pound in January 1960.

During the first year, the contractor reported many problem areas, particularly in the supply of titanium. He experienced a high rejection rate of stock due to poor quality control standards of the metal suppliers. Much time was lost due to lengthy delivery delays. There was also a high waste factor, due to not only the rejection rate, but also to machining methods. An example of this occurred in the case where a 1,000 pound billet was required for machining down to an odd-shaped 66-pound fitting. Machining costs ran three to four times higher than initial estimates. In the course of overcoming these deficiencies, Lockheed had no choice but to develop its own techniques to handle the metal. Consequently, costs and time involved increased considerably. On 14 September 1960 the contractor revised his delivery schedule to the extent that the first aircraft's delivery slipped four months, and the twelfth by one month. The first flight date for Aircraft No. 1 was now 30 August 1961 instead of 1 May 1961.

As a consequence of forecasting deficiencies and technical problems encountered along the way, prices also changed. Lockheed had originally quoted a 12-aircraft production price of $96,000,000 in August 1959. Increased material prices and program changes caused an upward revision to $103,784,000 in January 1960.

The prime contractor had to select subcontractors for various aircraft systems, components, parts, and materials. The subcontractors experienced countless problems as design and production encountered the inflexible demands imposed by the environment within which their product was expected to operate.

What had hitherto been satisfactory design for parts and fittings now proved unsatisfactory in this new aircraft. Subcontractor research and development programs had to be initiated to find new materials and methods to meet the rigid specifications imposed. The result was much closer than usual contractor relationships and sharing of technical know-how. The costs increased on the one hand, but incalculable benefits were derived on the other. The OXCART program was destined to bear the financial brunt for many advances in the science of supersonic aerodynamics which Government and industry would profitably employ in future programs.

It is recalled here that a low radar cross-section was a requirement that the follow-on reconnaissance aircraft had to meet. The choice of manufacturer had been made with assurances that his design could achieve a satisfactory goal in this respect. Since final A-12 configuration and design was not firmly established when Lockheed was chosen, anti-radar testing continued at the Watertown base on the full-scale mock-up. The airframe areas giving the greatest radar return were the vertical tail, the inlet, and the forward side of the engine nacelles. An improvement in the chine and wing regions was also being looked at. Research in ferrites, high-temperature absorbing materials and high-temperature plastic structures was going on to find methods to reduce the return. It was proposed to construct the vertical tail section fins of laminated plastic, and Narmco was subcontracted to build the fins. The work in ferrites was expected to be helpful in reducing the reflectivity of the inlet and engine nacelle surfaces. A metal and plastic surface arrangement was proposed for the chine and wing edges. In combination, it was hoped that a significant reduction in radar return could be accomplished. While Lockheed and its subcontractors came to grips with airframe fabrication, the engine manufacturer was experiencing problems of his own.

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The final designs submitted by both Lockheed and Convair in the summer of 1959 incorporated a Pratt & Whitney Mach 3.2 J-58 engine. A first run had been made in December 1957 as a Mach 3.0 design test-stand engine and it had enjoyed impressive development progress during the following two years. In its presentation of cost estimates in the fall of 1959, P&W forecast a total of $80 million would be required through 31 December 1962 for further development, production of 36 engines, and maintenance, overhaul, and spare parts support. Company representatives felt it would not be too difficult to take the J-58 engine from its current stage of development (the 26,000 pound thrust P-2 model) and incorporate the features necessary for Mach 3.2 flight (in the 32,500 pounds thrust JT11D-20 model). So confident were they that they priced the engine at $750,000 per unit. The figure was one P&W had been using for other jet engine sales, and they estimated it to be a valid figure for the J-58.

In August 1960 P&W informed Project Headquarters it was experiencing considerable increases in cost, particularly in materials in the development and production portions of the contract. Development costs increased by $12 million and the production costs for 36 engines by $10+ million. Project Headquarters, while greatly disturbed, agreed to fund the additional development costs within limits. It was forced to reduce the order for engines from 36 to 30 because of the limitation on funds available. Pratt & Whitney gave assurances that the J-58 program could be accomplished within the revised dollar estimates.

The rapidly increasing costs in the engine program were due to varied problems that surfaced as the development phase proceeded. The high-Mach performance design introduced temperature environments that were never previously experienced or anticipated. For example, the engine thrust requirement dictated a turbine designed for an average 1900° F. inlet temperature. Early tests on the stand revealed extremely hot areas in the turbine where temperatures peaked at 2500° F. The materials used in combustion section and turbine fabrication could not sustain such an extreme condition. Many costly engineering man-hours went into redesign of the combustion section and turbine. New materials and alloys were selected for the turbine vanes and blades. Each change that was incorporated had to be verified on the test stand. A change or modification in one area of the engine would quite possibly necessitate redesign, rework, experiment, and test on other engine parts. Burner cans and diffuser cases were redesigned to even out the temperature profile and at the same time to endure the extreme heats. Choice of adequate new materials introduced fabrication difficulties. New and very expensive machining and welding processes had to be devised. The afterburner liners were found to be too light and sections would buckle during test runs. The buckled sections would tear loose and be blown out the engine tailpipe. The compressor rotor design was found to be inadequate structurally and it required reconfiguration. Major engine components such as the Hamilton Standard main and afterburner fuel controls and the Vickers hydraulic pumps were breaking down far ahead of their expected operating times. Again heat was the major contributor to the lack of materials durability and to equipment malfunctions. These engine component suppliers found themselves having to go into crash engineering development and testing to find satisfactory designs and materials with which to modify and retrofit their hardware which was already on production lines.

With each new fix to the engine or a component, there was an accompanying penalty in the form of added weight. Concurrently, then, a weight reduction campaign was necessary to remain within the original weight estimate that had been provided to the airframe manufacturer. A vicious cycle had developed. For each problem that arose, a domino effect resulted which was costly and time-consuming.

It should be noted here that consideration of developing the J-58 from a Mach 3.2 engine to a Mach 3.5 capability was dropped in December 1960. Weight and fuel trade-off's resulted in no appreciable improved performance for the A-12 mission.

Continuing Development:

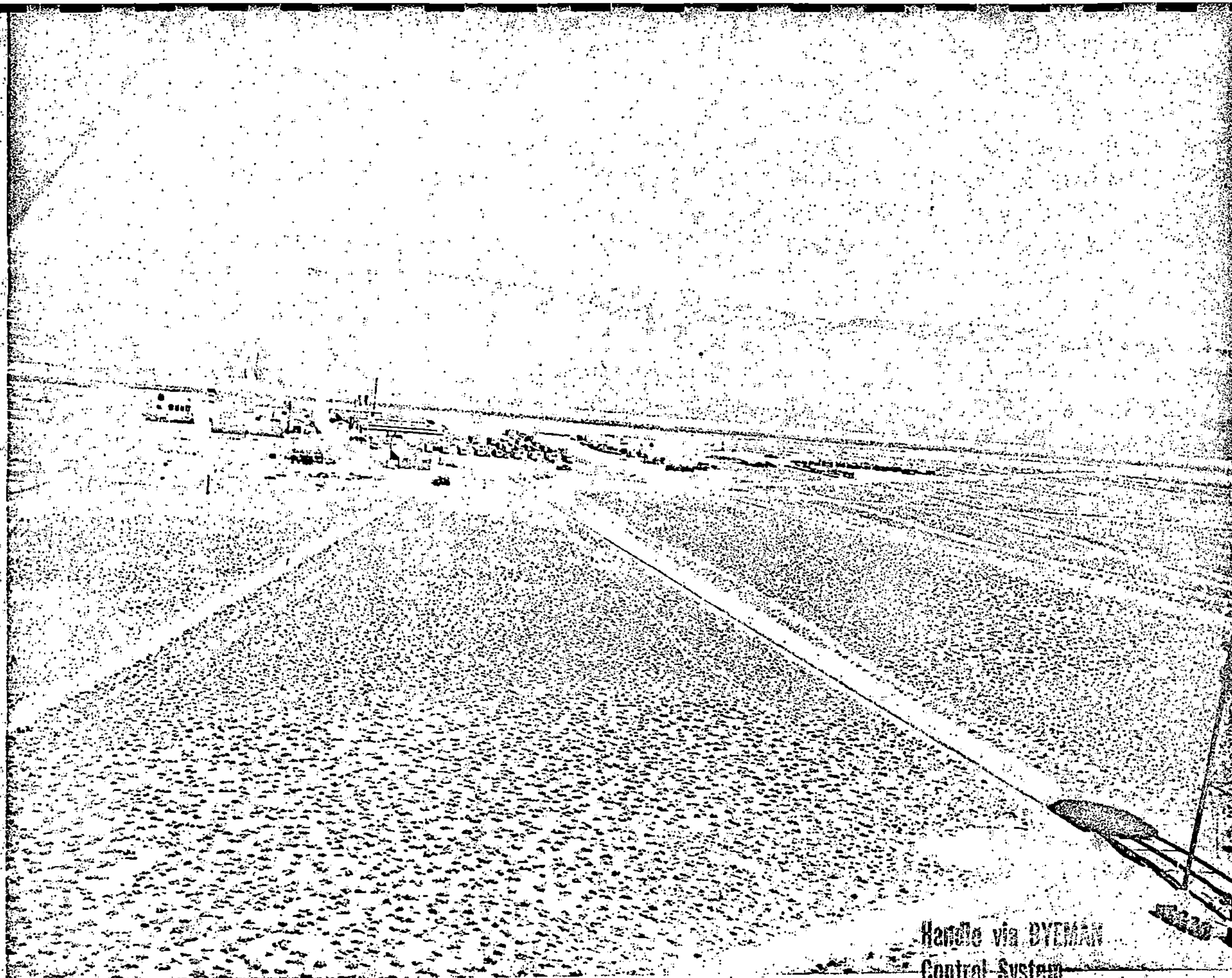
Selection of Test Site

In the fall of 1959, the matter of selecting a domestic flight test and operational site was taken up by the Development Projects Division. The OXCART operational concept envisioned that missions would be flown from and return to a domestic base with range extension accomplished by aerial refuelings enroute. For security reasons the project could not be located at an active military base where it would be subject to widespread scrutiny. The criteria for site selection required that the base be remote from metropolitan areas; remote from civil and military airways to preclude aerial observation or collision; be easily accessible by air; have good year-round weather; be capable of accommodating large numbers of personnel; have POL storage facilities; be fairly close to an Air Force installation; be near a source of labor; and have an 8,000 foot runway.

A total of ten Air Force bases that were programmed for closure were inspected during this period. All ten were evaluated for possible use. None met the remoteness test, and at most of them the annual operating costs would be unacceptable. Only Edwards Air Force Base and the Watertown site were considered worthy of serious consideration, and the security at the former base was subject to question. Watertown was deficient in personnel accommodations, POL storage and its runway was inadequate. However, the security it provided by virtue of its location within the restricted AEC reservation, made it ideal for clandestine aircraft testing and operations. What it lacked in physical plant could be rectified with a relatively moderate construction program. On 23 December 1959 the DDP approved a decision to establish Watertown as the primary domestic base for Project OXCART, subject to the concurrence of the USAF and the AEC. His decision, however, did not imply that a large program of base improvements and new construction be started. Until a final go-ahead to build aircraft was given, expenditures to improve Watertown facilities were to be limited only to those necessary to sustain the AR test program. (See overleaf for view of Watertown during early OXCART period.)

With the January 1960 approval for the full-scale program, the advance planning in selecting an operating base paid off. Early identification of the Watertown base permitted Headquarters engineers to develop an orderly plan to ready the base for the aircraft and associated ground equipment on schedule. Lockheed was consulted from the very beginning on what facilities would be required to support the flight test program. Lockheed estimated major items such as runway loading weights, monthly fuel consumption, hangars and shop space, and numbers of people necessary to conduct the flight test. Other contractors were consulted on their needs. Armed with the major requirements, Headquarters was able to come up with a preliminary construction engineering plan.

Since the Watertown base was within the AEC nuclear test site, it was necessary to obtain AEC approval to reactivate the base. An agreement drawn up in 1955 between the Agency and AEC allowed the Agency to use the Watertown site for the U-2 flight testing and training.



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To preserve cover and security, the AEC ostensibly managed the facility. All construction, maintenance and housekeeping had been performed by an AEC proprietary concern, the Reynolds Electric and Engineering Company (REECO). The same type arrangement was renewed with the AEC and REECO. There was considerable advantage to having REECO perform the work. It was a qualified construction organization, equipped to handle the job and was on the scene. Its relation to AEC provided the cover essential to the security of the operation. Its employees possessed security clearances to work on the Nuclear Test Site.

A cover story for the reactivation of Watertown was prepared in the form of a public information release to use in reply to press or other inquiries. It stated that the AEC facilities at the site had been made available to EG&G to conduct various and sundry radar studies with support from the USAF. The remote site was chosen to reduce the likelihood of outside interference affecting instrument calibration and ultimate test results. Use of AEC facilities did not affiliate the AEC or any of its programs with the work going on at Watertown. The AEC and EG&G were furnished the text of the press statement to use as required. They were also instructed to pass further requests for information to Headquarters, USAF, Office of Information Service, who would in turn seek replies from Project Headquarters.

In order for the reader to appreciate the task of preparing the base for occupancy, certain facts are necessary. Due to its location, 120 miles from the nearest metropolitan area (Las Vegas), personnel were required to live at the site during the work week. In 1960 the numbers were low, beginning with 75 and growing to 150 by the year's end. This number represented chiefly contractor personnel engaged in the AR testing and base construction. Except for contractors based in Las Vegas (EG&G and REECO) no contractor personnel were allowed to maintain residences in Las Vegas. Lockheed supplied a C-47 shuttle service between Burbank and Watertown for its freight and passenger needs. A chartered D-18 (Lodestar) was provided for transportation between Las Vegas and the base, chiefly to support the EG&G contingent. Surface access to Watertown was quite difficult because of distance and the fact that the only road leading into the site had deteriorated since 1957.

Immediate needs at Watertown were fulfilled on an as-needed basis during 1960. Surplus housing in the form of trailers was

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procured to billet construction workers as they arrived. A new well was dug. Limited recreational facilities were provided. An Agency staff civil engineer was assigned to the base. He provided the necessary engineering guidance to the Chief of Base, and performed liaison for Project Headquarters with the construction contractor,

By May 1960 the Operations Branch, DPD, estimated a requirement for 500,000 gallons of aircraft fuel per month. Neither storage facilities at, nor means of transport to, Watertown existed. Fuel would be rail-transported to Las Vegas from the refinery. After examining airlift, pipeline, railroad, highway and combinations of these modes of transport, it was determined that truck transport was most economical. Eighteen miles of highway leading into the base needed resurfacing to bear truck weights, but this was cheaper than to construct rail or pipeline systems.

Initial estimates of A-12 runway requirements called for an 8,500 foot length. The existing runway was a 5,000 foot asphalt strip incapable of supporting the weights of the A-12. Plans for a new concrete runway were drawn up and preliminary engineering begun.

The section of the AEC Nevada Test Site on which Watertown base was located was officially designated "Area 51" on AEC maps.

As such, it was afforded the normal security protection the rest of the AEC reservation enjoyed. There were some 14,000 acres of land immediately adjacent to and overlooking the Watertown facility that were not part of the AEC complex. Unrestricted access to the adjoining property would permit unauthorized viewing of the base's activities. Legal measures were instituted to have the land withdrawn from public use in an attempt to provide a protective screen.

In October 1960 a USAF cover organization was established to give the activities at Watertown a legitimate character. This organization was designated Detachment 1, 1129th (USAF) Special Activity Squadron, Mercury, Nevada. Its parent unit was a fictitious unit at Fort Myer, Virginia. All Agency staff and contract personnel were given USAF documentation upon assignment to the field activity.

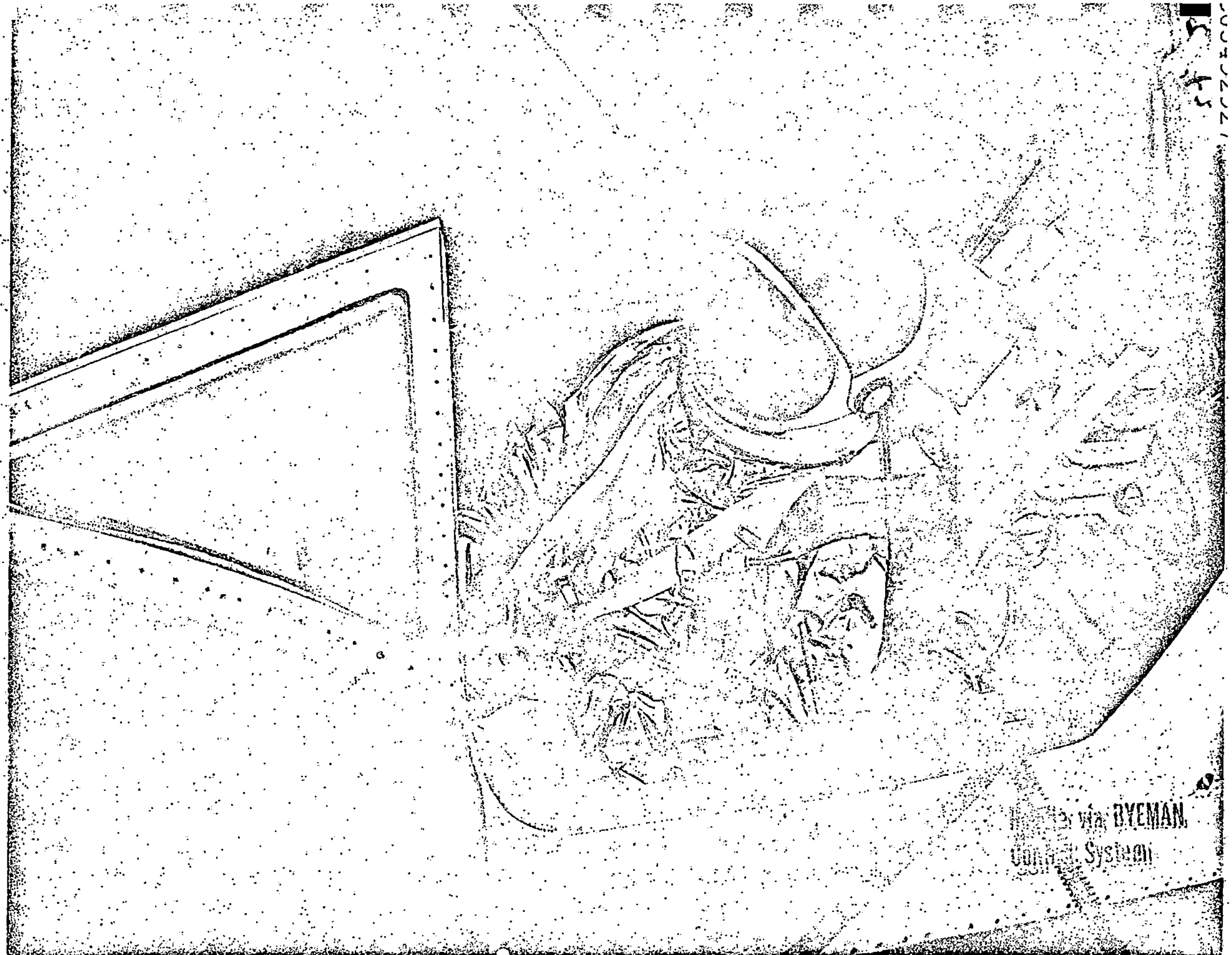
CIA/USAF Agreement on OXCART

On 14 October 1960 the final version of the joint CIA/USAF agreement on organization and delineation of responsibilities for Project OXCART was completed. The document was signed in February 1961 by Mr. Dulles and General White, Chief of Staff, USAF.[1/]

1/ OXC-0321 (BYE 2608-66), 14 October 1960. Organization and Delineation of Responsibilities Project OXCART. See Annex 127.

USAF Procurement: LRI Version of A-12

In October 1960 the USAF decided to buy a long range interceptor version of the A-12. The Contracts Staff of DPD was asked to write the contracts. A twofold purpose was served by having contracting performed outside normal military channels. The security of the A-12 program would be preserved by keeping the AF-12 purchase classified. Secondly, the order for three AF-12 aircraft made easier a decision to reduce the 12 A-12 aircraft order to 10. The cost estimates being submitted by Lockheed were exceeding available funds. A reduction in the numbers of A-12's to be procured was the only practical step that could keep the program budget in balance. Adding three AF-12's to the production contract therefore lessened the impact of a two A-12 aircraft reduction on Lockheed, and eased the strains on the OXCART budget. Included in the USAF AF-12 procurement was an order for 10 J-58 engines as a follow-on to the 30 engines previously ordered for the OXCART program. Extension of the engine order also gave some relief to the pressing financial problems of Pratt & Whitney. The total AF-12 program (Project KEDLOCK) was estimated to cost over $111 million, one-half of which was for the Hughes Aircraft Company to design and build the fire control and



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missile system for the AF-12. The contracts were the first of many the Agency would write for the USAF in follow-on or associated programs to preserve the security of A-12 development and production.

Area 51 Designated

The scope of DPD activities in the OXCART program widened in 1961 as the program picked up momentum. Action was expedited to ready the operating site for occupancy by the aircraft and test personnel. Security considerations called for a new name by which the site would be identified. Some association of the CIA and the U-2 with the base had become known in uncleared USAF and industry circles as a result of the Powers incident in May 1960. To minimize possible speculation by unwitting persons, all earlier terms of reference to the base, such as "Watertown", "Groom Lake", "The Ranch", etc., were ordered eliminated from the vocabulary of OXCART-cleared personnel. Henceforth it was to be referred to simply as "Area 51", the official AEC designator for that portion of the Nevada Test Site. Every effort would be made throughout the program to disassociate Agency interest in the base.

Tables of organization were drawn up by the Operations and Materiel Staffs of DPD for initial manning. The first T/O for the

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operating detachment called for 70 personnel. Personnel levies were made on the USAF for the various military specialties necessary to man the detachment. A phasing schedule for USAF detailees was worked out, timed to the estimated arrival times of the A-12 aircraft. It was planned to have people identified by 1 May 1961; necessary clearance and processing by 1 August; in place at Area 51 by October, and ready to begin training on 15 March 1962.

The Air Force personnel were carefully selected prior to nomination for duty with CIA, as in the case of the U-2 program. Because of close working relationships with SAC in the U-2 program, a request was sent to that Command for guidance in the procurement of a detachment commander. SAC responded with nominations for a commander and key members of his staff, screened from the ranks of the Strategic Air Command.

OXCART Pilot Selection

Great emphasis was put on the choice of pilots for the program. General Don Flickinger was tasked to coordinate the medical and physiological criteria. Operational requirements were established by the DPD operations staff. The pilots had to demonstrate outstanding proficiency and professional competency. They had to be jet fighter pilots with certain mandatory experience qualifications in the latest jet fighter aircraft. They had to be emotionally stable, well motivated, enthusiastic and possessed of good personal habits. It was desired that they be between 25 and 40 years of age, under six feet tall and 175 pounds or less in weight. The size qualification was dictated by the size of the A-12 cockpit. (See overleaf for view of pilot in cockpit.) Air Force pilot files were screened quite carefully for possible candidates and a list of pilots was obtained. Background investigations and security assessments eliminated some. Psychological assessments and physical examinations eliminated others. All remaining nominees were given a final review by the Agency Medical and Psychological Staffs prior to final candidate selection.

Pre-evaluation processing resulted in sixteen potential pilot nominees. This group underwent an intensive security and medical scrutiny by the Agency. Those who remained were then approached to take employment with the Agency on a very highly classified project involving a very advanced aircraft. In November, 1961, commitments were obtained from five of the group. The small number recruited required that a second selection process be undertaken. Qualifying standards were not relaxed, but administrative procedures were revised to tighten up pre-evaluation processing and speed up pilot candidate identification.

Pilot selection was conducted under the cover legend of "establishing selection criteria for space crews". Arrangements were made with the USAF to effect appropriate transfers and assignments to cover their training, and lay the basis for their transition from military to civilian status. Pilot compensation and insurance arrangements were similar to that for the U-2 pilots.

Only one further step remained before a pilot would be brought into the operational phase of the program. Following the Powers incident, an Overflight Panel had been established under the Director of Security to grant the Agency's final approval or disapproval on each individual from a risk-of-capture and associated considerations standpoint. The panel had representation from the Office of Security, CI Staff, Medical Staff, TSD, OTR, and Project Headquarters. The Panel met periodically the next two years until the initial pilot complement was complete.

Build-up, Area 51

The Area 51 physical build-up in 1961 saw completion of the 8,500-foot concrete runway, 100 feet wide for cost saving purposes versus 200 feet for military runways. Three surplus Navy hangars were obtained, dismantled and erected on the north side of the base. Surplus Babbitt housing was located on an old Navy installation. Slightly over 100 of these buildings were transported to Area 51 and made ready for occupancy. The 18 miles of road paving was also completed in 1961. Since commercial power was not available, additional generators were brought in to provide the electrical power required by the growing installation. The fuel tank farm was begun in 1961, and construction was completed in early 1962 with a capacity for 1,320,000 gallons of fuel. Warehousing and shop space was provided, either by new construction or rehabilitation of older buildings. Essential facilities were ready in time for the forecast delivery date of Aircraft No. 1 in August 1961.

Delivery Schedule Delays

Lockheed reported in January 1961 that tooling problems were being solved, but that the material delivery situation was a dismal picture. In particular, titanium wing extrusions were far behind delivery schedule. Without material, Lockheed was unable to work to a programmed manpower level. At one point, in March 1961, only 20% of the labor force was able to work on fabrication due to material shortage. In one of his progress reports, Mr. Johnson wrote as follows to Mr. Bissell:

> "Schedules are in jeopardy on two fronts. One is in 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 3 to 4 months behind the current schedule. While every effort is being expended to make up much of this time, I would be greatly amiss not to state these facts, so that excessive overtime is not applied at great cost in such areas as development of facilities at the test area. And there may be other important vendors in trouble trying to make the initial schedule." 1/

Mr. Bissell responded with the following sharp message:

> "Johnson from Bissell.
>
> "1. 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.
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> "2. In addition to the problems in overweight and effects on performance uncertainties in the A.R. field,

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1/ OXC-1433, 7 March 1961. LAC Progress Report #18 (filed in D/R&D/OSA files).

and the extreme difficulties being encountered by other contractors, these delays cause me to question the desirability of continuing the reconnaissance version of this aircraft.

"3. I trust this is the last of such disappointments short of a severe earthquake in Burbank. On that assumption I presume you are working round the clock to complete the wing assembly and will employ all reasonable short cuts to expedite completion of the first several aircraft and recovery of delivery schedules ASAP.

"4. I should welcome your remarks on measures you are taking to prevent skyrocketing costs due to this delay both in Burbank and other suppliers on the subjects of build-up at the test site, personnel acquisition, overtime, etc.

"5. I am anxious also to explore the impact of the highly accelerated flight test program of this additional delay. This has become an item of major expense and perhaps need be replanned on less costly basis." 1/

It was imperative at this point that Project Headquarters improve its capability to monitor airframe development against the fiscal and timing requirements. It was decided to employ a top-level aeronautical engineer, to be resident at the contractor's facilities, who could monitor program progress and submit technical reports. In May 1961 an experienced in-plant representative of the Agency was installed and his independent reports kept the program technical staff abreast of developments at Lockheed on a more timely basis.

1/ ADIC 8511, 7 March 1961. ADIC to BEIGE.

To improve delivery of titanium a Headquarters team visited Titanium Metals Corporation (TMC) directly to impress on its President the high national objectives and priority of the OXCART program. Fuller cooperation was promised by the titanium supplier. In May Lockheed reported that sufficient sheet metal was on hand for capacity production, but that extrusions were still giving trouble. The first flight for Aircraft No. 1 was now set for 5 December 1961. Concern was again expressed with the status of engine development and possible late deliveries.

By mid-year, fabrication of the first airframe was in hand. On 11 September, Pratt & Whitney informed Lockheed of their continuing difficulties with the J-58 in terms of weight, delivery and performance. Completion date for Aircraft No. 1 by now had slipped to 22 December 1961, and first flight 27 February 1962. In order to meet even this last date, a substitute engine would be necessary since the J-58 would not be ready. It was proposed that a P&W J-75 engine, designed for the F-105 and flown in the U-2, 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.

Adding to the anguish that each slip in delivery caused at Project Headquarters was the accompanying increase in cost. On 13 November 1961 the total proposed target price for 10 A-12 aircraft submitted by the contractor had risen to $165,000,000.

The J-58 engine development problems of Pratt & Whitney were discussed in the preceding pages of this chapter. These technical problems were to persist on into 1961 and beyond, with progress slow in solving them. The spiraling costs attending the engine development program was also causing concern at Project Headquarters. Pratt & Whitney, in submitting its original cost estimates, had sadly estimated on the low side.

In January 1961 the Navy and the Air Force entered into negotiation for direct funding of the J-58 development program. This, in effect, reduced Project Headquarters' funding requirements. However, by May 1961, the costs had again risen. The production cost of the 30 engines was now estimated at over $45 million, and by September 1961, the costs had increased to over $51 million.

The Air Force accepted a greater financial responsibility in engine procurement because of its involvement in the AF-12 program. It was also deriving many technological benefits in other Air Force programs. The Navy continued to provide funds for similar reasons. Despite the magnitude of its development problems and the consequent cost increase, the J-58 engine was still considered the only properly sized propulsion system for the A-12 family of aircraft.

If the contractor were to be held to the terms of the contract, the company would have indeed been in serious financial jeopardy. It was as much to the interest of the Government as to the company that such did not occur. The additional 10 engines required for the AF-12 program afforded the opportunity to renegotiate the existing engine procurement contract. The contract was amended to permit repricing the 40 engines at a higher unit level. The revised ceiling price would guarantee ultimate recovery to Pratt & Whitney of all the projected overrun. The net result was that Pratt & Whitney would not run the risk of defaulting on the delivery of engines. It would also result in P&W delivering the 40 engines without a penny profit. An account of the negotiations and contract action is contained in Annex 128. [1/]

Project Headquarters was not gentle in its relations with the engine contractor during these trying days, and in one instance

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1/ OXC-2401, 17 October 1961. Price Overrun on Pratt & Whitney Engines, Contract No. TT-1002.

strongly recommended to Pratt & Whitney management that reorganization was necessary. Pratt & Whitney production facilities were in East Hartford, Connecticut, and its research and development facility was in West Palm Beach, Florida. In view of the apparent stagnation of the program, particularly in accumulating meaningful engine test time, Mr. Bissell, as part of his strategy, recommended that primary development work be co-located with production in Connecticut. He concluded his letter of 29 November 1961 to Pratt & Whitney's General Manager, Mr. L. C. Mallet, with the following:

> "In view of increasing national and international emphasis on high Mach number manned flight, it must be clearly understood that this customer as part of the defense community is obligated to examine and re-examine all avenues leading toward the expeditious and economic realization of this goal. In this regard, the contractor's progress and performance must be and is reappraised continuously in relation to the progress achieved by competitive programs." 1/

Pratt & Whitney was already responding with shifts in managerial personnel to and within the Florida facility rather than relocation to Hartford. Definite improvement began to appear in the engine development management picture and the tactic of relocation to Hartford was not pressed further.

1/ OXC-2661, 29 November 1961. Relocation JT11D-20 Engine Development Program. See Annex 129.

In addition, and as a result of Headquarters continued pressure to get the program moving, two other contractor reorganizations were implemented. Substantial increases in engineering manpower and test facilities availability were undertaken by Hamilton Standard Division (fuel controls) and Vickers Inc. (hydraulic pumps), both subcontractors to Pratt & Whitney. These actions were implemented in the Fall of 1961 and in January 1962 respectively. By December 1962 these efforts had resulted in substantial improvement. Fuel control, hydraulic pump, and engine turbine durability had each increased to the point of acceptable operation at their extreme temperature environments for fifty hours. After integration of these improved components into the engine as a whole, the engine satisfactorily completed its fifty hour preliminary flight rating test in January 1963. (See overleaf for picture of J-58 engine on test stand.)

Events of 1962-1964

Detachment 1, 1129th (USAF) Special Activities Squadron Established

While awaiting the Lockheed flight test phase to begin in early 1962, the operational detachment was taking form under the command of Colonel Robert J. Holbury, USAF. Colonel Holbury had been recommended as the Commander by Headquarters, SAC. In

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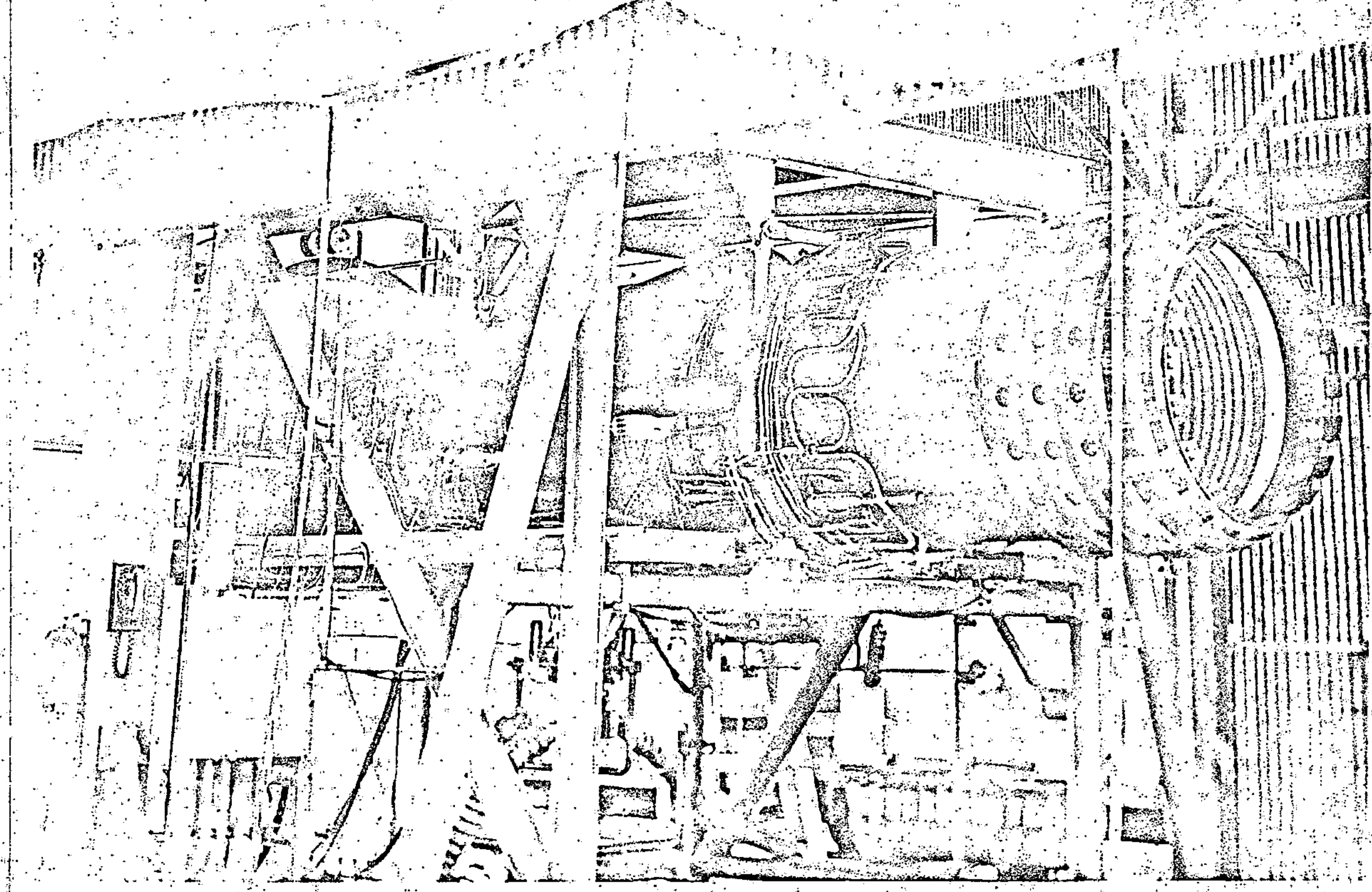

November 1961, he and his staff had been given several days' briefing at Project Headquarters. His charter is appended as Annex 130. The previous Chief of Base, [redacted] a staff employee, continued at the site as Deputy Commander for Support.

Key staff personnel were first sent to A-12 ground school at Burbank and to F-101 training. The F-101 most closely approximated the A-12 in flying characteristics and was equipped with two after-burning engines. As unit training would develop, the F-101 was to serve primarily as a trainer for the A-12 pilots, and secondly as a chase aircraft to monitor A-12 take-offs, refuelings, and landings.

Headquarters' planning for detachment training called for several types of support aircraft to be supplied by the USAF. 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 administrative 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. The support aircraft began arriving in the Spring of 1962.

Maintenance of the support aircraft was to be accomplished at Area 51. Additional personnel were required, and in July the staffing complement at Area 51 (also referred to as Station D within DPD to distinguish it from the U-2 detachments) increased to 144 positions. Most of the new positions reflected the needs to maintain the support aircraft.

In January 1962, an agreement was reached with the Federal Aviation Agency that expanded the restricted air space in the vicinity of Area 51. The purpose of the restriction was to prevent unauthorized aircraft from overflying Area 51. Certain FAA air traffic controllers were cleared for the OXCART Project. Their function was to insure that the unauthorized aircraft did not violate the order. The restricted air space was expanded in subsequent years as the A-12 began flying longer training routes over the continental United States. The expanded air space restriction was necessary to allow the A-12 to climb out to operating altitudes unobserved by other aircraft. This subject will be treated later in more detail.

Briefings were given to the North American Air Defense Command to prepare them for the flights of the A-12. The briefings and clearances were necessary to preclude air defense fighters reacting to the appearance of high-speed, high-flying unidentified aircraft. Procedures were established with NORAD whereby A-12 flights would not excite air defense alerts and air defense system radar stations would not report or discuss the appearance of this high performance aircraft on their radar scopes.

Refueling concepts required prepositioning of vast quantities of fuel at certain points outside the United States. Special tank farms were programmed at Beale Air Force Base, California; Eielson Air Force Base, Alaska; Thule Air Base, Greenland; Kadena Air Base, Okinawa; and at Adana, Turkey. Since the A-12 used specially refined fuel, these tank farms were reserved exclusively for use by the OXCART program. Very small detachments of technicians were installed at these locations to maintain the fuel storage facility and arrange for periodic quality control fuel tests.

First Flight of the A-12

At the Lockheed Burbank plant, Aircraft No. 1 (serially numbered 121) had completed assembly. It was given its final tests and checkout during January and February, 1962. When the engineering tests were completed, the aircraft was partially disassembled for shipment to Area 51. It had been established very early in OXCART planning that for practical reasons, i. e., inadequate runway, the A-12 could not fly from the Burbank manufacturing facility to the test site. The movement of the full-scale AR test model had been successfully accomplished via a specially-designed trailer truck over 453 miles of highway in November 1959. A thorough survey of the route was made in June 1961, to determine the hazards and problems of moving the actual aircraft. It was found possible to move a package, which measured 35 feet wide and 105 feet long, without major difficulty. Obstructing road signs had to be removed, trees needed trimming and some road-side earth banks required leveling. 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 and covered, loaded on the special-design trailer and moved out of the Burbank plant on 26 February 1962. It arrived at Area 51 two days later. (See overleaf for enroute picture.)

Reassembly of the aircraft was accomplished and the J-75 engines installed in preparation for ground runs and taxi checkouts prior to flight test. When fuel was placed in the tanks, numerous leaks developed, many of a dangerous nature. The tank sealing compounds had failed in large areas due to non-adherence to the metal. It was necessary to strip the tanks of the faulty sealing compounds and reline them with new materials. First flight was again delayed.

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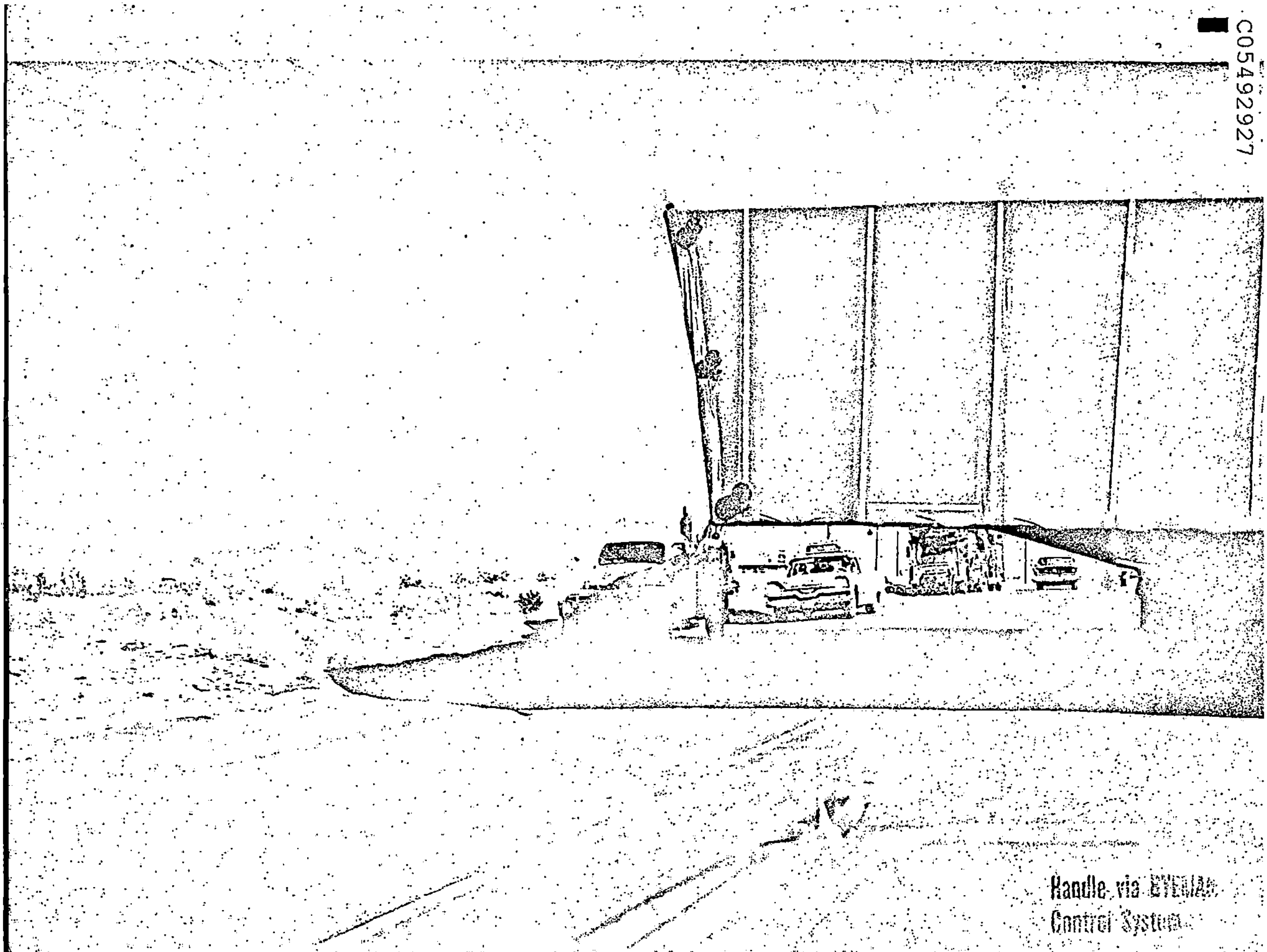

Lockheed turned to a fuel tank sealing compound that would be satisfactory for early stage flight testing and repaired the aircraft's fuel tanks. On 26 April 1962, Aircraft 121 made its maiden flight of some 40 minutes, and it performed satisfactorily.

On 30 April 1962, the official first flight of the OXCART aircraft occurred, witnessed by Project personnel led by Dr. Herbert Scoville, Deputy Director for Research,* representatives from cooperating government agencies, and participating contractors. The aircraft, piloted by Lockheed test pilot, Mr. Louis Schalk, took off at 170 knots, at a gross weight of 72,000 pounds, and climbed to 30,000 feet altitude. Top speed of 340 knots was attained. After 59 minutes of flight, the aircraft landed. The pilot reported the aircraft responded well and was extremely stable. Mr. Johnson of Lockheed reported it to be the smoothest official first flight of any aircraft he had designed or tested. On its second flight, 4 May 1962, Aircraft 121 reached Mach 1.1. On both flights, only minor problems were reported. (See overleaf for first official flight picture.)

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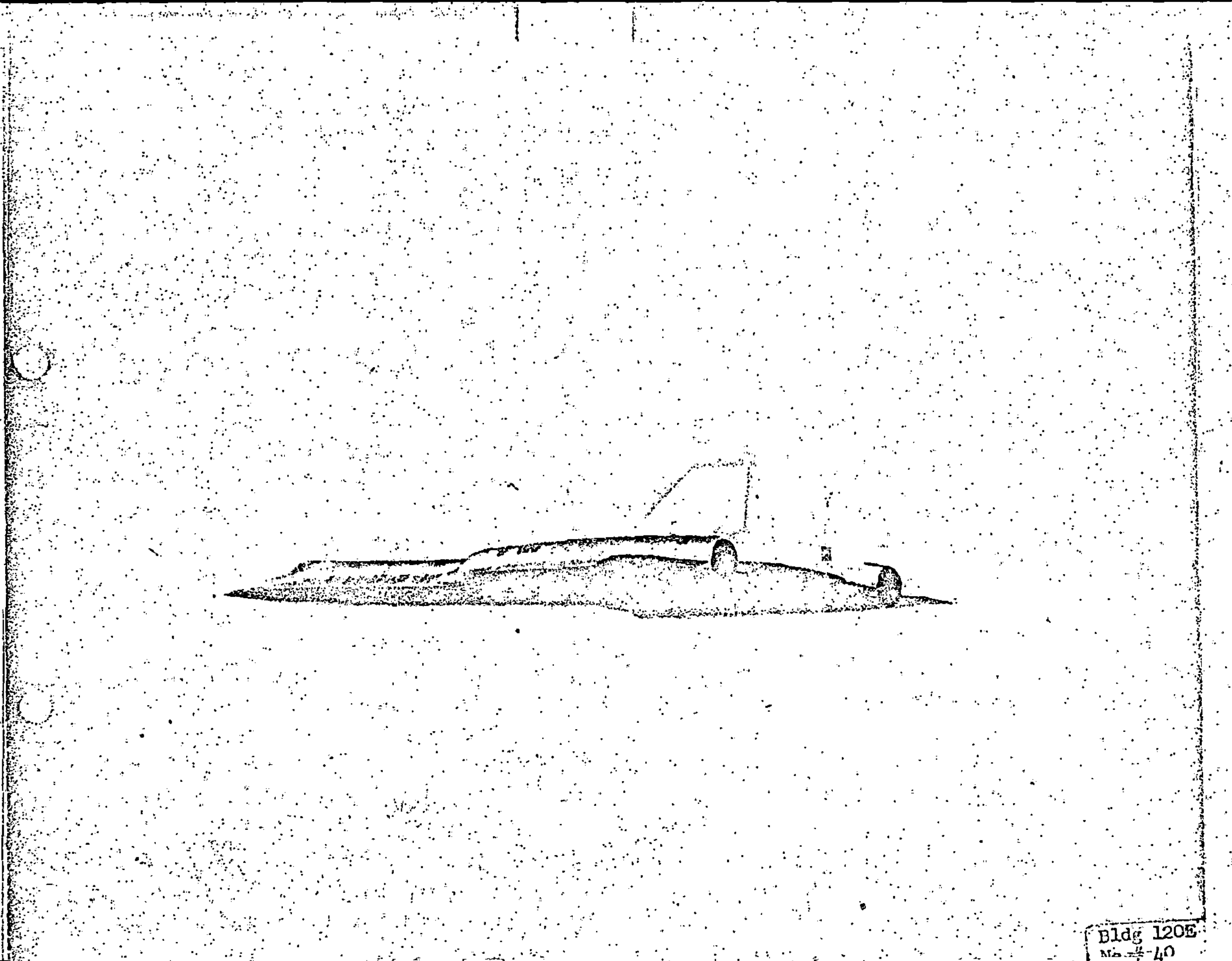
* Project Headquarters, formerly Development Projects Division in DDP, was now the Office of Special Activities under the Deputy Director for Research.



First Official Flight A-12. 30 Apr '62

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No. 4-40
-62

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Mr. John A. McCone (who had succeeded Mr. Dulles as DCI in November 1961) sent the following message of congratulations:

"To Mr. Johnson from Mr. McCone:

"Have been briefed by Dr. Scoville on the events of last Monday. Wish to extend my best wishes for continued success. Now that we have the initial flight accomplished, I am directing every effort be made by this Headquarters to expedite all aspects of program in order to attain an operational posture as soon as possible. Please pass to those who assisted you in this accomplishment my personal appreciation for a job well done." 1/

By now, the Pratt & Whitney J-58 (JT11D-20 model) engine development program was in an intensive ground endurance testing phase preparatory to flight qualification. Four 50-hour preliminary endurance engine tests had been completed. Test time accumulation reflected the following figures:

Total Engine Time (Various J-58 configurations)	3,883 hours
Afterburner Time	548 "
JT11D-20 Configuration Time	1,030 "
Mach 1.5 Temperature Time	398 "
Mach 2.0 Temperature Time	243 "
Mach 3.0 Temperature Time	23 "
Maximum Turbine Temperature Time	276 "
Engine Time with Automatic Controls	295 "

Significant progress was being made in problem areas such as hydraulic pump durability, combustion temperature distribution as

1/ ADIC 0737, 7 May 1962, Hqs to Lockheed Aircraft Corporation.

it affected turbine durability, and engine controls development. Additional facilities were authorized to accelerate development and endurance testing. Production engines appeared to be on a firm schedule, and the first production engine was delivered in August.

Aircraft No. 122 was delivered to Area 51 on 26 June. It spent three months in AR testing before engine installation and final assembly. Aircraft No. 123 arrived in August and flew in October. The two-seat trainer A-12 was delivered in November 1962. It was to be used to train OXCART Project pilots. It had been intended that it also be powered by the J-58 engines. However, J-58 engine delivery delays and a desire to begin pilot training concurrently with flight test prompted a decision to install the smaller J-75 engines. The trainer flew initially in January, 1963. Aircraft No. 124 has remained the only A-12 to be powered by the J-75. The fifth aircraft to be delivered in 1962, No. 125, arrived at the Area 17 December 1962.

The year 1962 witnessed the establishment of the Soviet presence in Cuba. The U-2's were 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. Thereafter, U-2 reconnaissance increased and on 27 October 1962 an Agency U-2 (flown by a SAC pilot on a SAC-directed reconnaissance mission over Cuba) was shot down by a surface-to-air missile. The prospect of possibly being denied continued manned, high-altitude reconnaissance of Cuba suddenly appeared very real. The OXCART program assumed greater significance than ever, and its achieving an operational status became one of the highest national priorities.

At the close of 1962, the program had two aircraft in flight test status, one powered by two J-75 engines and the other with one J-75 and one J-58. A speed of Mach 2.16 and altitude of 60,00 feet had been reached. Auxiliary components and payloads had been flown at low speeds, but their performance could not be assessed further until the aircraft reached design speed and altitude.

The primary causes for the slow start in the flight test program were the slow delivery of engines and poor engine performance at altitude. Instead of 14 engines promised for delivery, 9 had been delivered in late November 1962. Of the 9, only 4 could be considered for use in the flight test program. At a time of greatest need to reach an operating capability, the program appeared to be at its lowest ebb.

At the initiative of the DPD Project Officer, the following message was prepared to send to the President of United Aircraft Corporation.

in order to place pressure on UAC top management:

"Mr. Horner from Mr. McCone:

"I have been advised that J-58 engine deliveries have been delayed again due to engine control production problems. At this moment, we have four engines with satisfactory controls and one with a questionable control to operate two aircraft. By the end of the year it appears we will have barely enough J-58 engines to support the flight test program adequately. Furthermore we have been forced to use J-75 engines in airplanes one, three and four.

"Furthermore 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 development of the complete system.

"This situation gives me the greatest of concern because of the critical importance of the program. It is necessary that the United Aircraft Corporation, Pratt & Whitney, particularly the Hamilton Standard Division, place highest priority on the solution of all technical and production problems and assign to them the most senior and competent men within your combined organizations.

"The OXCART program has been designated of the very highest national priority and I cannot emphasize enough the necessity of its reaching operational status as quickly as possible. Would appreciate your informing me personally of your actions taken to correct these difficulties." 1/

By the end of January 1963, ten engines were available at Area 51. The first flight with J-58 engines occurred on 15 January 1963.

1/ ADIC 9838, 3 December 1962, Hqs to United Aircraft Corp.

Thereafter, all A-12 aircraft were fitted with the J-58 engines upon delivery to Area 51. Flight testing was accelerated and contractor personnel went to a three-shift work day. With each succeeding step into the higher Mach regime, new problems were uncovered. The single most important problem that paced flight development of the A-12 was the air inlet and its control system. A supersonic inlet or air induction system is designed to provide best possible aerodynamic performance over a range of supersonic Mach numbers with a stable and steady flow of air to the engine. As flight testing moved into Mach 2.4 to 2.8 regions, the aircraft was experiencing severe inlet duct roughness. An improper airflow match was occurring between the inlet and the engine. It was also determined that improper aerodynamic contouring of the inlet duct was a contributor to the roughness. Redesign corrected the latter. Investigation revealed that the primary cause of the improper airflow to the engine was the controls system which activated movement of the inlet spike. Two control designs had been developed, one hydromechanical and the other, a back-up approach, electronic. Resolution of this problem was extremely difficult and considerably prolonged the date when the A-12 would be declared operationally ready.

Another practical problem developed in the spring of 1963 which caused concern. Costly damage was occurring to engines due to foreign objects being ingested in the engines. The foreign objects were primarily nuts, bolts, clamps and other debris left behind in the manufacturing process. They were sucked out of inner nooks and crannies of the nacelle during ground run-up or take-off, and entered the intake duct. A thorough investigation, including the possibility of sabotage, concluded the principal cause to be carelessness and poor housekeeping. Rigorous inspections and controls corrected the situation, and subsequent occurrences were infrequent.

First A-12 Loss

The first aircraft loss occurred in the spring of 1963. While on a routine training flight, 24 May 1963, one of the detachment pilots obtained an erroneous indication of air speed and elected to eject from the aircraft. The aircraft crashed 14 miles south of Wendover, Utah. The pilot was unhurt. For public consumption, the aircraft was identified as an F-105. The complete wreckage was removed from the scene and returned to Area 51 by 26 May. All individuals at the crash scene were identified and requested to sign secrecy agreements. Press inquiries concerning the pilot's identity were forthcoming, and the following story was issued by Air Force sources:

> "The F-105 aircraft was on bailment to Hughes Aircraft Company from Air Force Logistics Command, Wright-Patterson Air Force Base, Ohio. The aircraft piloted by Mr. Collins originated from Wright-Patterson Air Force Base on Friday. After a brief stop at Nellis AFB, Mr. Collins, early Friday afternoon while testing a classified system, experienced aircraft difficulties and bailed out from his aircraft in the vicinity of Wendover, Utah..." 1/

All A-12 aircraft were grounded for a week pending accident investigation. A plugged pitot static tube during icing conditions was found to be the cause of the faulty cockpit instrument indications. The accident was listed as an F-105 crash on official records.

USAF A-12 Procurement

Closely interwoven with the chronicle of OXCART development were the events occurring on its periphery. We recall that in December 1960 the USAF, using Project procurement channels, contracted for three long-range interceptor (LRI) versions of the A-12. This program was given the cryptonym KEDLOCK. In January 1962, the USAF added another five A-12 buy to the existing A-12 production contract, and it was termed the WEDLOCK program.

1/ See Annex 131 for newspaper stories on the crash.

In 1962, another reconnaissance concept was proposed by the Deputy Director for Research and Engineering, Department of Defense, which would offer an alternate to the manned supersonic reconnaissance system. It was a Mach 3.3 ramjet drone aircraft to be launched from an A-12 mother aircraft. After feasibility studies were completed by Lockheed and evaluated, a go-ahead was authorized by the Pentagon (NRO). Management and technical monitoring of development was assigned to CIA (Project Headquarters, now OSA) on 17 October 1962 by the Director of NRO. On 4 June 1963, for political reasons (during a USAF-CIA tug-of-war on the NRO), the responsibility was shifted from CIA to the USAF. The program became known as TAGBOARD. Two of the five WEDLOCK A-12 aircraft were scheduled for conversion to a TAGBOARD drone launch configuration. On 6 November 1963 the remaining three were transferred to the OXCART program.

On 29 January 1963, the Secretary of Defense approved purchase of six additional aircraft for Air Force use as a general purpose reconnaissance vehicle configured to carry a variety of intelligence collection systems. An additional procurement of 25 was approved by the Secretary of Defense in August, 1963. This new configuration

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LOS ANGELES TIMES

Monday morning, March 2, 1964

Page 1.

U.S. Has Dozen A-11 Jets Already Flying

WASHINGTON (AP) — Sen. Richard B. Russell (D-Ga.) said Sunday there are 11 or 12 of the newly-unveiled U.S. "manned missile" jet fighter planes already flying and that they have successfully passed numerous tests.

Russell, chairman of the Senate Armed Services Committee, said he had known about the 2,000-mile-an-hour A-11 since work first began on it in 1959, although President Johnson just announced its existence Saturday.

In a television interview ("Face the Nation"—CBS), Russell indicated the plane is far advanced in required tests.

"It's been put through all kinds of tests," he said, and noted that others are continuing. He said it is virtually in shape to be accepted formally by the Air Force. This hasn't taken place yet.

President Johnson told his news conference Saturday that the plane's performance "far exceeds that of any other aircraft in the world today."

Russell said his knowledge of the plane's existence was the reason he recently knocked out of an appropriations bill a $40 million request for funds to develop an improved manned interceptor.

He said he does not know why the Air Force asked for the money when it also knew of the A-11.

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LAS VEGAS SUN

Wednesday, March 4, 1964

Picture p. 1, story page 2.

Secret of Sizzling New Plane Probably History's Best Kept

WASHINGTON (UPI)— America's revolutionary A11 aircraft, secretly developed with such success that the government still is congratulating itself, has been test flown for about two years in remote regions of the west.

The 2,000-mile-per-hour jet's unheralded flights over the wide open, sparsely populated areas recall the secret drills over Utah 20 years ago when the Air Force was turning the B29 into history's first atomic bomber.

About a dozen of the Titanium A11s have been built so far and flights now are beginning at the test center at Edwards Air Force Base, in more populous California.

FASTEST IN WORLD

President Johnson revealed the A11 program at his news conference last Saturday, saying that the plane's performance "exceeds that of any other aircraft in the world today." Besides its ability to fly more than three times the speed of sound, the President said the plane could fly over distances of thousands of miles and at altitudes above 70,000 feet.

Johnson said there would be extensive tests at Edwards to learn the A11's capabilities as a long-range interceptor.

It is understood that the super-secret airplane, started in 1959, began and may continue chiefly as a reconnaissance aircraft—a successor to the slow but high-flying U2 design which was then five years old.

SECRECY KEPT

Secrecy surrounding the plane, over six years, was remarkably well kept. Editors of Aviation Week magazine said that they learned of the A11 program one and a half years ago and yielded to Air Force entreaties to publish nothing about it. Ironically, they were scooped when Johnson revealed the project too late for their weekly deadline.

How was the secrecy maintained so well? It is a testimony to the discipline of hundreds, perhaps thousands, of persons in the military and civilian ranks of government and in the aircraft industry.

The story began on Lockheed Aircraft's sprawling acres in Burbank, Calif., where apart from the main plant, there is a hangar nicknamed the "Skunk Works."

This hangar is the domain of Lockheed Vice President Clarence L. (Kelly) Johnson, one of the great aircraft designers. Whenever the government wants something revolutionary, it is likely to turn to Johnson. He came up with the F104 fighter, a 1,400-mile-per-hour plane at a time when most other fighters were flying about half that speed. He designed the U2, probably the highest flying airplane before the A11.

'SKUNK WORKS'

Designer Johnson went to work in his "Skunk Works" with the building surrounded by guards and employes admitted only after careful security screening. Very few people at Lockheed not working on the project knew anything about it, even some of its top officials.

Possibly hundreds of people in the Pentagon and elsewhere in the military knew something about the A11 but there is no evidence that anyone talked.

The airplane had a classification higher than "top secret"—a classification which itself was secret.

Within the hangar, planes were custom-made by the carefully chosen employes. There was no semblance of a production line as in other plants.

was designated the R-12 (later redesignated as the SR-71). CIA again acted as procurement agent.

A-11 Aircraft Program Surfaced by White House

As the numbers of A-12 family of aircraft on order or proposed for order grew, so did the problem of preserving the covert character of the OXCART program. Serious consideration was being given by the Secretary of Defense to issuing a press release announcing the existence of an X-21 development (actually the AF version of the A-12) in January 1963. Since the action was tied directly to the B-70 controversy, it was feared that there would be more political controversy and critical examination which could possibly expose the A-12. When the situation was reviewed by the President's Foreign Intelligence Advisory Board, it was the Board's conviction that it would be best not to make any statements which would possibly result in exposing A-12 development, or any military version thereof. The President decided not to surface the R-12. No statement was made at that time, but it was apparent that as the delivery date of the first R-12 approached, public disclosure of Lockheed's work in Mach 3.0 aircraft manufacture was inevitable.

The Agency's chief concern with surfacing was to protect the AR aspects and capabilities of the A-12, and to protect the scope and nature of the activities at Area 51. The OXCART program had progressed through development, construction, and a year of flight testing and training without attracting public attention. It now appeared advantageous to surface some version of the A-12 type aircraft to serve as cover for the OXCART program in the event of incident or inadvertent exposure. The loss of Aircraft No. 123 in May 1963 became a case in point.

The matter continued under review during 1963. The Department of Defense was having difficulty in concealing its participation in the program due to the increasingly high rate of expenditures as the SAC R-12 aircraft came into production. Political pressures increased in the DOD/Congressional controversy involving appropriations for the improved manned interceptor and the manned bomber. In addition, the Administration desired to make Mach 3.0 aircraft technology data available to participants and evaluators of the SST program.

There was growing awareness in industry and in the press of the existence of the program. See Annexes 132 and 133. Operational activity, both in numbers of aircraft and extended flight profiles, was increasing the probability of accidental sightings and incidents. All parties were in agreement that an announcement to the public was necessary.

President Johnson was apprised of the matter on 29 November 1963, a week after taking office. He decided that surfacing was in order and directed a paper be prepared for announcement in the spring of 1964. At his 29 February 1964 press conference, the President made the following statement:

> "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.
>
> "This advanced experimental aircraft, capable of high speed and high altitude and long-range performance of thousands of miles constitutes a technical accomplishment that will facilitate the achievement of a number of important military and commercial requirements. The A-11 aircraft now at Edwards Air Force Base are undergoing extensive tests to determine their capabilities as long-range interceptors.

The development of supersonic commercial transport aircraft will also be greatly assisted by the lessons learned from this A-11 program. For example, one of the important technical achievements of this project has been the mastery of the metallurgy and fabrication of titanium metal which is required for the high temperatures experienced by aircraft travelling at more than three times the speed of sound. Arrangements are being made to make this and other important technical developments available under appropriate safeguards to those directly engaged in the Supersonic Transport Program.

"This project was first started in 1959. Appropriate members of the Senate and the House have been kept fully informed on the program since the day of its inception.

"The Lockheed Aircraft Corporation of Burbank, California, is the manufacturer of the aircraft. The aircraft engine, the J-58, was designed and built by the Pratt & Whitney Aircraft Division of the United Aircraft Corporation. The experimental fire control and air-to-air missile system for the A-11 was developed by the Hughes Aircraft Company.

"In view of the continuing importance of these developments to our national security, the detailed performance of the A-11 will remain strictly classified and all individuals associated with the program have been directed to refrain from making any further disclosure concerning this program. I do not expect to discuss this important matter further with you today, but certain additional information will be made available to all of you after this meeting. If you care, Mr. Salinger will make the appropriate arrangements." 1/

The reference in his announcement to the "A-11" was deliberate. To announce the aircraft as being one of the "X" series would not

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1/ Text of statement to the press by President Lyndon B. Johnson read at his press conference on Saturday, 29 February 1964.

have been completely true, whereas the "A-11" had been the original designation of the all-metal aircraft first proposed by Lockheed. The surfaced "A-11" was subsequently redesignated the YF-12A. (See overleaf for press treatment of the announcement.)

In order to preserve the distinction between the "A-11" and the A-12, Project Security had briefed practically all witting personnel in government and industry on the impending announcement. This was to preclude relaxation of the OXCART security standards. There was considerable press speculation on an Agency role in the A-11 development but it was never acknowledged by the Government.

Timed to the President's announcement, the A-11's were flown from Area 51 to Edwards Air Force Base, California. All subsequent A-11/YF-12A activity was done at Edwards AFB. On 24 July 1964, the President announced the SR-71 (R-12) development. The existence of Area 51, its activities, and the role of CIA in its operation, was preserved and has never become public information.

<u>OXCART Pilots</u>

In November 1962, the first group of four A-12 pilots were separated from the Air Force with the understanding that they could upon satisfactory termination of their services with Project OXCART, be reinstated to active military service should they so desire. Cover arrangements were made for them to be employed as "independent contractors" to the Hughes Aircraft Company.

The pilots had arrived at Area 51 in mid-November 1962, and began training in the A-12 in January, 1963, when the two-seater trainer, Aircraft 124, became available to the detachment. As J-58 equipped aircraft were made available by Lockheed, the pilots began flying them. Training flights were limited to developing proficiency, aerial refueling training, navigation training, camera systems operation, and so on. Altitude and speed restrictions applied until Lockheed flight test validated a particular flight profile, whereupon detachment aircraft were allowed to extend to the same limit. The OXCART program was a first in the manner it moved forward after delivery of aircraft. Development breakthroughs were very quickly validated or rejected by flight test and the results were passed on to the detachment for incorporation in training procedures. A standard Air Force weapons system programming cycle divides development, flight test, and operational training into three distinct phases, one following the other. This sequence results in a longer time span to achieve operational readiness. By comparison, concurrent development, flight test, and operational training greatly foreshortened the time when the A-12 could be declared operationally ready.

Further Construction at Area 51

To accommodate the additional aircraft which had been ordered (three YF-12's and five more A-12's), facilities at Area 51 were further expanded in 1963. An additional hangar, an administration building, new mess hall and a special handling building for the camera systems were constructed. Base population reached 1423 in November 1963. Additional BOQ facilities were installed. From experience gained in operation of the aircraft, it was decided to extend the runway. The extension was necessary to provide an acceptable margin of safety in the event of rejected take-off. The aircraft would use the additional length to come to a stop rather than run out on the lakebed where structural damage might occur due to surface roughness. The runway was extended by 11,000 feet of load-bearing asphalt with additional 5,000 feet of graded over-runs on each end. (See overleaf)

Continued Flight Testing

It was reported at the end of 1963 that there had been 573 flights totaling 765 hours since first flight in April 1962. Nine aircraft were in the inventory and the three more would be available by the end of

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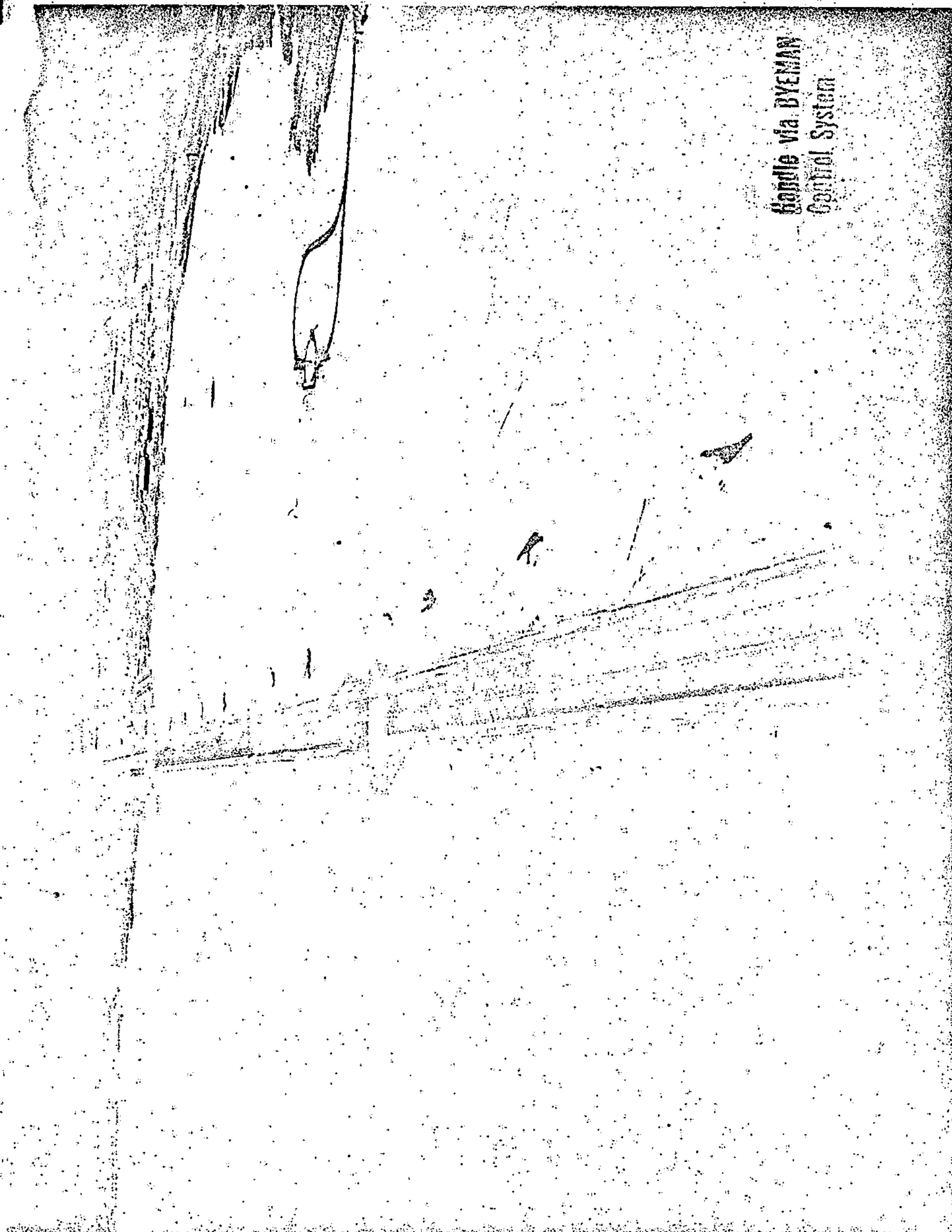

Handle via BYEMAN
Control System

March 1964. On 20 July, the first Mach 3.0 flight had been achieved by flight test aircraft. In November, Mach 3.2 had been reached at 78,000 feet altitude. The inlet duct roughness problem appeared to be solved, but the inlet performance was still below design requirements. The entire aircraft system was operating reasonably well within the limits of testing thus far. A jamming device to work against the guidance link of the SA-2 missile system was in development and was expected shortly for testing. The two camera systems were also performing satisfactorily within the limits of airspeed and altitude flown to date. A third camera system, built by Hycon, was inherited with the three WEDLOCK aircraft and was part of the OXCART sensor inventory.

Maximum effort for the next few months was to be directed toward optimizing the inlet to a firm production configuration, improving aircraft transonic performance, and operating at high temperatures and altitudes to provide the proper environment in which to test equipment and sensors.

The longest sustained flight at design conditions was conducted on 3 February 1964, and it lasted for 10 minutes at Mach 3.2 and 83,000 feet. Flight test data continued to show inlet performance to be deficient between Mach 1.8 and 3.2, resulting in excessive fuel consumption. In May 1964, a special task force was formed to focus exclusively on the aircraft inlet/propulsion interface problems. It was comprised of senior performance personnel from the contractors involved, and it stayed in residence at Burbank until a comprehensive inlet/engine improvement program was developed. By May 1964 a limited Mach 2.35 operational capability had been reached, but the basic inlet/propulsion interface problems still remained.

Project SKYLARK

About this time, Project OXCART operational planners embarked on a program to develop flight planning as performance data could be documented. Operational planning was developing apace with flight test and detachment training. As each new performance plateau was reached and proven, it became a flight planning factor. Project Headquarters, foreseeing a possible contingency whereby the A-12 might be needed to overfly Cuba, began an in-house operations plan for that purpose. It was designated Operation SKYLARK.

Flight testing and detachment training suffered a serious interruption in mid-year of 1964. On a shakedown flight on 9 July

Aircraft No. 133 crashed just short of the runway on its final approach. At an altitude of 500 feet and airspeed of 200 knots, the aircraft began a smooth steady roll to the left. The Lockheed test pilot could not overcome the roll, and at an approximate 45 degree bank angle and 200 feet altitude he ejected safely. The primary cause of the accident was that the right outboard elevron servo valve stuck in a partially open position. The fleet was grounded for a month for incorporation of fixes. The fleet now stood at eleven aircraft. *

Having occurred within the Area 51 reservation, this accident received no publicity. All Area 51 personnel were admonished against discussing the crash, and it was quietly investigated by an accident investigation board. Neither the press nor the public were ever made aware that the accident had occurred.

On 11 August, SKYLARK became a directed project with the imposition of an emergency operational readiness date of 5 November.[1/]

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* The delivery of the three USAF A-12's had been completed in March for a total of 13. The loss of Aircrafts 123 and 133 reduced that total to eleven.

1/ BYE-4631-68, 22 August 1964. DDCI Memorandum to DD/S&T, Subject: SKYLARK. (See Annex 134.)

A strenuous effort was begun to prepare the aircraft, pilots, and supporting elements for a reliable capability. The goal was a Mach 2.8 and 80,000 feet altitude capability. Sixteen mandatory changes or additions to the aircraft were necessary. Only one of the electronic countermeasures equipments would be available by the readiness date, camera performance would have to be validated at the SKYLARK level, pilots would have to be Mach 2.8 qualified, and necessary coordination with supporting elements would have to be accomplished. A senior intra-governmental committee, including representation from the President's Scientific Advisory Committee (PSAC), had examined the problem of operating over Cuba without the full complement of defensive systems. It was its assessment that the first few overflights could be conducted without them. Thereafter, countermeasures would be necessary. The delivery schedule of ECM equipment was compatible with this course of action.

Four of the six detachment aircraft were turned back to Lockheed technicians for modification and update. By 19 October the mandatory hardware modifications were complete and the aircraft returned to the detachment. This was more than two weeks behind the scheduled date because of various aircraft systems integration problems. A multitude of unrelated malfunctions had made the aircraft unacceptable from an operational reliability standpoint and required correction. This in turn delayed Detachment pilot training, systems and payload validation, and over-all reliability determination. In fact, due to the delayed delivery of aircraft, only three pilots were being qualified for the contingency. The Detachment simulated SKYLARK missions on training flights, practicing multiple aerial refuelings and operating systems and payloads. On 5 November 1964, a limited emergency SKYLARK capability was announced. With two weeks' notice, the OXCART detachment could accomplish a Cuban overflight, but with fewer ready aircraft and pilots than had been originally planned.

Primary detachment emphasis in the ensuing weeks was devoted to developing the SKYLARK capability 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, complete pilot training, prepare a family of SKYLARK missions, complete coordination of routes with NORAD, CONAD and FAA, and exercise command and control through operational readiness inspection and command post exercises.

Flight Test Achievements

Primary emphasis in the Lockheed flight test program in the weeks following was devoted to accelerated testing of defensive systems and attainment of the original Mach 3.2 performance specification, and improvement of equipment and component reliability. The highest speed flown at this point had been Mach 3.27, the highest altitude attained was 83,000 feet, and a sustained flight of 32 minutes over Mach 3.0 at 82,000 feet had been reached.

Three years' experience in high altitude, high speed flight testing had proven that achieving a reliable capability at design specification was an extremely difficult and frustrating task. Mach 2 had been reached after six months of flying, and Mach 3 after 15 months. Two years after first flight, Mach 2 time totaled 38 hours, Mach 2.6 time, three hours and Mach 3 time less than one hour. After three years, Mach 2 time had increased to 60 hours, Mach 2.6 time to 33 hours, and Mach 3.0 time to 9 hours. However, all Mach 3.0 time was confined to flight test aircraft, and Detachment aircraft were restricted to Mach 2.9.

Events of 1965

OXCART Develops Operational Capability

Since the first flight on 26 April 1962 through 31 December 1964 there had been 1160 flights, totalling 1616 hours, by all thirteen aircraft built (eleven of which remained). Twin J-58 engines had powered 743 flights and had accumulated 928 hours. Seven aircraft, including the trainer, were now assigned to the detachment and four remained in flight test. SKYLARK aircraft operational performance had reached a speed of Mach 2.9, a range of 1700 nautical miles, and an altitude of 76,000 feet. Inlet modifications and a faster climb schedule would allow a Mach 3.05 speed and increase range to 2500 nautical miles.

On 27 January 1965 one of the flight test aircraft flew a SILVER JAVELIN mission. It was the first in a series of long-range, high-speed flights designed to demonstrate the maximum range capability. The total flight time was 1:40 hours with 1:15 hours above Mach 3.1. Total range was 2580 nautical miles at cruise altitudes between 75,600 and 80,800 feet. It represented the longest sustained flight closely approximating design conditions.

On 28 January 1965 "Exercise Echo" was conducted with joint Project Headquarters, SAC, Detachment and FAA participation. It was a simulated SKYLARK mission and served to exercise all elements that would be involved in an actual overflight. All phases of the exercise were successful. It was significant because it inaugurated operational mission type training by the Detachment.

Two modification programs were embarked upon at Area 51 in 1965. The objectives were to increase speed, improve reliability, improve range, increase mission duration and to incorporate electronic countermeasures. The first, or Phase II SKYLARK modification, was to improve the SKYLARK capability to a Mach 3.05 level and was begun in the spring of 1965. The second, or minimum major modification (MMM), represented the minimum actions necessary to achieve the design Mach 3.0 performance on a repeatable and reliable basis. SKYLARK II modifications included: further improvements in the inlet system; strengthening the structure of plastic panels; increasing the aircraft's supply of nitrogen (nitrogen is used as the inert fuel tank pressurizing medium, and an increased supply would provide for more refuelings on a mission); strengthening the rudder pose; and incorporating minor equipment changes. The MMM program included changes to allow a faster climb schedule; provided space in the chines to install the ECM equipment; strengthened fuselage station joint 715 (this was necessary because of the increased bending movement being introduced by the weight of the ECM gear, heavier payloads, and to provide a better safety margin); and increased the liquid oxygen supply for longer missions. The MMM program also converted the inlet control system. Flight Mach number extensions had been paced by the air inlet system and its interaction with the engine. Key to proper inlet performance was the control system. The performance of the primary inlet control system had not been considered satisfactory. Inlet roughness and shock expulsion had permitted speed extensions only in small increments to Mach 2.8. After extended flight test and instrumentation the contractor opted for the back-up electronic inlet control system over the hydro-mechanical system. The MMM program also standardized the configuration of the aircraft. The numerous approaches to solving A-12 problems had resulted in non-standard configurations for several of the aircraft. At completion, the modification programs would provide a uniform operating fleet of A-12's, equipped and capable of performing the design mission.

The modification programs were phased in such a way that at least five aircraft were available to the detachment at all times for training and proficiency flying. As aircraft were completed and accepted by the Detachment, the pilots began to acquire experience in the higher Mach numbers that the modifications permitted. On 25 March 1965 a Detachment pilot flew a Detachment aircraft at Mach 3.0 for the first time. Thereafter, accumulation of time at the high speeds became routine, and all the Detachment pilots were Mach 3.0 qualified by mid-1965.

The year 1965 can be considered the high point in level of activity in the history of the program. The base at Area 51 reached full physical growth with the completion of construction. Eight Butler shelter-type hangars now housed the Detachment aircraft. Commercial power finally reached the site. Area 51 was now comparable to a normal USAF installation, though on a reduced level. Its population reached a high of 1835 during the year. This large number is attributed chiefly to the fact that the prime contractors were working three shifts a day on the modification programs. Other increases in the Area 51 personnel totals were results of an increase in the Detachment T/O to 280, the TAGBOARD activity which had begun in August 1964, and the base construction and support activities.

Three Constellation aircraft now made daily scheduled workday flights between Burbank and Area 51 to transport contractor personnel and vital freight. Two daily C-47 shuttle flights were made from Las Vegas to transport EG&G personnel to operate the radar range. Range activities now included operation of a surplus USAF radar which had been procured from Fort Fisher, North Carolina, and moved to Area 51. It was a FAN SONG radar simulator, and it was employed in the OXCART ECM systems flight testing program which was beginning to get underway.

In the spring of 1965, Project Headquarters and the Detachment began contingency planning for possible A-12 overflights in the Far East. Since the aircraft was not yet capable of reaching its design range, it was not feasible to mount such operations from Area 51. It was now necessary to plan for an overseas A-12 operating base in the Far East. A forward detachment did exist at Kadena Air Base, Okinawa, but it was capable of supporting only the KC-135 refueling tankers. Under the original OXCART concept of operations, the A-12 operated from Area 51, and the supporting tankers operated from the forward overseas bases.

Project BLACK SHIELD Initiated

On 18 March 1965 the DCI (Mr. McCone) and Secretaries McNamara and Vance had a conversation on the increasing hazards to U-2 and drone reconnaissance of Communist China. Of the meeting he wrote as follows:

"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." 1/

The DDCI (Gen. Carter) transmitted Mr. McCone's memorandum to the DD/S&T for action. Annex 135 contains the text of the DDCI's memorandum. On 22 March, Gen. Ledford, AD/SA, briefed Mr. Vance on the operational concept of a Far East OXCART operation. The plan was called Project BLACK SHIELD. Mr. Vance advised he had directed the D/NRO, Dr. McMillan, to provide the facilities and necessary support to implement the plan.

A joint CIA/USAF team went to Kadena to survey the facilities and construction requirements. The existing special fuel storage and communications facility, plus the adequate runway, made Kadena the logical choice of bases on which to locate an OXCART operating detachment. It was also centrally located relevant to potential target areas. After construction and other support requirements were determined,

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1/ Memorandum for the Record, 18 March 1965, Discussion with Secretary McNamara and Secretary Vance concerning Aerial Reconnaissance over Communist China. See Annex 135.

Secretary Vance made available $3.7 million to assure that the necessary support capability would be available by early fall of 1965. (See Annex 136.) OXCART planning for BLACK SHIELD called for staging three A-12's to Okinawa for 60-day TDY periods twice a year with about 225 personnel involved. A second phase BLACK SHIELD capability would be to establish a permanent detachment.

On 3 June 1965, the Secretary of Defense noted to the D/NRO that the Soviets were deploying SAM's around Hanoi. He queried the practicability of substituting OXCART aircraft for U-2's and drones. 1/ The D/NRO replied on 8 June 1965 that the controlling factor on the use of OXCART was the question of performance, operational readiness, and aircraft reliability, and secondly, the question of vulnerability. He advised that a program was being developed to "make statistically valid determinations of the range, fuel consumption, and other operating parameters of the airplane in its final configuration." 2/

The D/NRO stated he would report again (circa 1 July) to include an analysis of vulnerability and aircraft performance verification by operational aircraft.

1/ BYE-5451-65, 3 June 1965. Memorandum from the Secretary of Defense to the Under Secretary of the Air Force (see Annex 137).

2/ BYE-31530-65, 8 June 1965. Use of OXCART over China and Southeast Asia (see Annex 138).

With a possible deployment overseas in the fall, the Detachment began a comprehensive aircraft and aircraft systems reliability validation program. As aircraft completed the modification program, the Detachment set out to demonstrate complete systems reliability at Mach 3.05, 2300 NM range, and penetration altitudes of 76,000 feet. A demonstrated capability for three aerial refuelings was also part of the validation process.

Considerable improvement in aircraft performance and in the operation of ancillary systems was observed in the post-modification test and evaluation program. The inlet, camera, hydraulic, navigation and flight control systems all demonstrated acceptable reliability. However, due to the sustained time being flown at the high Mach, high temperature environment, new problems surfaced. Most serious among them was with the electrical wiring system. Electrical wiring connectors and components had to withstand temperatures over 800° F along with structural flexing, vibration and shock. Repeated malfunctions were occurring in the inlet control, communications equipment, ECM systems, and cockpit instrumentation which were attributable to wiring failures. There was disturbing evidence that careless maintenance was also contributing to electrical connector failures. There were continued fuel tank sealant problems. A compound had still not been found that withstood the range of temperatures and structural flexing. There were air conditioning failures, transducer and indicator failures, oscillations in the inlet system, and a host of miscellaneous bugs appearing during aircraft operation. Frequent inspections were necessary to assure the durability of the engine. Flight and ground test development was still required to improve the durability of engine components, such as the combustion section, and the accuracy of the engine control systems.

Project Headquarters and detachment maintenance supervisors very carefully observed Lockheed procedures and progress in solving the new problems. There were indications of lessening interest in the program, and a lack of aggressive interpretation of flight test results. There was mounting concern that the BLACK SHIELD readiness date schedule 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 squarely upon Lockheed.

Mr. Parangosky, Deputy for Technology, OSA, met with Mr. Johnson at the Lockheed plant on 3 August 1965. A frank session ensued concerning the measures necessary to insure that BLACK SHIELD and OXCART commitments were made. Mr. Johnson concluded that he should go to Area 51 on a full-time basis to get the job done expeditiously. Mr. Daniel Haughton, President of Lockheed, concurred with the proposal. He offered the full support of the corporation in terms of senior people or any other assistance to achieve BLACK SHIELD readiness. Mr. Johnson began full-time duty at Area 51 the next day. In addition, he augmented the Lockheed contingent at Area 51 with senior inspectors, electrical technicians and manufacturing people.

The assignment of top-level supervisors resulted in improvement in maintenance crew performance, better inspection procedures, and a general tightening-up of Lockheed management at Area 51. The end result of the contractor reorganization was to get Project BLACK SHIELD back on schedule. Four primary BLACK SHIELD aircraft were identified and, upon completion of modifications, went into a flight program to validate BLACK SHIELD operational profile sorties. Flight test aircraft established the following performance milestones during 1965:

Maximum Speed	Mach 3.29
Maximum Altitude	90,000 feet
Maximum Sustained Time	
At or above Mach 3.0	1:17 hours
At or above Mach 3.2	1:14 hours

During the course of BLACK SHIELD validation flights, Detachment aircraft, flown by Detachment pilots, recorded a maximum endurance flight of 6:20 hours duration and another on which 3:50 hours of Mach 3.0 or above time was logged.

On 14 August, a flight test aircraft flew from Area 51 to Orlando, Florida, and return, thence to Kansas City and return. It simulated, exactly as planned, an operational mission with two air refuelings and three cruise legs. The flight covered 6500 nautical miles in 5:27 hours, including air refueling time. Between 4 and 15 August, an aircraft was deployed to McCoy AFB, Florida, for a series of climatic tests to determine vehicle performance in areas of high humidity. Cockpit fogging, hot-air deicing, and windshield rain removal were items which required environmental testing. Data obtained from the flight testing at McCoy indicated that descents into moist, warm climates presented no flight safety problems, and that it was feasible to operate in such a climate, one which was very similar to that of Okinawa.

On 20 November 1965, BLACK SHIELD validation was completed. The aircraft system was performing with acceptable reliability and repeatability. The detachment was manned, equipped and trained. The two primary camera systems were performing according to specification. A considerable amount of material had been shipped by surface, and was in place at Kadena to support a deployment. Kadena facilities were essentially completed. A deployment schedule called for an operating capability in being at Kadena Air Base on 15 January 1966. To strengthen the declaration of operational readiness he was soon to make, General Ledford called the principal contractors to a meeting at Headquarters on 23 November 1965. There he asked for, and received from each one, a written statement that each contractor felt his system was ready for successful BLACK SHIELD operation. Statements were received from Lockheed (aircraft and over-all systems); Pratt & Whitney (engines); Minneapolis-Honeywell (INS and Flight Control System); Perkin-Elmer and Eastman Kodak (Cameras). (See Annex 139 for statements provided by the contractors.)

On 1 December 1965, a proposal was forwarded to the 303 Committee via the D/NRO that the OXCART Far East deployment be approved. It was indorsed to the 303 Committee by the D/NRO on

2 December 1965 (see Annex 140). The 303 Committee examined the matter the next day. It did not approve an actual deployment as requested. It did agree that all steps be taken, short of moving aircraft, to develop and maintain a quick reaction deployment capability, ready to deploy within a 21-day period any time after 1 January 1966. (See Annex 141.)

OXCART Accomplishments in 1965

A review of operational activity for 1965 reveals that 600 A-12 flights had been made for a total of approximately 1000 flying hours. There had been a sharp increase in Mach 3.0 flight time (108 hours accumulated as compared to only 8 hours total Mach 3.0 time acquired prior to 1965), and detachment sortie effectiveness rose from a low of 25% in 1964 to 65% in December 1965. A sortie is rated effective only if all subsystems performed properly and all planned objectives of the sortie were satisfactorily accomplished. The OXCART Program had reached the stage where it was capable of conducting reconnaissance of Cuba and deploying to the Far East, simultaneously if required. The year's accomplishments, however, were clouded by the third aircraft loss.

On 28 December 1965, Aircraft No. 126 crashed immediately after take-off at Area 51 and was totally destroyed. The pilot ejected safely at an altitude of 150 feet. The accident investigation board determined the cause involved human error wherein a flight line electrician had connected the yaw and pitch gyros of the aircraft stability system in reverse. This resulted in complete uncontrollability of the aircraft when it began a series of violent yawing and pitching gyrations immediately after lift-off.

The Office of Security was directed by the DCI to conduct an inquiry into the accident. It was concluded that the accident occurred as the result of unintentional errors on the part of the workers directly involved. There was no indication or evidence of sabotage, malicious intent or wanton disregard of proper procedures. There was no publicity connected with the accident. Corrective actions included closer technical supervision of maintenance personnel, increased emphasis on formal training courses and higher maintenance standards.

Assignment of responsibility for reconnaissance of targets in the Far East solidified employment concepts and tactical training. Training programs and requirements were focused upon BLACK SHIELD planning. Training for three AR missions, over-water rendezvous, single-engine refueling proficiency, subsonic missions and ECM procedures received heavy emphasis. Pilot fatigue studies were conducted to verify pilot capability to perform the missions of duration expected in deploying subsonic to overseas locations.

Subsonic deployment to the Far East was revised with the validation of a reliable over-water air-refueling rendezvous system. This development made supersonic deployments feasible and materially reduced the staging logistics requirement and pilot fatigue factors.

Basic inflight and photo flight line tactics evolved from the U-2 operational experience. While the A-12 speed, altitude, and ECM made the aircraft virtually invulnerable to enemy air defense reactions, special techniques had to be developed in planning camera flight lines due to the high speed and turn characteristics (86 mile turn radius) of the aircraft. Although stable flight lines were planned over primary target areas, bonus photography could be planned on during a coordinated turn.

In-Flight Refueling (IFR) Techniques

Perhaps the most singular and certainly a first in tactics was the development and establishment of the air refueling rendezvous and the accompanying air refueling techniques. The basic problem to be solved encompassed getting the A-12 from very high cruise altitudes

(80,000 plus) and high supersonic speed (Mach 3.2) to the comparatively low (30,000 feet) air refueling altitude and speed (Mach .80), directly behind the tanker in position for a hookup. The complete rendezvous and refueling operation from cruise altitude back to cruise altitude encompasses some 700 nautical miles; the rendezvous is accomplished by means of the A-12's navigation system plus a UHF, discrete radio system which provides range and azimuth information. An airborne beacon and TACAN are used as additional rendezvous equipment. After considerable test and evaluation, today's A-12 refueling tactic consists of a 240 NM descent to a 30,000 foot level refueling profile. The receiver pilot utilizes one engine in afterburner during actual refueling. After refueling, the A-12 climbs back up to cruise Mach (3.1/3.2) and continues mission.

In the early days of the pre-operational period, considerable coordination effort was expended in the establishment of air refueling tracks and attendant procedures for operating the A-12 into the Polar areas. Some initial training routes were conceived and planned along these lines and included the procedures necessary for overflight of Canada. The cooperation of the Canadian Government to use Canadian airspace was obtained in 1963.[1/]

1/ BYE-3194-63, 4 September 1963 (see Annex 142).

The foregoing, of course, was consistent with the initial OXCART concept which envisioned the Sino-Soviet Bloc as the primary area of interest. Subsequently, as political interest and emphasis shifted to the China/Southeast Asia area, training routes were concentrated over the southern United States land mass and some Pacific Ocean areas.

Mission Planning

The formulation of operational tactics has been a continuing effort designed to optimize mission capability consistent with requirements and safety. The A-12 Tactical Doctrine Manual was developed and formalized to govern all A-12 operations. This manual prescribes in detail A-12 operational planning factors, tactics and procedures for the employment of the A-12 reconnaissance system.

OXCART program mission planners began working up a dossier of BLACK SHIELD missions, using the computerized techniques developed in the two prior years. Until late fall of 1964 OXCART mission planning was in the primitive state of manual manipulations and computations utilizing data subscribed by contractor specifications. By November 1964 enough graphs, charts, and benchmark data had been gathered to begin a computer program which was to eventually afford an automated flight plan.

With this limited capability, mission planners began eliminating each manual function of planning. Prior to the summer of 1965, automated magnetic variation, minimum fuel required to designated bases, along with a flight plan format had emerged. The need for more definitive-type systems capabilities and vehicle performance mission planning factors became apparent. Significant progress was made in automated mission planning during the A-12 validation period, including the following major accomplishments:

(1) Automated plotting capability.

(2) Post-mission plot to inertial navigation system tape.

(3) Distance to "go" information.

(4) Extraction of certain data in flight plans for NPIC's use in correlating mission "take".

(5) Sun relative bearing with its change rate per minute.

(6) A defense analysis program to give probability of mission success.

(7) Inertial navigation systems program.

This validation period, which ended in November 1965, saw the advent of worldwide capability of the INS system, testing and validation of all weapons systems and repeatable performance information.

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With data gleaned from this validation period, mission planners were able to incorporate into the computerized flight plan the A-12 turn radius, automated weather data and fuel curves for the different types of cruise profiles. Additionally a KC-135 automated flight plan was developed which has been declared the most advanced system ever affordeda supporting organization. At this time, all camera programming data was also included in the automated program.

In summary, with a minimum number of specific computer inputs such as departure coordinates and time, target coordinates and destination coordinates, the computer program could output a complete flight plan depicting all necessary information for planning and employment. A customized planning concept with a mission generation countdown of 24 hours was tried and proved.

The computer program is capable of planning missions at either subsonic or supersonic speeds, varying power settings, maximum altitude or long-range cruise profiles and varying gross weights, and will automatically compute fuel consumption utilizing the correct parameters.

Events of 1966

The 1966 training program included a mission plan exercise in April to familiarize new mission planners with flight planning preparation and timing. Film handling and movement procedures, stimulating both SKYLARK and BLACK SHIELD operations, were exercised. A command post exercise in May checked out the special procedures to be followed by supporting commands in the Far East for BLACK SHIELD. Forward base exercises were conducted at Adana, Turkey, and Kadena, Okinawa. New procedures, schedules, and priorities were developed with the SAC KC-135 aerial refueling tanker support unit. By mid-year, liaison and coordination with appropriate U.S. Navy and USAF commands had compressed to seven days the response time to launch an overflight of Cuba. Experience gained from BLACK SHIELD training exercises resulted in a revised operations plan that reduced from 21 to 15 days the response time to deploy and commence operations at Kadena.

ZI Air Traffic Control Procedures

In April 1966 the problem of air traffic control at altitudes above 60,000 feet was the subject of a meeting between Project Headquarters, USAF and FAA. The increase of flying activity by YF-12's and SR-71's from both Edwards Air Force Base and Palmdale, California, made it necessary to establish procedures which would provide for air traffic control at altitudes above 60,000 feet without compromise of project security. The OXCART operations personnel contributed substantially to the development and establishment of flight separation criteria for this previously uncontrolled airspace, and the establishment of coded altitude reporting to protect the classified aspect of operations above 60,000 feet.

As mentioned earlier, control of airspace in the environs of Area 51 was mandatory to preserve security of the base and the flying activity. The task of safely and securely operating a supersonic aircraft which publicly did not exist, from an air base which also did not exist, required the establishment of unusual, specialized procedures. The following are examples:

(1) <u>Yuletide Approach Control:</u>

This approach control was established in January 1962, ostensibly as the airspace controlling agency for all of the Nevada AEC Test Site, but in fact did not control the airspace surrounding Area 51. A separate covert approach control was established at Area 51 which managed and controlled all flight activity there.

(2) Yuletide Special Operations Area:

As flight test and training progressed and performance envelope of the aircraft increased, access to additional secure Airspace was required. The Yuletide Special Operating Area (SOA) was established in early 1963 restricting use of designated airspace north of Area 51 specifically for Area 51 aircraft's use between altitudes of 24,000 feet and 60,000 feet. This SOA has been revised periodically due to changing requirements and is presently approximately 150 NM by 350 NM in area on an East-West orientation.

(3) Arrival/Departure Corridors:

Covert procedures utilizing covert arrival/departure corridors for support aircraft operating from Area 51 were also established in coordination with FAA. These procedures provided for filing of aircraft clearances ostensibly from Nellis Air Force Base, Nevada, though in fact the aircraft were flying from Area 51.

(4) Mode X - IFF/SIF:

This discrete, selective identification feature was developed and installed in A-12 aircraft for secure flight following.

In this system, the airborne transponder responds only to ground radars specifically modified to be compatible with the airborne equipment. Installation was made only in selected ground radars. This feature was necessary to insure adequate flight following since all A-12 flying from Area 51 through July 1965 was flown black, i.e., no flight clearance was filed. The covert aspect of this type of flying required extensive coordination and the establishment of specialized procedures with FAA and NORAD to assure no compromise of A-12 aircraft existence or performance should the aircraft be tracked by their radars.

(5) Clearance Filing Procedures:

A-12 clearance filing procedures begun in July 1965 included ostensibly departing VFR from Edwards AFB as an SR-71 to a fix within the Yuletide SOA; there picking up an IFR clearance for a route of flight above 60,000 feet, returning to a fix within the SOA, cancelling the IFR flight plan and ostensibly proceeding to Edwards VFR for a landing.

OXCART Pilot Training

Individual pilot flight activity in 1966 was geared to maintaining proficiency and operational readiness. Most training flights included at least one aerial refueling and averaged 45 minutes of Mach 3.0 time. The pilots were checked out in night flying and refueling. Escape, evasion and survival training continued with emphasis on tropical and seacoast areas. Para-sail training was instituted as part of the water survival training program.

Average A-12 flying time for the six pilots who were Mach 3.2 qualified increased to 353 hours. Two new pilots came into the program in the fall of 1966.[1/] Their training followed the same general pattern of the earlier groups of pilots. All A-12 pilots completed the Lockheed A-12 ground training course. This course consisted of academic instruction on normal and emergency procedures for the aircraft, propulsion system and aircraft systems. Academic training accomplished concurrently with the A-12 transition flight program consisted of extensive instruction on the navigation, sensor and ECM systems.

Concurrently with operational readiness flight training, additional academic instruction was devoted to aircraft systems, plus tactical doctrine study. The objective was to reach peak proficiency

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1/ For a recapitulation of pilot selection and recruitment phasing, see Annex 143.

in all areas during the period. Standardization (ground phase) required the pilot to successfully pass a comprehensive examination on all aspects of aircraft operations and tactics. Integrated into the formal pilot training program are specialized courses of instruction as follows:

(1) Pressure suit fitting and physiological training.

(2) Security and resistance to interrogation training.

(3) Escape and evasion training.

Once declared operationally ready, each pilot continued to receive extensive ground and flying training to assure optimum proficiency.

To the maximum extent possible and consistent with flying safety, OXCART project pilot training was conducted concurrently with the manufacturer's developmental flight testing. As an example, Lockheed cleared detachment pilots incrementally for training at speed regimes beginning at Mach 2.35 and ultimately to Mach 3.2, the aircraft design operating speed. This unique training philosophy proved advantageous in that the detachment attained operationally ready status far more quickly than had the normal Air Force Category I, II and III approach been followed.

Prior to A-12 flight training, all OXCART pilot candidates were qualified in the F-101 aircraft to include aerial refueling. The

F-101 was used as the companion trainer aircraft to the A-12 to augment pilot proficiency.

The basic A-12 flying training program consisted of 21 training missions and approximately 52+30 flying hours. The program required eight transition missions and a standardization check in the J-75-equipped two-seated A-12 trainer. A total of twelve training flights were required in the J-58-equipped A-12 during the operational readiness phase. Training included day and night transition flying, instrument flying, aerial refueling, navigation, photographic procedures, ECM training, plus normal and emergency procedures for all systems. The final three training missions were simulated operational missions with multiple aerial refuelings.

Deployment and Use of OXCART Opposed

While the OXCART Detachment trained for its operational role, attempts were made to commit the capability to operational use. At the 17 February 1966 meeting of the 303 Committee, the question of deploying the OXCART to the Far East was again raised. Mr. Vance advised that Mr. McNamara still opposed deployment on the basis that the situation remained unchanged since December 1965 (see Annex 144). On 22 March 1966 the Director (Admiral Raborn) expressed his deep concern over the lack of adequate photography to detect a possible Chinese Communist strategic build-up in South China and direct involvement in the Vietnam war. The inherent limitations of satellite coverage and the defensive threat to U-2's and drones was seriously inhibiting timely acquisition of high resolution photography. He therefore recommended that the OXCART aircraft be deployed immediately to Okinawa, fly missions over North Vietnam as soon as possible, and be ready to back up the U-2 and satellite capability in South China should they prove incapable of fulfilling the intelligence requirements. The JCS supported this view. At the 28 March 1966 meeting of the 303 Committee, Mr. Vance stated that he and Mr. McNamara were still against deployment despite the JCS views. They felt that existing systems could provide sufficient coverage of North Vietnam. Since the Department of Defense was the principal customer and was willing to live with lesser coverage, the Committee concluded not to deploy at that time. It was recommended, however, that after further study of certain aspects, the views of the DOD and CIA be brought to the attention of the President. (See Annex 145.)

Subsequent discussions of the matter occurred on 11 May 1966 and 27 June 1966. The minutes of these meetings reflect that the

CIA favored immediate deployment and use; the State Department was against; the DOD was split, with Messrs. McNamara and Vance opposed and the Joint Chiefs of Staff in favor of deployment. The PFIAB was on record as favoring deployment and use. The time had come to present the divergent views to the President. (See Annexes 146 and 147.) This was done and on 12 August 1966, Mr. Walt Rostow advised the DCI (Mr. Helms) that the President had decided for the time being not to deploy the OXCART (see Annex 148).

On 6 September 1966 a proposal was submitted to the 303 Committee to conduct OXCART reconnaissance missions over Cuba. The Director had recommended, and the Secretary of Defense had concurred (see Annex 149) that the OXCART capability be exercised over Cuba to confirm the reliability of the basic aircraft system, to test the EWS against the Cuban SA-2 defenses if they responded, and to evaluate a Soviet-type defensive environment reaction and capability to a low cross section, Mach 3.0 aircraft. While it would provide higher resolution photography than the SAC U-2 was currently obtaining, it was not proposed that the OXCART replace that capability. The main objective was to establish and validate the operational capability of the OXCART system to perform reconnaissance of a defended area.

The 303 Committee considered the proposal on 15 September 1966. In general, the attitude was negative. In spite of advantages which might accrue from testing in a hostile environment, the opinion prevailed that introduction of OXCART over Cuba would disturb the existing calm prevailing in that area of our foreign affairs. Until an overriding requirement could be presented, the majority decision was not to commit the A-12 to a Cuban operation.

Further Development and Testing of A-12 System

Although A-12 performance had been validated at the high Mach and high altitude, there were still problems to be worked out. Until the real world of the A-12's flight regime was actually experienced, its effects on aircraft performance had been unknown. Vibrations, aero-elastic effects, thermal and mechanical shock during transients, systems interactions, control accuracies and environmental conditions make up this real world. The interaction of these variables affect range, for example, as follows:

a. Inlet spike 4% inaccuracy penalizes inlet performance by 3%.

b. 1% inlet leakage penalizes inlet performance by 1%.

c. Inlet bypass one-tenth inch inaccuracy penalizes inlet performance by 1%.

d. Inlet performance off 5% increases fuel consumption by 5 % to 10%.

e. Fuel consumption 5% to 10% higher penalizes aircraft range by 5% to 10%.

f. Engine turbine temperature 40°C low penalizes aircraft range by 5%.

g. Flight path environment 10° C hotter than standard penalizes aircraft range by 7%.

h. Environmental temperature shears cause unscheduled control surface movements resulting in additional drag.

i. Fuel temperature and density variations can reduce fuel onload by 1,000 to 2,000 lbs.

j. Less than precise center of gravity management causes control surface movements resulting in additional drag.

k. Deviations from optimum climb schedule reduces fuel available for cruise.

Engineering development and flight testing concentrated on further improving the air inlet control system, main and afterburner controls, bypass door schedules, Mach hold, autopilot and stability augmentation systems. A performance optimization flight program was run in conjunction with hardware improvements. A reliable cruise capability was established which reflected an approximate 200 mile increase in operational tanker-to-tanker range. Cruise range, with 6000 pounds of fuel reserve, reached 2870 nautical miles at altitudes ranging between 75,000-84,000 feet at Mach 3.1. On 21 December 1966, a flight test aircraft flew a two-aerial-refuelings mission of 6:09 hours' duration of which three hours and thirty minutes were flown at or above Mach 3.2 One leg of the mission covered a distance of 3067 NM. Operational aircraft were never to attain that range because the program termination ground rules restricted the necessary hardware improvements in the fleet. While it is doubtful that the original 4000 NM range figure would have been achieved, there were prospects of improving range performance beyond those demonstrated.

On 5 January 1967 the fourth A-12 was lost. Aircraft No. 125's accident occurred during descent about 70 miles from Area 51, near Leith, Nevada. It involved a fuel system gaging malfunction which resulted in a higher than actual fuel quantity reading. Because of this, the aircraft's fuel supply depleted before reaching the base. The aircraft was totally destroyed. The pilot was ejected but was killed when he failed to separate from the ejection seat prior to its impact.

A search was initiated for the wreckage and pilot by Area 51 personnel and aircraft. The wreckage was discovered on 6 January, and the pilot's body was recovered on 7 January. A week was spent retrieving pieces of the wreckage. The cover story for the accident was that an SR-71 aircraft out of Edwards AFB was missing and presumed down in Nevada. The aircraft was on a routine test flight and the pilot was missing. This story was released via USAF channels on 6 January, and the pilot was identified the next day as a civilian test pilot. Although his employer was not disclosed, the newspapers identified him as a Lockheed employee. This story was never refuted by USAF Public Information Officers. See Annex 150 for samples of press reporting.

Flying activity was suspended pending investigation of causes both for the crash and the seat separation failure. Upon determination of causes, precautionary action in the form of inspections and calibration checks was taken to preclude recurrence of similar malfunctions.

Of interest is the fact that none of the four A-12 accidents involved the high Mach number, high temperature, regime of flight. All the accidents involved traditional problems inherent in any aircraft. In fact, the A-12 by now was performing with a high degree of reliability at the high Mach environment. Detachment flight sortie effectiveness was near 80%. Major subsystem reliability was also good. A detailed examination of OXCART experience data and systems reliability is contained in a final report on that subject dated 15 January 1968 (BYE-8725-68), a copy of which is appended hereto as Appendix I. This document provides a comprehensive and detailed record of the levels of reliability of major aircraft systems, cameras, and electronic warfare systems.

Detachment training in the spring of 1967 consisted of routine flying for pilot proficiency and systems checkout, with emphasis on two aerial refueling missions. Such profiles were similar to those that would be flown on operational missions should either the SKYLARK or BLACK SHIELD contingencies be activated. Construction at Kadena was near completion except for new hangars. Provision had been made to use other hangar facilities on a temporary basis should the need arise. Final BLACK SHIELD deployment planning was complete, appropriate operations orders were issued, and the Detachment was capable of being in position ready to fly an operational mission fifteen days after notification to go. The plan called for flying the A-12's non-stop from Area 51 to Kadena with three aerial refuelings enroute. Supporting tankers would operate from Beale Air Force Base, California; from Hickam Air Force Base, Hawaii; and from Kadena Air Force Base, Okinawa. In a crisis situation, the deployment route could be extended to include photographic coverage of North Vietnam and recovery at Kadena.

OXCART Deployment, Operations and Termination

During May 1967, concern was growing over the possible introduction of offensive surface-to-surface missiles into North Vietnam. The problem of detecting such missiles was discussed with the President on 11 May. He requested a proposal on how best to monitor the situation. The Agency responded the next day with a briefing to the 303 Committee on the photographic coverage required for missile search and the extent of existing coverage, which was inadequate. CIA presented a proposal to use the A-12's. The State and Defense members of the 303 Committee decided to further examine the requirement and the political risks. While they conducted their examination, a formal proposal to deploy the OXCART was submitted to the 303 Committee by Mr. Helms on 15 May 1967.[1/] On 16 May Mr. Rostow reported that the President had given his approval for immediate deployment and use of the OXCART over North Vietnam. (See Annex 152 for an account of events leading to the deployment decision.) The BLACK SHIELD contingency plan was immediately placed in effect. On 17, 18 and

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1/ BYE-2369-67, 15 May 1967; Memorandum for 303 Committee, Subject: OXCART Reconnaissance of North Vietnam, Annex 151.

19 May, logistical airlift to Kadena was accomplished. Six C-141 aircraft transported approximately 120,000 pounds of cargo and equipment and the task force personnel from Area 51. Communications and support teams were positioned at Hickam AB and at Wake Island to assist in recovery of the aircraft in case of emergency landings at either site. Arrangements were confirmed to fully brief the Ambassador [redacted] 50X1, E.O.13526 The Prime Ministers of Japan and Thailand were advised, as were the President and Defense Minister of the Republic of China. The Chiefs of the Air Force of Thailand and the Republic of China were also briefed. The reactions were favorable. On 22 May the first A-12 (Serial No. 131) flew to Kadena from Area 51, non-stop in 6:06 hours for a distance of 6874 nautical miles. Refuelings were accomplished west of San Francisco, near Hawaii and near Wake Island. There were no major aircraft malfunctions, and the flight was completed as planned without difficulty.

Aircraft No. 127 departed Area 51 on 24 May and arrived at Kadena 5:55 hours later. Again the flight, including three refuelings, was accomplished without difficulty. Average speed from take-off to landing, including refueling time, was Mach 2.03. The third A-12, No. 129, was launched as planned on 26 May 1967. The flight proceeded normally until the pilot experienced an Inertial Navigation System problem and communications difficulties in the vicinity of Wake Island. Under the circumstances, he elected to make a precautionary landing at Wake Island. The prepositioned emergency recovery team secured the aircraft without incident and continuation of the flight to Kadena was accomplished the next day.

On 29 May 1967, the deployed unit at Kadena was ready to fly an operational mission. Under the command of Col. Hugh C. Slater, (who had become Area 51 Commander in September, 1966), two hundred and sixty personnel had deployed to the prepared BLACK SHIELD facility at Kadena. Except for hangars, which were a month short of completion, the facility was ready for sustained operations. On 30 May 1967 the Kadena Detachment was alerted for a mission for the 31st. The first BLACK SHIELD mission was flown on 31 May 1967. Two photographic flight lines were flown, one over North Vietnam and the second over the DMZ with good results. The mission was for a duration of 3:39 hours, and the cruise legs were flown at

Mach 3.1 and 80,000 feet. An analysis of the mission is contained on pages 3 and 4 of Annex 153.[1/] Seventy of the 190 known SAM sites in North Vietnam were photographed as were 9 of the 27 COMIREX priority one targets. Three more missions were flown in June 1967.

All operational missions were planned, directed and controlled by Project Headquarters against targets identified by USIB and approved by higher authority. A constant watch was maintained on the weather in the target areas. Each day at a specified hour (1600 hours local) a mission alert briefing occurred. If the forecast weather appeared favorable, the field was alerted to a mission and provided a route to be flown. This alert preceded actual mission take-off by 28 to 30 hours. Twelve hours (H-12) prior to take-off, a second review of target weather was made. If it continued favorable, the mission generation sequence continued. At H-2 hours, a "go-no-go" decision was made and communicated to the field. The final decision, it should be noted, was not just based on the target area weather factor. Weather had to be adequate also in the refueling areas and at the launch and recovery base for safety of flight reasons.

1/ BYE-44232/67, 22 September 1967. "BLACK SHIELD Reconnaissance Missions, 31 May-15 August 1967". (Annexes 154 and 155 cover BLACK SHIELD missions from August 1967 through March 1968.)

In the field, operations and maintenance generation began with the receipt of alert notification. A primary aircraft and pilot, as well as a back-up aircraft and pilot, was selected. The aircraft were given thorough pre-mission inspection and servicing, all systems were checked, and the camera was loaded into the aircraft. The pilots were given a detailed mission route briefing in the early evening prior to the day of flight. On the morning of the flight, a final briefing occurred at which time the aircraft and systems status was reported, last minute weather and intelligence was briefed, and any flight plan amendments or changes were provided the pilots. Two hours prior to take-off, the primary pilot was given a medical examination, was suited, and transported to the aircraft. In the event of equipment malfunction or for other reasons the primary aircraft could not take off, the spare or back-up was prepared to execute the mission one hour later.

A typical route profile for a BLACK SHIELD mission over North Vietnam included a refueling shortly after take-off, south of Okinawa, accomplishing planned photographic pass(es), withdrawing to a second aerial refueling in the Thailand area, and returning to Kadena. Mission timing, tactics and routes were varied, consistent with photographic requirements and threat analyses.

Following recovery at Kadena, the camera film was removed from the aircraft, boxed, and couriered by special aircraft to the processing facilities. Processing of early missions was done at the Eastman Kodak plant in Rochester, New York, and photo interpretation at the NPIC. In late summer, the responsibility for processing and exploitation of BLACK SHIELD material was placed on the Pacific Theater photo interpretation center at Yokota, Japan. The time saved permitted the photo intelligence to be in the hands of the American commanders in Vietnam within 24 hours of the completion of a BLACK SHIELD mission.

During the course of the BLACK SHIELD operations, 29 missions were flown, 24 over North Vietnam, 2 over Cambodia, and 3 over North Korea. Fifty-eight photographic flight lines were accomplished. All missions were launched and recovered from Kadena, except for one precautionary landing at Ban Takhli, Thailand. That aircraft returned to Kadena the next day. Annexes 153, 154 and 155 contain maps and routes of all BLACK SHIELD missions.

Enemy radar tracking was reported on all but four missions. It ranged from very brief reflections of the A-12's presence on early missions to extended and accurate tracking. On three missions, SA-2 missiles were unsuccessfully launched at the A-12. Post-flight inspection of the mission aircraft of 30 October 1967 revealed that a piece of metal had penetrated the lower wing surface of the aircraft. It was not an SA-2 warhead pellet, but possibly a part of the debris from one of the missile detonations. Eight missiles were reported launched during the mission. Resumés of BLACK SHIELD missions are contained in Annexes 153, 154 and 155. They include a route description, enemy radar tracking, hostile reaction, extent of coverage, and target statistics.

In early March 1968 the USAF's SR-71 aircraft arrived at Kadena to relieve the OXCART Detachment of its BLACK SHIELD commitment for North Vietnam coverage. The OXCART Detachment went on standby status to back up the SR-71 capability. The last A-12 operational mission was flown on 8 May 1968 over North Korea.

The cover plan for BLACK SHIELD explained the presence of the aircraft at Kadena as experimental test bed versions of the YF-12A and SR-71 family, undergoing environmental and field tests. (See Annex 156 for text of the contingency and cover plan.) The OXCART vehicle had been on Kadena for over a month before the the first local newspapers reported their presence. The USAF PIO news release, in response to an Okinawan press inquiry, was in accordance with the cover story. After the initial articles in Far East newspapers, nothing significant was reported when reference was made to the presence of the aircraft on Okinawa and they were always termed USAF YF-12A/SR-71 aircraft.

With reaffirmation of the OXCART phase-out decision, the Kadena Detachment was advised to prepare for redeployment to Area 51. Project Headquarters selected 8 June 1968 as the earliest possible redeployment date. Flights of A-12 aircraft were to be limited to those essential for flying safety and to maintain necessary pilot proficiency to redeploy from Kadena and ferry the aircraft to Palmdale, California, for storage. All Area 51 aircraft (Nos. 121, 124, 128, 130, and 132) were placed in storage at Palmdale by 7 June 1968.

On 4 June 1968, Aircraft 129 departed Kadena Air Base on a functional check flight which was required due to an engine change. It did not return. The last known position of the aircraft was 520 nautical miles east of Manila. Search and rescue operations were begun shortly after the mishap. No visual or radar sightings were reported. The primary cause of the loss is undetermined. The most probable cause was catastrophic failure of an engine. (See Annex 157 for press coverage.)

In addition to the five A-12's lost during the course of the OXCART Program, two F-101 aircraft were lost. Both accidents were fatal to the pilots. On 1 June 1967, Lt. Col. Welton King was killed when the aircraft tail section separated in flight shortly after take-off at Kadena. On 26 September 1967, Lt. Col. James S. Simon, Jr., was killed when he inadvertently flew his aircraft into the ground at Area 51. A recapitulation of aircraft losses is attached as Annex 158.

The two remaining A-12's redeployed to Area 51 in June 1968. After post-flight maintenance, both were ferried to Palmdale where they joined the rest of the OXCART fleet in storage. The Kadena operation was closed out as of 30 June 1968. Of the total thirteen A-12's procured, eight remain. Aircraft installed and ground equipments (with appropriate spare systems) will be retained at Palmdale to support all A-12's in storage. Spare parts and equipment will be stored at Palmdale to support at least a 90-day level for the five operational A-12 aircraft stored. It will be possible to remove the aircraft from storage at some future date and prepare them for operation. This will be accomplished only at great cost in money and time.

Summary of OXCART Accomplishments

The OXCART Program lasted nine years. The total cost, including development, production, maintenance and operation, and support amounted to approximately $950 million. From concept to operation, it pioneered the way in the aerospace industry to reach the plateau of Mach 3.2 flight. The technical data accumulated over the nine years have made, and will continue to make, significant contributions to developments in supersonic aircraft, high Mach turbine engines, aerial reconnaissance, electronic countermeasures, life support and ancillary systems.

It was particularly responsive to priority intelligence requirements when it was maintaining surveillance of North Vietnam. It did not detect the introduction of offensive missiles, but it did provide bomb damage assessments and over-all military logistics estimates to the field commanders. It located the Pueblo in Wonsan harbor and provided valuable information relative to the size and disposition of North Korean forces.

A summary of activities at Area 51 during the BLACK SHIELD deployment is contained in the Commander's Monthly Activities Report for August, 1967, which is attached as Annex 159.

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Postscript

In a ceremony at Area 51 on 26 June 1968, Adm. Rufus L. Taylor, Deputy Director of Central Intelligence, presented the CIA Intelligence Star for Valor to the following pilots in recognition of their participation in the BLACK SHIELD Operation:

Mr. Kenneth S. Collins
Mr. Ronald L. Layton
Mr. Francis J. Murray
Mr. Dennis B. Sullivan
Mr. Mele Vojvodich

The posthumous award to Mr. Jack W. Weeks was accepted by his widow.

The USAF Legion of Merit was presented to Col. Slater and his deputy, Col. Maynard N. Amundson. The Air Force Outstanding Unit Award was presented to the members of the OXCART Detachment (1129th Special Activities Squadron, Detachment 1) and the USAF supporting units.

OXCART Phase-Out

On 10 November 1965, Mr. W. R. Thomas, Chief of the International Division, and Mr. S. B. Leach, Chief of the Military Division, Bureau of the Budget, submitted a memorandum to the Budget Director in which they expressed concern at the total costs of the A-12 and SR-71 programs, both past and projected. They stated that 2.5 billion dollars would have been spent on both programs through FY 1966, and expected 2.1 billions more would be spent through 1971. They questioned the requirement, first for the total number of aircraft represented in the combined fleets, and second, the requirement for a separate CIA (OXCART) fleet. Several alternatives were posed to achieve a substantial reduction in forecast spending. They recommended that the A-12 program be phased out by September 1966 and that there be no further procurement of SR-71 aircraft. Copies of this memorandum (see Annex 160) were distributed to the DOD, D/NRO and DCI with the suggestion that these agencies explore the alternatives set out in the paper. The Secretary of Defense declined considering the proposal, presumably because the SR-71 would not be operational by September 1966.

The matter rested until July 1966 when Mr. Schultze, Director of the Budget, reopened the subject. He proposed that a study of the relationship between the OXCART and SR-71 programs be made by the DOD/CIA/BOB in time for FY 1968 budget deliberations. He suggested possible alternatives that the study group might examine:

1. Retention of separate A-12 and SR-71 fleets, i.e. status quo.

2. Co-location of the two fleets.

3. Transfer the OXCART mission and aircraft to SAC.

4. Transfer the OXCART mission to SAC and store the A-12's as attrition replacements for the SR-71's.

5. Transfer OXCART mission to SAC and dispose of the A-12 aircraft.

Mr. C. W. Fischer was designated as the BOB representative on the study group.

The DCI (Mr. Helms) appointed Mr. Carl Duckett, Assistant Deputy Director for Science and Technology, as the Agency member, and the DOD appointed Mr. Herbert D. Bennington. Mr. Duckett shortly thereafter became the Acting DD/S&T and was unable to devote the time required to the study. He appointed Mr. John Parangosky, who was then the AD/OSA, as the Agency's member of the study group. Throughout the summer and fall of 1966 the panel conducted a detailed

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appraisal of the two fleets, examining the relative technologies, operational capabilities, support facilities and costs. The capabilities of advanced aircraft were balanced against those of satellites and drones. The special covert and civilian characteristics of the OXCART fleet were reviewed for the effect that termination of the OXCART project would have on U.S. relations in matters of clandestine reconnaissance. The study group identified three principal alternatives for decision. They were:

1. Maintain the status quo and continue both fleets at the currently approved levels. Estimated costs through FY 1972 would total $1.377 billion.

2. Mothball all A-12 aircraft, but maintain the OXCART capability by sharing SR-71 aircraft between SAC and CIA. This would save $252 million over the first alternative.

3. Terminate the OXCART fleet in January 1968 (assuming an operational readiness date of September 1967 for the SR-71) and assign all missions to the SR-71 fleet. A cost savings of $365 million would be realized by adopting this alternative.

The report made no recommendations per se. Its purpose was to provide information upon which higher level judgments could be made.

A copy of the Fischer-Bennington-Parangosky report is attached as Appendix II.

On 12 December 1966 there was a meeting at the Bureau of the Budget attended by Mr. Helms, Mr. Schultze, Mr. Vance, and Dr. Hornig, Scientific Advisor to the President. A vote was taken on the alternatives posed in the Fischer-Bennington-Parangosky report. Messrs. Vance, Schultze and Hornig voted to terminate the OXCART fleet, and Mr. Helms voted for eventual sharing of the SR-71 fleet between CIA and SAC. The BOB immediately prepared a letter to the President conveying the course of action recommended by the majority. Mr. Helms, having dissented from the majority, requested a letter be prepared by the DD/S&T to the President stating the case for CIA remaining in the reconnaissance business, and his reasons for voting as he did.

On 16 December 1966, Mr. Schultze handed Mr. Helms a draft memorandum to the President which requested a decision either to share the SR-71 fleet between CIA and SAC, or to terminate the CIA capability entirely. On 20 December Mr. Helms wrote Mr. Schultze that new information of considerable significance had been brought to his attention concerning SR-71 performance. He requested another meeting after 1 January to review pertinent facts, and also requested that the memorandum to the President be withheld pending that meeting's outcome. Specifically, evidence and data had been obtained that the SR-71 program was having serious technical problems and there was real doubt that it would achieve an operational capability by the time the A-12 program was scheduled for termination. So concerned was he with SR-71 capabilities, Mr. Helms changed his position from sharing the SR-71 aircraft with SAC to a firm recommendation to retain the OXCART fleet under civilian sponsorship and separate basing. Other eleventh hour attempts to review the subject were in vain. On 28 December 1966, the President accepted the recommendations of Messrs. Vance, Hornig and Schultze, and directed the termination of the OXCART program by 1 January 1968.

The decision to terminate the OXCART program required the development of an orderly phase-down procedure. After consultation with Project Headquarters, the D/NRO advised the Deputy Secretary of Defense on 10 January 1967 of the phase-out schedule of aircraft. Four A-12's would be placed in storage in July 1967, two more by December, and the last four by the end of January 1968.

Until 1 July 1967, the OXCART Detachment was to maintain a worldwide capability to conduct operational missions from a prepared overseas location and simultaneously from Area 51 in Nevada. The operational readiness posture was to include maintenance of a 15-day quick reaction capability for deployment to the Far East and a 7-day quick reaction for deployment over Cuba. Between 1 July and 31 December 1967, the capability would be maintained to conduct operational missions from either a prepared overseas base or from Area 51, but not simultaneously. The quick reaction capability for either Cuban overflights or deployment to the Far East would also be maintained. On 9 May 1967, Secretary Vance directed that the SR-71 assume the responsibility to conduct Cuban overflights as of 1 July 1967, and the dual capability of Southeast Asia and Cuban overflights by 1 December 1967.

A joint CIA/USAF working group was established by the D/NRO to coordinate planning actions incident to the OXCART phase-out. The group was responsible for identifying decisions and problem areas, recommending courses of action, and advising the NRO, CIA and USAF of progress in the phase-out. The code name SCOPE COTTON was given to the over-all phase-out schedule.

Basic assumptions to guide the phase-out were made. There would be no further major up-dating of the A-12 aircraft. Only those engineering change proposals, retrofits, and modifications which affected safety of flight or were absolutely essential to maintain an operational capability would be authorized. All aircraft would be mothballed and stored by 31 January 1968. No new construction would be authorized at Area 51 and it would be closed upon removal of aircraft and other assets. No new equipment procurements would be made, and spares and supplies would be maintained at levels sufficient only to sustain the operational commitment through 1967. The OXCART engine inventory would be reduced, and overhauls and improvements would be accomplished only as necessary. Procurement actions for USAF detailee personnel would be suspended.

As action items were identified, the D/NRO issued a series of SCOPE COTTON decisions. The TAGBOARD program would remain at Area 51 through 1967. OXCART assets at Kadena and deployment flyaway kits were to be maintained through 1967. Twenty engines would be stored with the aircraft. Repairable items, excess to OXCART requirements, would be redistributed to other programs. No airframes would be cannibalized. Guidance equipment, cameras, EWS and pilot equipment would be retained in minimum quantities and types to support the stored aircraft. Residual stocks of A-12 spares common to the SR-71 would be used by the latter program. Responsibility for follow-on contracting and funding for J-58 engine product improvement would transfer to the USAF, as well as for the YF-12A, beginning in FY 1968. Excess support assets would be redistributed to other NRO programs. Overseas facilities, except at Kadena, would be transferred to the base at which they were located effective 1 January 1968. A gradual transfer of SR-71 contracting responsibilities would be made to the USAF. The radar range at Area 51 would be dismantled and transferred to USAF installations. Research and development would be suspended for countermeasures as they applied to OXCART.

Project Headquarters moved quickly to advise the contractors of the phase-out decision. At the same time they, along with all witting personnel, were cautioned to observe the same standards of security during termination as were observedduring the development and operational readiness stages of the program. The security precaution was necessary to protect CIA's role in the program, CIA procurement and contracting methods, and, most importantly, the mission posture for the year. Dissemination of the information was held down even in the cleared community until orderly phase-out plans could be worked out. Premature release of the information among contractor employees could have had a serious effect on the operational posture. Realizing the short term prospects of the OXCART program, technicians might seek employment elsewhere. The delicacy of the situation was not lost on contractor management; but by careful planning, they were able to maintain their capabilities and program excess personnel into other activities at the appropriate time.

With the program committed to a definite time-table, certain specific actions were taken by Project Headquarters. Systems in, or scheduled for, flight test, unless very near operational acceptance, were removed and placed in storage or made available to other NRO programs. These included second generation ECM systems, the side-looking radar, the infra-red sensor, and the System XVII Elint collection gear. An aircraft standard operational-ready configuration was adopted. Any equipments surplus to the standard configuration were removed from stock and returned to depot storage. Two of the Perkin-Elmer cameras, which were scheduled for overhaul and up-date were removed from the inventory and stored.

On 16 May 1967, the President directed the deployment of OXCART to Kadena, Okinawa, for reconnaissance of North Vietnam for the primary purpose of detecting surprise introduction of offensive missiles. Three aircraft were deployed, and the first mission was flown on 31 May 1967. The deployment had the effect of slowing actions to phase-out OXCART, but the 31 December 1967 termination date still abided at the time of the deployment. In June the Agency proposed two options to modify the phase-out in view of the Kadena deployment. One was to defer mothballing of any aircraft until 31 December 1967 to insure a back-up capability for the deployed aircraft. The second option was to continue the entire OXCART fleet through FY 1968. The D/NRO was amenable to the first option, influenced by the fact that the SR-71 had not yet achieved an operational ECM capability; October was the earliest date it would be ready. The Deputy Secretary of Defense modified the delay in mothballing aircraft by recommending one test aircraft be put down in July and the remaining eight in December 1967. He further directed that SAC would be responsible for Kadena operations on 1 December 1967, using SR-71's.

At the 12 September 1967 meeting of the NRP Executive Committee (ExCom), Admiral Taylor stated that the OXCART aircraft would be withdrawn from Kadena by mid-November to make way for the SR-71 operation. He pointed out that beginning 1 December experienced contractor personnel would be reassigned from the program, and spare parts supply would be depleted to a point where it would be most difficult to sustain an operational posture. October 1 was emphasized as the deadline by which any meaningful change in the phase-out schedule could be effective. Dr. Hornig stressed the importance of the SR-71 being operationally ready before the point of no return had been reached in the phase-out of the OXCART. He requested a current comparison of the OXCART and SR-71. Dr. Flax, D/NRO, said he would provide such a paper prior to 1 October for review by the ExCom.

The minutes of the ExCom meeting of 29 September, which best reflect the situation vis-a-vis the SR-71 deployment for BLACK SHIELD, are quoted herewith:

> "Mr. Nitze stated that the purpose of this meeting was to review the status of the SR-71, to determine what problems may have arisen from SR-71 Category III Tests, and to recommend actions for the future on OXCART phasedown and SR-71 deployment.
>
> "Dr. Flax referred briefly to the papers he had distributed to the members, pointing out that they summarized about two-thirds of the information available from the SR-71 Category III Tests (which would be officially concluded about

[redacted]

October 1, 1968). He stated that, in general, the SR-71 was in a satisfactory state and it was the judgment of operational experts that the Air Force could assume the North Vietnam missions on December 1, 1967. This judgment was also reflected in a Joint Chiefs of Staff statement that the SR-71 is ready for operational employment.

"Dr. Hornig referred to the documents furnished to the ExCom and, in particular, to data dealing with the vulnerability of both the OXCART and SR-71 aircraft. He pointed out that, from his assessment of the data, the SR-71 appeared to be two to four times more vulnerable than the OXCART, based on the listed equipments, statistical factors, and performance curves. There followed a detailed discussion on vulnerability studies, operational techniques and impact, ECM systems and capabilities, the present activity of the enemy, his intentions in the future, and the outlook for future operations. Dr. Hornig then compared the payload volumes of the aircraft and the photographic swath widths of their sensors. He believed the committee should not be too hasty in reaching a decision to deploy the SR-71.

"Dr. Flax stated that a simple comparison of sensor swath widths was not, in his view, a valid way to compare the mission coverage capabilities of the aircraft and that a factor of two in vulnerability which might be assumed on this basis did not reflect mission requirements in any event, since complete area coverage of North Vietnam was not being sought or achieved.

"Mr. Nitze outlined the following options for consideration: (1) delay the transition from OXCART to the SR-71, (2) recommend a reversal of the December 1966 decision, or (3) adhere to that decision. The discussion turned to the first option. Asked the desirability of this option, Dr. Flax stated that if there were no economic restraints whatever he would prefer to retain the total force. However, economic constraints were very real and he believed a firm decision

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was called for at this time. A six-months' delay, in making the transition, he pointed out, could cost $32.0 million. A question was raised as to the cost of reclaiming OXCART aircraft from storage, if required. [redacted] stated that this would involve approximately $300 to $500 thousand per aircraft, if done within the first year. [redacted] also pointed out that the present financial plan provides some OXCART overlap by providing for continued operation at Area 51 during December.

"Mr. Nitze observed that the additional $32.0 million required for a delay in transition from the OXCART to the SR-71 was extremely critical in today's budgetary environment. Dr. Hornig favored a delay of six months. Dr. Foster agreed with the concept of delay but recommended a shorter period: somewhere between three and six months. Mr. Hoffman stated that the original decision of last December should be followed unchanged. Mr. Helms favored a delay. Dr. Flax agreed that a delay would provide a higher degree of confidence in assuring continued operational effectiveness in the face of possible improvement of North Vietnamese defenses, which were just now beginning to be brought to bear on the OXCART aircraft. The cost of this insurance would of course be related to the length of delay in phase-out. He believed that the SR-71 deployment should not be held until the very last day of any agreed-to delay period; if a three-month delay were recommended, the SR-71 deployment should be scheduled for mid-February 1968.

"Mr. Nitze asked for a memorandum spelling out (1) what the decision for a three-month delay would do for the program, (2) the associated costs, and (3) what is intended for the interim. Dr. Flax was asked to prepare such a paper. Mr. Nitze stated he would confer with the Secretary of Defense on this matter early in the following week." 1/

1/ BYE-52712-67, 29 September 1967. Minutes of NRP Executive Committee Meeting. (See Annex 161.)

The deliberations which followed resulted in a decision to retain the three OXCART aircraft at Kadena through 1 February 1968. SAC would assume BLACK SHIELD operations by 15 February. All operational aircraft would remain flying until 31 March 1968, at which time they would be mothballed. The details of the extension and the revised phase-out plan are contained in a D/NRO memorandum of 3 October 1967 to the Deputy Secretary of Defense (see Annex 162).

On 29 December 1967, the Deputy Secretary of Defense advised the D/NRO that the OXCART program was extended through 30 June 1968. The SR-71 was to assume North Vietnamese reconnaissance by 15 March 1968. OXCART aircraft were directed to remain at Kadena for 30 days thereafter to provide a contingency overlap.

The original decision to terminate the program, made in December 1966, tended now to be obscured by the BLACK SHIELD deployment and the two extensions of the termination date. That decision now appeared open to question and the feeling prevailed that Presidential reaffirmation was required. The President's Special Assistant, Mr. Walt Whitman Rostow, had expressed the opinion that removal of the OXCART capability from the Far East should not be undertaken unless the President specifically approved. Key

Congressional figures and members of the President's Foreign Intelligence Advisory Board and the President's Scientific Advisory Committee were also concerned with the loss of OXCART. Consequently the ExCom decided to reopen the matter and once again examine alternatives to outright phase-out of the program. Again the arguments were marshalled in defense of retaining the OXCART capability, buttressed now by its demonstrated operational performance.

(In March the SR-71 unit deployed to Kadena with three aircraft and on 15 March assumed the BLACK SHIELD mission. The OXCART aircraft remained in place to provide a contingency back-up capability, and to provide coverage of North Korea as a result of the Pueblo affair.)

A study of the feasibility and cost of continuing the OXCART program beyond its phase-out date was completed in the spring of 1968 by the D/NRO. Four alternatives were considered:

1. Transfer all OXCART aircraft to SAC by 31 October 1968; substitute Air Force for contractor support where possible; turn the test A-12 aircraft over to the SR-71 test facility. FY 1969 costs would be $62,160,000.

2. Transfer OXCART as in alternative 1, above, and store eight SR-71's. FY 1969 costs would be $40,960,000.

3. Close Area 51 and co-locate OXCART fleet with SR-71's at Beale Air Force Base, California, but with CIA retaining control and management. FY 1969 cost would be $72, 240, 000.

4. Continue OXCART operations at Area 51 under CIA control and management. FY 1969 costs would be $72, 000, 000. 1/

Mr. Helms expressed his reactions to the alternatives considered by the NRO in a memorandum to Messrs. Nitze, Hornig, and Flax dated 18 April 1968. In it he questioned why, if eight SR-71's could be stored in one option, they could not be stored in all the options, with the resultant savings applied in each case. He questioned the lower cost figures of combining the A-12's with the SR-71's and disagreed, for security reasons, with co-locating the two fleets. Above all, however, he felt the key question was the desirability of retaining a covert civilian capability. It was his judgment that such a requirement continued. In conclusion, he flatly recommended maintenance of the OXCART capability at Area 51 under CIA management. 2/

1/ BYE-12721-68, 7 March 1968. D/NRO Memorandum to the Deputy Secretary of Defense, Subject: Study of Options for Continuing Operation of the OXCART Aircraft in FY 1969. See Annex 163.

2/ BYE-6441-68, 18 April 1968. Memorandum from DCI to Messrs. Nitze and Hornig, Subject: Considerations Affecting OXCART Program Phaseout. See Annex 164.

Time, however, was fast running out for the OXCART program. The prime consideration in every phase of discussions concerning the OXCART was budgetary. This was made very clear in the penultimate paragraph of the minutes of the ExCom meeting of 29 April 1968.[1/] Despite the very cogent reasoning of the DCI, supported by the President's Scientific Adviser, the Deputy Secretary of Defense felt the central issue was budgetary. Since in the FY 1969 budget it had been assumed that the OXCART program was terminated, there simply was no money available to sustain the program. On 16 May 1968 the Secretary of Defense reaffirmed the original decision to terminate the OXCART program and store the aircraft. At his weekly luncheon with his principal advisers on 21 May 1968, the President confirmed the Secretary's decision.

1/ BYE-13013-68, 29 April 1968. Minutes of NRP Executive Committee. (Annex 165).

OXCART Auxiliary System Development:

Electronic Warfare Systems

One of the original design goals in the OXCART program was to produce an aircraft with a radar cross-section sufficiently reduced to make it difficult to be detected and/or tracked with accuracy. The anti-radar testing program was pursued to provide data necessary for optimum aerodynamic shaping and choice of materials to minimize radar reflectivity. No provision was made to equip the OXCART aircraft with defensive electronic systems in its original design. Its safety was assumed to lie in its low level of detectability, and in its speed and altitude.

The cross-section levels that the designers achieved were, in fact, quite low. However, the advances the Soviets were making in their radar defense network were equally impressive. It became apparent , as more became known about the Soviet air defense system, that the OXCART aircraft would be unable to overfly hostile territory without penetration aids. The early-warning TALL KING radar, which was replacing older equipments throughout the Soviet Bloc, was estimated to be capable of detecting and accurately tracking the A-12 during an overflight. Improved performance was being evidenced in missile associated radars. A much more threatening environment existed by the end of 1961 than had been planned against in 1959. The new threat environment assessment spurred an already intensive collection program to measure the parameters and sensitivities of new generation Soviet radars. Vulnerability assessments indicated that the SA-2 threat was sufficient to warrant employment of ECM equipment and camouflage techniques. The resultant data and conclusions provided the base on which countermeasures were developed.

The conclusions were expressed in an OSI report as follows:

> "The principal conclusions of this study are as follows: (1) The OXCART vehicle can be detected and tracked by the Soviet TALL KING radar network at significant ranges (essentially line-of-sight); (2) Soviet interceptors can be scrambled in time to attempt an intercept, however, in view of limited speed and altitude performance, as well as insufficient AI radar and AA missile capability, the probability of a successful engagement is exceedingly small; (3) the SA-2 missile system must be considered as a definite threat to the OXCART vehicle on the basis of the capability of the FAN SONG radar to achieve detection at a range that is adequate to permit launch of at least one and probably three GUIDELINE missiles.
>
> "These statements lead quite naturally to the requirement that all possible means of reducing vehicle vulnerability be explored. In addition to penetration aids described in Chapter V, feasibility studies related to the following equipment concepts are being actively pursued: (1) FAN SONG radar detection and track indicator; (2) strange signal detector whose purpose is to detect and identify radar signals that may

emanate from missile guidance radars whose characteristics are presently unknown; (3) barrage and/or deception jamming of the FAN SONG radar; and (4) a missile launch indication radar. It can be seen that these equipments, properly integrated, should provide the capability of the OXCART vehicle to monitor and react to the Soviet ABS in such a manner as to reduce vulnerability to an acceptable level.

"Investigations of the various elements of the Soviet ABS elements are continuing in order to permit refinement of the present performance estimates. In addition, typical missions are being examined critically to provide information relative to optimum techniques and tactics for successful penetration. The results of these studies will be given in a forthcoming report." 1/

In the development of OXCART countermeasures a conscious effort was made to avoid techniques and equipments which duplicated, or adapted, military hardware. This was to prevent possible compromise of military systems should an A-12 loss occur during overflight. A family of novel warning and jamming devices emerged under what was called the SUPERMARKET approach to the problem. It consists of a number of electronic systems, passive and active, to warn the pilot of missile activity and to initiate jamming and confusion signals. A redundancy was designed into the total package to give a lower degree of vulnerability and to assure a high degree of

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1/ SC-04312-64, 19 February 1964. OSI Report, Subject: OXCART Vehicle Vulnerability Study. (On file in D/O/OSA/INTEL.)

total system reliability. A number of combinations of systems was made available for use on a given mission. Judicious employment of the combinations would prolong the A-12's freedom of operation over denied areas. The defensive electronic warfare systems that were developed and employed in the OXCART aircraft, with a brief functional description of each, are listed below:

> BIG BLAST - (Active Jammer) - Denies target range from the SA-2 radar to force the missile into a three point guidance mode and early arming of the fuze.
>
> BLUE DOG - (Active Jammer) - Recognizes missile guidance activity and actively transmits false commands to the SA-2 missile guidance systems.
>
> PIN PEG - (Passive DF System) - Passively intercepts SA-2 radar frequency signal. Locates and positions SA-2 radar site in azimuth within vulnerable zone.
>
> MAD MOTH - (Active Jammer) - Denies SA-2 tracking radar accurate angle information resulting in large missile miss distances. 1/

A Signal Intercept Package was also developed to collect Elint data. It was succeeded by System 6S, an advanced Elint collection system, which monitors the frequency range of 50 to 12,500 MH_z and provides analog recording of the signals.

1/ For a more detailed description of the ECM systems developed for the OXCART program, see Electronic Warfare Systems Data Book, October 1967 (BYE-44246-67), published by the Air Systems Division, Office of Elint, DD/S&T.

Second generation ECM equipments that were in development and/or test stage when the OXCART program was closed out were:

[redacted] 50X4, E.O.13526

OCCASION [redacted] 50X4, E.O.13526

A-12 Camera Development

A funded study by Perkin-Elmer in 1959 explored the feasibility of developing a precision photographic reconnaissance sensor for use in a Mach 3.5, 80,000-foot-altitude vehicle, having a photographic range of 2500 nautical miles. The principal problem areas identified in the study were:

a. Control of the camera environment, i.e., thermal, pressure and motion.

b. Effects of turbulence and shock wave on the optical wave front entering the camera.

c. Optimizing the components of the sensor system to provide photographic range, swath width and resolution within the confines of the available space.

d. Providing a window for the camera to look through that is 550° F on the outside and less than 150°F on the inside that will not distort the imagery to an unacceptable extent.

During the ensuing development and test phases of the Type I system, these identified areas proved to be the most troublesome. They still limit system performance.

The design philosophy employed by Perkin-Elmer reflected a need for controlling the camera operating environment and in some areas extending the state of the art to achieve the maximum performance. This resulted in a complex design that would give excellent results if it could be adequately maintained and serviced in the field; however, concern about reliability resulted in letting a contract to Eastman Kodak for the development of an alternate system that would be easy to service and have high reliability, but would not have as good a resolution potential. Both cameras were flight-tested in other vehicles prior to the availability of the A-12, and both essentially achieved their design goals. When the delivery schedule of the vehicles forced a decision in favor of the production quantities of one or the other, the Perkin-Elmer camera was selected on the basis of its demonstrated reliability and better ground resolution. The Land Panel concurred in this decision. Eight P-E cameras were eventually procured. Eastman Kodak built two cameras.

The third camera system developed by Hycon for the USAF A-12 program was introduced to the OXCART inventory to serve as a back-up for the P-E camera in the event the Eastman camera was phased out. It is a framing camera as contrasted with the panoramic design of the other two, and basically follows the design philosophy so successfully used for many years with the Hycon B camera in the U-2; that is, large scale, large format and long focal length. These characteristics limit the amount of photographic coverage, and require an amount of thermal control of the optical system that so far has not been available in the A-12.

Significant Developments:

a. An air bar system of supporting the film during its passage through the camera results in extremely low friction and tension on the film, reduces abrasion and permits right angle direction changes in the film travel.

b. Vacuum windows with dual glazings inhibit the transfer of high temperatures from the outside to the inside of the vehicle without distorting the camera's view of the ground. Studies and development in photographic window technology for supersonic airborne vehicles have established manufacturing techniques and the effects of thermal transients on windows that have proved extremely valuable in reconnaissance vehicles and sensor design.

c. A technique for synchronizing film velocity with optical system scan rate permits continuous photography at vehicle rate and reduces camera dynamic motions. This technique has been applied to other sensors in recent years.

Over 200 test flights of the Perkin-Elmer system in the years 1964 through 1966 established a degree of reliability and performance that culminated in 29 successful operational reconnaissance missions in Southeast Asia during the period from May 1967 to May 1968. No failures were encountered. Each of these missions covered approximately 100,000 square miles of denied territory. The Eastman Kodak cameras were removed from the inventory in July 1967 as part of the OXCART phaseout program. The Hycon camera, having entered the program later, continued testing through 1967 and was validated as being operationally ready. It was not employed on operational missions due to the satisfactory performance of the Perkin-Elmer camera.

Inertial Navigation System

The Minneapolis-Honeywell Corporation (M-H) was selected to provide the inertial navigation system. It is a self-contained system and operates without the use of electromagnetic radiation or external references. In operation it displays present position, ground speed, and the direction and distance to go to any of 42 preselected positions. When operated in the appropriate mode the aircraft will be steered automatically to each point in the flight plan sequentially with no pilot action required. The INS has demonstrated a high degree of reliability. The specification error ratio for the system is 1.5 nautical miles per hour of flight. The system consistently demonstrated less than one nautical mile per hour error.

Automatic Flight Control

The automatic flight control system for the OXCART, also built by M-H, includes stability augmentation, autopilot and air data systems. The three axis stability augmentation system is a combination of electronic and hydraulic equipment which augments the natural stability of the aircraft. The system was designed to take corrective action rapidly when its sensors detect pitch, yaw or roll motion which change the proper attitude of the aircraft. The resultant dampening effect is essential to maintaining the stable platform necessary for high quality photography. While the stability augmentation system, autopilot and air data computers were not unique to the A-12, the aeroelastic and thermal problems associated with A-12 flight increased the system complexity in terms of required response rates, cooling requirements, etc.

Side-Looking Radar

The side-looking radar designed for the OXCART vehicle is a high resolution synthetic aperture radar using optical recording of the doppler signal and using ground-based optical correlation techniques. Two flight units and one engineering breadboard were procured. In addition, a strip correlator and two detailed correlators were procured for support.

The radar operates at a frequency of 9.432 gigahertz with a pulse width of 20 nanoseconds. Peak power is one megawatt. Pulse repetition rate is 4,000 pulses per second. The receiver noise figure is 6-1/2 db. System resolution is approximately 15 feet in range and 8 feet in azimuth (a long track) over a swath 20 nautical miles wide centered about 30 nautical miles off track. The 500 feet of thin based film used for original recording will cover approximately 1,000 miles of track. The system weight is about 950 pounds with an antenna length of 10 feet.

The system was first proposed in April of 1960 by the Scientific Engineering Institute. Development of the equipment was initiated in August 1960 with Westinghouse being the prime contractor for development of radar equipment and Itek developing the airborne recorder and the optical correlators. Initial flight test was started in March 1962 in an especially modified F-101 aircraft. In 1964 the system was delivered to Area 51 and underwent extensive ground checks. Subsequently, in early 1965, the system was returned to the factory and F-101 tests continued as OXCART aircraft were not available for this test program because of other higher priority activities. Over 200 flights were made in the F-101.

In late 1965 a review was made of the requirement and useage of the OXCART radar and a decision was made to reinstitute the flight test program. Equipment was therefore returned to the field in the fall of 1966 and flight test work initiated. Initial flights were unsuccessful in that the antenna suffered breakdown when operated at altitude. This problem was apparently solved in December 1966 and flight tests were programmed for early 1967. However, as only one aircraft was configured for accepting the radar, it was an early victim of the phasedown decision, as operational capability would not have been available without extended down time of additional aircraft for outfitting with modifications.

The radar was designated the AN/APQ-93 (XA-1) and was developed under the guise of an Air Force secret procurement. The program was also known as INVAR.

Additional work was done on the F-101 in support of Navy radar programs. The capability of the APQ-93 is better than most of the existing side-looking radars but is somewhat lower in performance than some test and development models now in existence.

OXCART Life Support Equipment

Introduction. At the time the A-12 aircraft was being developed, there were no operational aircraft in the USAF inventory that had an equivalent performance envelope. Aircraft that were in existence in 1959 that presented similar problems, in terms of life support requirements, were the F-104, B-58, F-106, U-2 and X-15. Life support equipment used in such aircraft provided a basic foundation upon which the life support equipment for the A-12 was developed.

Life support equipment has, in general, two basic functions: (1) to enable the pilot to fly the aircraft and complete the mission throughout the entire performance envelope of the vehicle, under both normal and emergency operating conditions, and (2) to enable the pilot to safely escape from the aircraft throughout its performance envelope in the event of catastrophic emergencies. In order to provide these functions, A-12 life support equipment had to include a safe and reliable pressurization, air conditioning, and oxygen system with adequate redundancy and duration to meet any operational requirements. In addition the equipment had to provide the pilot with back-up pressurization and an emergency oxygen supply, and protection from windblast, high temperatures, deceleration and spinning in the event of emergency escape from a disabled aircraft.

<u>Specific Problem Areas.</u> The specific parameters and problem areas presented by the A-12, around which the life support equipment had to be developed, were as follows:

(1) <u>Pressure altitude.</u> The A-12 would operate up to a maximum altitude of 100,000 feet above sea level.

(2) <u>Speed.</u> The A-12 would operate up to a maximum speed of Mach 3.5 at maximum altitude, or a maximum equivalent airspeed of 450 KEAS.

(3) Range/Duration. The A-12 would have, because of aerial refueling, a worldwide range with flight durations in excess of 8 to 10 hours.

(4) Windblast/Deceleration. The worst windblast/deceleration conditions under which a pilot could eject would be at Mach 3.2 at 74,000 feet, which would expose the pilot, at the moment of ejection, to an instantaneous maximum dynamic pressure (windblast) of 950 lbs. per square foot and a maximum linear deceleration of 9 G's.

(5) Temperatures. Under normal A-12 operating conditions the pilot would require protection from radiant heating due to aircraft skin and windshield temperatures approaching 400° F. Upon ejection at 100,000 feet and Mach 3.2, the pilot would be exposed to an instantaneous stagnation temperature of 800° F. Upon deceleration and free fall from high altitudes, the pilot would be exposed to temperatures of -67° F or lower.

(6) Spinning. If a pilot ejected at maximum altitude, where it is unsafe to open a normal parachute, he would enter a flat spin which would be uncontrollable. Such a spin, which could exceed 200 RPM would produce serious to fatal injuries and

would likely result in parachute failure when it was automatically opened at a lower altitude.

A-12 Life Support Equipment Development. Life support equipment falls into two categories: (1) aircraft systems, and (2) personal equipment. The following paragraphs describe the A-12 equipment and briefly cover the development of each item.

Aircraft systems were developed by the prime contractor, Lockheed Aircraft Corporation, and included the following items:

a. Pressurization and air conditioning systems. The cockpit pressurization schedule for the A-12 was unique as compared to existing high performance aircraft. The cockpit remains essentially unpressurized from ground level up to a flight altitude of 26,000 feet. At flight levels from 26,000 to 100,000 feet, the cockpit remains isobaric at 26,000 feet (5.25 psia). This schedule was chosen to give (1) optimum temperatures and airflows to the cockpit air conditioning system especially during climb and descent; (2) lowest oxygen consumption consistent with adequate physiological protection; (3) safest pressure differential across the cockpit glass during critical refueling maneuvers.

The air conditioning system chosen was also unique in that a completely dual system was chosen. The unique problem of aerodynamic heating of this vehicle dictated that, for mission completion and adequate pilot protection, a complete redundancy of air conditioning had to be provided. The system was therefore constructed with one system providing cockpit/pilot cooling and the second system providing Q and E bay cooling. In the event of failure of the system providing cockpit/pilot cooling, the pilot would operate a crossover selector to divert the Q and E bay cooling to the cockpit/pilot.

Changes and modifications were made to the air conditioning system over the years until peak efficiency and maximum pilot comfort were achieved in 1966-67.

b. <u>Oxygen System</u>. Because of the critical nature of operational concepts, a completely redundant oxygen supply and delivery system was provided in the A-12. The initial system consisted of two high pressure oxygen cylinders and associated plumbing, reducers and regulators. A failure of one system would have no effect on the pilot because the second system would continue to provide the pilot with his life-sustaining oxygen. Only the duration of supply would be affected with such a failure. The calculated duration for both systems being used was 15-3/4 hours while failure of one system after 5-1/4 hours of flight would reduce the total oxygen duration to 10-1/2 hours available. In the period 1964-65 the oxygen systems were converted to liquid oxygen (LOX), using two 10-liter converters, either one of which would provide in excess of 14 hours oxygen availability at altitude. In addition to the added safety margin, this change increased reliability and reduced weight and volume occupied by the oxygen system.

c. Ejection System. In 1959 LAC analyzed the possible escape systems for the A-12 including fuselage nose capsules, encapsulated seats, and rocket-catapult seats. It was determined that, because a pressure suit was required in any case, due to potential loss of cockpit pressure, the most reliable, lightest, smallest and safest escape system which would satisfy the high and low level escape problems for the A-12 consisted of a full pressure suit and a rocket-catapult ejection seat. The pressure suit proposed was that developed for the X-15, because of its demonstrated capability for resistance to windblast and elevated temperatures which exceeded the resistance required for use in the A-12. The ejection seat proposed was the upward ejection C-2 seat as used in the F-104. The C-2 ejection seat pyrotechnics were modified for use in the A-12 to qualify them for service use at the elevated temperatures encountered with the A-12 (i.e., qualified for use at 300^{o} F versus 160^{o} F for the F-104 pyrotechnics).

The escape system was qualified through testing including component tests, system functional (breadboard) tests, static tests, Edwards AFB track tests, aircraft drop tests at El Centro, California, and finally by inflight ejection tests using a specially equipped F-106 at El Centro. The test period covered a span from 1960 through final inflight ejection tests in August 1964. The A-12 ejection seat was equipped with a rocket catapult mounted on the rear of the seat, which propels the seat upward on vertical guide-rails during ejection. During ejection, seat to aircraft attachments and pilot to seat attachments are disconnected by quick-disconnect fittings; one for all electrical leads, one for the suit vent hose, one for the normal aircraft oxygen supply and one for actuating the emergency oxygen supply. The seat incorporated the following features:

(1) A headrest for support and positioning of the pilot's head during ejection.

(2) A centrally located ejection D-ring which initiates the entire ejection sequence and precludes arm flailing after ejection.

(3) A shoulder harness and inertial reel lock assembly, which locks the harness automatically during ejection, whenever a 2 to 3 G force is exerted in a forward direction, or manually when desired by the pilot.

(4) A pyrotechnic operated automatic opening seat belt and man-seat separator. An airspeed sensor is attached to the aircraft pilot static system and senses aircraft airspeed at ejection. If aircraft airspeed is below 250 KIAS (later changed to 290 KIAS), a 0.6 second delay is selected between seat ejection and seat belt/separator actuation. If airspeed is above 250 KIAS (later changed to 290-300 KIAS), a 4.0 second delay is selected by the sensor. This variable delay assures that the pilot is automatically separated from the seat as soon as possible, and within the limits of tolerable G forces for deceleration and parachute deployment.

(5) Knee guards which erect forward to protect the pilot's legs.

(6) An automatic foot-retraction and retention system which pulls the pilot's feet into stirrups and holds them.

until automatically released at man/seat separation. The foot-retention cables are automatically cut at man/seat separation or may be manually released by pulling a head-rest mounted D-ring for firing the cable cutters in the event of rapid ground egress.

(7) A canopy removal system tied, pyrotechnically to the ejection seat D-ring, and also removable by alternate internal and external canopy jettison handles.

Personal Equipment:

a. Pressure Suit/Oxygen System. The David Clark Co., working with the Firewel Co., developed a new pressure suit for use in the A-12 which represented a state-of-the-art improvement over the then existing X-15 pressure suit and the USAF standard A/P-225-2 full pressure suit. The major improvements and changes from previous suits were a dual oxygen regulator and dual suit pressure controller for increased reliability and safety, increased helmet visor thickness to prevent deformation or failure from the high temperatures which could be encountered in the A-12, a flotation vest for water survival which was incorporated into the outer cover of the pressure suit, and an aluminized flame resistant fabric outer cover for protection from high cockpit temperatures or high stagnation temperatures which would be encountered upon ejection at maximum altitude and airspeed.

b. Parachute/Emergency Oxygen System. Standard ejection seats, pressure suits and aircraft systems (oxygen, pressurization, and air conditioning) had to be upgraded and improved for use in the A-12, and the efforts involved represented product improvement. However, the personal parachute required to complete the A-12 life support system was an entirely new concept and required considerable development and testing efforts. The development and testing program started with a complete review of parachute systems in existence in early 1960 and an initial manned parachute jump in September 1960, and ended with final configuration full system testing (parachute and ejection seat) by inflight ejection from an F-106 during August 1964. The initial parachute jump in September 1960 made by Capt. Harry Collins, who was the program manager and primary test subject throughout the development, established the requirement for an entirely new parachute concept. In this jump the subject wore a full pressure suit, a packed survival (seat) kit, and a standard parachute. The jump was programmed for a 50 second free fall to determine the body position that would be encountered. After only 40 seconds of free fall the subject was spinning at a rate of 140 to

152 RPM in a head and back down position. The jumper overrode the automatic timer and pulled the parachute ripcord and sustained high opening forces. Upon parachute opening, the spinning caused the parachute suspension lines to wind up approximately 28 times creating the danger of chute collapse. This jump indicated that an A-12 pilot ejecting at maximum altitude would require a stabilization parachute to keep him in an upright and stable position during free fall to an altitude where the main parachute could be deployed (approximately 15,000 feet). There were a total of 5 model configurations developed and tested during the complete period. Models A, B, and C were purely developmental and Model D was the first operational configuration. A total of 281 tests were made on these model parachutes and their sub-systems and covered the period from January 1961 through August 1963. During 1964 the fifth and current parachute configuration (Model E) was developed and tested. This configuration was developed to improve comfort, reliability, and maintenance of the parachute. An additional 37 tests were required to qualify this model, testing being completed in August 1964.

The personal parachute developed for and used in the A-12 has the following major features: (1) A 78-inch diameter, automatically deployed, ribbon-type, hemisflo stabilization parachute for maintaining the pilot in an upright position during descent from maximum altitude to 15,000 feet, (2) a 35-foot diameter, main parachute canopy that is automatically deployed at 15,000 feet, and (3) an emergency oxygen system that is automatically activated upon ejection consisting of two 45-cubic inch high pressure oxygen cylinders integrated into the parachute back pan containing the automatic parachute actuators. (See overleaf for picture of pilot, suited up and ready for flight.)

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