

9-16-81

Jim Cunningham:

This is what I have accomplished so far, and it is about halfway through. (Also it is the rough draft.)

Clarence L. Johnson

THE STORY OF THE LOCKHEED U-2 AIRPLANE

INTRODUCTION

I have been requested numerous times to tell the story of the Lockheed U-2 reconnaissance airplane, but the United States Government security directives have not allowed this to be done up until the present time. In view of the fact that the first U-2 flew over 26 years ago (August 4, 1955) and our potential enemies have had ample opportunities to measure most of its performance in flight, permission has now been granted to write a short history of this versatile aircraft and the remarkable program used to design, build, test, and operate the U-2.

Throughout this period, I was in charge of the Lockheed Advanced Development Projects group (better known as the Lockheed Skunk Works) in Burbank, California. We made the initial unsolicited proposal to our government and designed, built and tested all the U-2's. Mr. Richard Bissell was in overall charge of the project for the United States government during the first seven years of its existence and General Ozzie Ritland was the ranking Air Force officer during the same time period. Colonel Leo Geary replaced Ritland in 1963 and others followed him later.

I believe the best and most accurate way to describe the U-2 program is by direct use of the log I kept throughout the program. You will, of course, understand that these are my personal observations and many others may have quite different views from those I saw in my position. There are many other aspects in the training and operational phases away from Lockheed where I may have only generalized information but I think I was kept well informed on these subjects by both the CIA and the Air Force, particularly during crisis conditions such as the Gary Powers incident and the Cuban missile crisis.

CHAPTER 1 - HOW IT BEGAN

The U-2 concept took place in 1953 when the writer was told of our desperate need for an aircraft that could safely fly over the USSR and bring back information on their missile capability and other military useful data. To start the studies I issued a directive to our engineering department to see if it was possible to use any part of the F-104 fighter to be the basis of a new aircraft having our Lockheed California Company design number of the CL-281 (see appendix for first proposal report).

Let us now go directly to my log on developments from that period through the first flight August 4, 1955, and the "Official" first flight August 8, 1955.

December 1953

I wrote to Mr. Colman and Mr. Frost in our Preliminary Design Department to start an investigation of wing area modifications and weight reducing procedures to modify the F-104 airplane to get the maximum possible altitude for reconnaissance purposes.

February 1954

Jack Carter and Gene Root, of LMSC and the Scientific Advisory Board told me of Air Force interest that would be developed with an airplane having the characteristics we were finally able to obtain on the F-104A study.

March 5, 1954

I had about four men work up Lockheed Report #9732, describing the CL-282 high altitude aircraft. This was a complete report, still tying the high altitude airplane to the F-104. This report was sent to General B. A. Schriever early in March 1954. He was extremely interested and asked Lockheed to prepare a specific proposal.

April 1954

Early in April, I presented Lockheed letter LAC/156876 and a full description of the CL-282 (our design number) to Trevor Gardner, Gary Norton, and others in the Pentagon, including Generals Putt, Price, Kelsey, and Holloway. This proposal covered our construction of 30 airplanes, Lockheed taking complete responsibility for the whole program, including servicing of the airplanes in the field. I had a good reception on the part of Gardner and Norton - uncertain reaction from the others.

May 1954

Jack Carter visited Trevor Gardner and found that the Air Force was proceeding with the Martin Canberra, and that they were not too impressed with our CL-282 proposal.

June 7, 1954

Received a letter from General Floyd Wood of the Air Force Systems Command which turned down our proposal on the basis that it was too unusual, that it was a single engine aircraft, and that they were already committed to the Martin program.

November 17, 1954

I had a call from Trevor Gardner asking me to go to Washington at once on this project. Lockheed was in a big mess on engineering, due to having started Project Star and several military projects. My instructions were to not commit to any program during the visit, but to get the information and return.

November 19, 1954

I met with Trevor Gardner, Dr. Land, Dr. Baker, Dr. Purcell, General Putt, Allen Latham, and J. W. Kennedy for several hours. They wanted to be reassured that our proposal was technically feasible. I took Verne Johnson of our Washington office along, but he was not admitted to the meeting.

Later, I met and had lunch with Secretary for Air Force Talbott, Allen Dulles, and Dulles' right-hand man in the CIA, Larry Houston. They believed my story that we could make such an airplane in the time mentioned and also asked why Lockheed seemed to be the only one who could do this job. General Putt answered graciously that we had proven it three times; on the P-80, P-80A and F-104.

I was impressed with the secrecy aspect and was told by Gardner that I was essentially being drafted for the project. It seemed, in fact, that if I did not talk quietly, I might have to take a leave of absence from my job at Lockheed to do this special project.

I returned to Burbank in the evening, with instructions to talk only to Robert Gross and Hall Hibbard. They agreed that we must do the project.

November 21, 1954

Met with Robert Gross and Hall Hibbard at Mr. Gross home. I proposed that Engineering Experimental do the job, in spite of the large number of airplanes involved. This was accepted.

November 22-23, 1954

Spent two days personally in a redesign of the airplane to provide for use of a new landing gear, different engine, different camera bay, and means for improving performance.

November 29 -
December 3, 1954

I organized the project using 25 engineers including CLJ. Appointed A. M. Viereck in charge of shop which was gradually staffed to a total of 81 personnel.

December 14, 1954

I flew to Washington.

December 15-17, 1954

On the 15th, I met with Trevor Gardner, General Putt, Ozzie Ritland, and Messrs [redacted] BisseSTAT Houston of the special agency. We discussed at long length problems of security and method of dealing with each other. Large amount of time taken on the optimum cover story for the project. I reported status of the airplane and presented cost letter for \$22,500,000. Emphasized again

the importance of getting engine data. Wright Parkins and Bill Gwynn of Pratt & Whitney were called down, but they knew nothing of the general problem. I flew up to Hartford and back in their airplane and discussed altitude operating problems on the engine. It requires the P37 engine, and even then the fuel consumption and power are less favorable than what we estimated. I told all concerned that we would lose 2,000 to 3,000 feet of altitude and 200 miles in radius.

December 18, 1954

Returned to Burbank.

December 20-30, 1954

Working like mad on the airplane. Initial tunnel tests successful. Had a visit from [redacted] STAT discussed security problems with our Administrative Committee and told them, in a nice way, not to ask me for any information or otherwise interfere with the program.

December 30, 1954

I called Ozzie Ritland to give a brief rundown on where we were. Planning to meet him Monday, January 3rd. Also Gary Norton. We do not meet at Lockheed.

January 19, 1955

Was visited by Colonel Jerry Keeling and discussed the equipment procurement problem. Set up a means for our obtaining equipment from [redacted] STAT and [redacted] STAT

January 31, 1955

Visited NACA, Cleveland, to discuss certain fuels. Proceeded on to Washington.

February 1-4, 1955

Spent considerable time with Washington group, discussing first progress report, power plant problems, etc. Discussed a clearance problem with [redacted] Cost contract STAT sent out. It was signed by Lockheed February 9th. Very good visit. Ray Caleen of Pratt & Whitney was made their representative on the project.

Had special visit from Wright Parkins to tell of troubles on -31. He wanted to retreat to -37 configuration, but I would not accept this and requested their further studies for two weeks.

February 9, 1955

Visit from General Flickinger to discuss aeromedical aspects. Made arrangement for pilots to get pressure suits and indoctrination. He seemed pleased with our approach to the cockpit problem.

February 10, 1955

Had visit from [redacted] of CIA. SpeSTAT data given me and method of payment set up.

- February 15, 1955 Ray Caleen of Pratt & Whitney called and spent much of the day going over our power plant problems. He had nothing to offer in the way of information and was merely getting educated on the project.
- February 16, 1955 Trevor Gardner came out. He asked to be shown the construction area and I took him over there.
- February 18, 1955 Secretary Talbott and Trevor Gardner discussed the project with me for an hour or so and then asked to be taken to Bldg 82A. They seemed very impressed with the progress to date.
- We picked up the mock-up engine, in spite of the fact that X's clearance had been lifted, so he could not go to get it. A truck driver named Ritchie and George Welty picked it up. The shipping crate was damaged, with a big hole in it, where anyone who wanted to try could see the engine. Pratt & Whitney distributed 21 copies of the shipping instructions, stating that the engine was for Project Shoehorn. They just don't seem to get the idea on this job. [redacted] calSTAT and I gave him photographs that we took of the broken box.
- February 21, 1955 We submitted our first voucher for payment on the contract. Actually, there were two, for a total of \$1,256,000. A check for this amount was sent to me at my Encino home! Later ones to a special bank account.
- March 15-16, 1955 A Mr. Bissell, Flinkger and MacAfferty came out and went over the mock-up. Discussed base plans. I gave them our proposal and data on towing the U-2
- March 29, 1955 Ray Caleen was here with data on latest test of P31 engine. We discussed ram distribution and I brought up proposal for running complete mission profile in their tunnel. P&W not receptive.
- April 6, 1955 [redacted] came out on contract status. ISTAT stated that contract was in good shape as far as work definition went, but that additional contracts would be necessary for extraneous items like T-33 flight tests and Phase II operations. Had Bias, Welty, and White in on discussions. Had Kucera approve a letter on single bids for certain special aircraft items.
- April 12, 1955 Bissell, Ritland, Bert Miller and I met to discuss electronic problem. Lockheed is to fly a T-33 for Bert Miller. Problem of basing airplane is still up in the air. We are to get one C-47 and two T-33's in June. On the same date, discussed with Dick and Ozzie advanced phase on project design.

Will propose additional airplane with lightweight radar and a "D" package. Furthermore, we discussed the project continuing into design of new advanced special fuel airplanes. We will make a proposal on this subject.

April 12-13, 1955

With LeVier, Bissell and Ozzie, we flew all over Nevada looking for base sites. Mr. G. Greenway had come out in March and we had shown him our various sites off of the government reservation. Security was not sufficient at the best site and he gave an unfavorable report to our runway deal.

When we showed Ozzie and Dick this site, however, they were much impressed. We flew over to Frenchman's Flats (quite illegally) and found another site in the atomic test area. Checked fallout radiation and it was apparently OK. Site was a dandy, but will take much red tape to get cleared.

April 14-25, 1955

Workin on base design for special site and Phase II proposal. Airplanes are coming along well. Will go to Washington April 25 with Buschmann to report on tactics, current problems and base studies. Should present study on "D" package at that time.

April 25-29, 1955

Spent full time in Washington. Had discussions on base problems, training program, coordination of all equipment, presented our operational study with Rudi Buschmann and, in general, had thorough discussion of project.

Base location has been decided as Site II, for which they will accept my proposed name of STAT " I am greatly concerned that the base STAT not be built in time for first flights, and so reported to Herb, Dick and Ozzie. I also told them that the cost would be considerably higher than at Site I.

Have a growing feeling that our government friends are not getting organized for the project in the same manner in which we are building the airplane. I presented an improved schedule for the 5th and 6th airplanes.

May 2, 1955

Started contract proposal for our crew training operation with Bias, White, and Welty.

May 4, 1955

Tony, Dorsey, and I flew to Las Vegas, meeting with Mr. Donnell, Seth Woodruff, and engineers from the Silas Mason Construction Company. Donnell represents Washington and will take over responsibility for the base, which we give up at this point, except as it affects our particular operation. Herb Miller stated strongly that the

base's primary purpose is for us to test airplanes and "bygosh" he would see that it ended up that way. Donnell, being unfamiliar with the project, had little to say during this meeting, during which we gave to the Silas Mason Company the results of our three months' study on base requirements.

Had called the Butler Company to tell them that work we had done and bids received from them would now be transferred to another group. I then proposed that we go to Site II and try to realign the runway in keeping with our best wind information. Flew out and located runway at south end of lake, marked out general area for buildings, then flew back over the atom bomb sitting on its tower about nine hours before it was set off. Arrived home at 7:30 in the evening, after a rough ride in our Bonanza.

Started installation study of an autopilot.

May 5, 1955

Reviewed with each man major problem on his particular work. Most engineers considered they didn't have any, but after I suggested four or five each, they agreed we still have some problems. Asked group to record patents in special file for future record.

Said goodbye to X, who is leaving project because of association with a Communist woman. A very dirty case.

May 9, 1955

Air Force sent out proposal for a weapon system called the X-17. Apparently they copied our original proposal and circularized the industry. A dead ringer for our original set-up. I called Bissell Sunday night to point out the breach of security that this would involve. I saw Ozzie the next day. Ozzie thought, after discussing with Kelsey, that this was an entirely new type of airplane. I arrived there Tuesday, May 10th, expecting to stop two days later at Wright Field for a meeting. Was amazed to find that neither Bissell nor Ozzie was concerned about the competition. This changed to stark horror when I showed them actual spec requirements. We went to Gardner's office and he went to Talbott. It was stopped in ten minutes.

This is a wonderful example of a mixup in requirements, in getting a new airplane started because no one in the Pentagon knew a thing about the request to industry for a bid which would require the Air Force to spend from three to six million dollars, when actually a better airplane would be flying six weeks before they had the design proposals from the company.

May "x", 1955 Saw General LeMay and explained project in Gross' office.

May 9-13 1955 To Washington for coordination meeting. Spent all week on base problems, etc. Presented our operational study with Buschmann. Our friends are not organized to handle airplanes when they get them at this time. Much confusion.

May 17-19, 1955 In Washington again. More base discussions. Costs now up to \$832,000 from our original proposal of \$200,000 to \$225,000. Reason is new locale, 300% expansion, and permanent base. Site One came to \$450,000 on same deal, but was not as good or secure. We had Site One base all designed ready to go.

May 21, 1955 Number one fuselage out of jig. Having a tough time on wing. Put almost everybody on it.

May 24-25, 1955 Herb, Ozzie, Al Donnell came out. Reviewed base. They went to Las Vegas with Dorsey. Base proceeding fast. Hit a limited water supply. Decided to buy a Lockheed flight test trailer on our money. Flickinger, Knauber and Maher here on suit problems

May 27, 1955 Sent in cost proposal on Phase II - training and III - operation. Bias made knowledgeable on May 23 (?). Archie L. (Colonel, AAF) came out on bailment of C-47 and two T-33's. He loused things up. Contract he signed given back to Herb M.

June 1-3, 1955 Spent these days at Colorado Springs, flying up with Roger Lewis and back with Trevor Gardner. Spent extremely interesting period discussing Russian trend and what we could do about it. Gave two-hour speech on how to make airplanes more quickly and with less confusion. Discussed engineering training programs. Became very good friends with Tom Power, in spite of our clash on the F-104 several weeks previously. Raymond, Wellwood Beall and I represented the aircraft industry, but Roger asked me to give the basic spec from an individual, not a company, standpoint. Proposed the Lockheed system for construction of the airplanes, and showed why the Cook-Craigie plan was no good in general. Wellwood Beall gave enthusiastic support. Raymond said very little, but generally agreed. North American was represented by Larry Waite. In view of the fact that I was called upon as an individual, not to represent the company point of view, I am a little uncertain as to how much of 47 pages of notes I can pass on to Lockheed Management.

June 7-8, 1955

Coordination meeting at Staler Hotel with Herb, Ozzie, and others. Quite concerned whether base will be available on time. Having trouble drilling well. Coordination with Hycon and R-W pointed up several problems.

Had big discussion on ^{JM} wages and salaries for overseas crews. Dick Cunningham and [redacted], STAT work for Dick Bissell, stayed here and with Welty interviewed nine people for overseas. Most showed that they would accept terms. One of the more experienced in this matter said he wouldn't touch it with a ten-foot pole.

June 20, 1955

Returned to work. A very busy time, in that we have only 650 odd hours to the airplane completion point. Having terrific struggle with the wing. Our C-47 has been delivered and conditioned. Have one T-33 and second will be delivered July 15th.

June 24, 1955

Auto accident. Out til July 2 with four busted ribs, etc.

June 29, 1955

Terrific drive to finish airplane. Working on B "X"-H-which Gardner said was very interesting to him when returning from Colorado Springs.

July 7-8, 1955

To [redacted] in C-47. Doesn't look like it will STAT ready in time. An excellent job for only \$800,000 in time allowed. I'll bet this is one of the best Air Force bargains they've ever gotten. Trouble with water well.

Bissell, General Perrie Cabell and Ozzie here. Reviewed new work. Priority on Intruder SL radar, Air Defense fighter. Big meeting at Colorado Springs - LeMay, Smith, Talbott, Dulles, Bissell - on who runs project!!

July 11, 1955

Major Welch and Lt Col Wilson here on spares. Major Welch to stay [redacted] STAT
Gave them to Welty.

July 13, 1955

Colonel M. C. Mixon, Majors R. H. Carney and R. W. Burroughs here. Delivered C-47 spares, one more T-33. Saw bird. RWB is SAC navigation office Electronics Package #2 won't work. Back to dead reckoning.

First flight - T-33 - #1 electronic package.

- July 15, 1955 Airplane essentially completed. Terrifically long hours. Everybody almost dead.
- July 17-21, 1955 Ran flutter and vibration tests, control proof tests, and I inspected the airplane personally on a 689, finding about thirty items to improve.
- July 22, 1955 Airplane turned over to inspection for final check.
- July 23, 1955 Airplane disassembled and loaded in loading carts.
- July 24, 1955 Ozzie came out. We came down to the plant at 4:00 and loading operations were started at day-break. Took about three hours to load into the C-124. Rained at STAT
- July 25, 1955 Took off at 5:30 in C-47. We were informed that lake was unusable and that the 124 could not fly up
- We landed on the runway and after quick inspection decided that it would be safe to land the 124 if we let lots of air out of the tires. Dick Newton, recently appointed Base Commander, would not allow airplane to land, so I attempted to call Washington on field telephone. They refused to allow this. I expressed certain dissatisfaction, and five minutes later called Washington. Talking to Dick, he said that while Donnell, who built the runway, would no doubt shoot himself, it was up to me to determine whether the 124 should come in. Two hours later it landed in a cloud of dust, using reversing propellers, making a beautiful landing. The runway was indented $\frac{1}{2}$ inch for a distance of 50 feet and $\frac{3}{8}$ inch when the airplane turned around, where the inboard tire was held stationary. Newton wired Washington that the airplane landed with minimum damage to the runway. I didn't like this, because there was no damage to the runway. We unloaded the bird on schedule into the semi-completed hangars and assembled it.
- July 27-August 2, 1955 Made various taxi tests. Our special fuel would not start. On second taxi run, airplane flew inadvertently to 35 foot height and almost crashed because Tony LeVier didn't expect it to fly. Automatic observer data showed airplane doing what it should. In stopping the airplane, Tony blew both tires, and brakes caught on fire directly under the fuel tank. We were following in radio trucks, and finally got extinguishers on the brakes. No harm done. Airplane was subjected to terrific test. Pogosticks worked real well. Having fuel system troubles on paper.

August 4, 1955

Made first flight to 8,000 feet in a rainstorm. Lake was dry but we flew through rain just north of the field. Airplane flew beautifully, but in landing Tony came in tail high and airplane porposied badly. Made five other attempts before I could talk him down from C-47 chase plane. Makes fine landing when tail wheel hits at same time or slightly ahead of main gear. Airplane landing characteristics quite unusual, but this was not unexpected. Ten minutes after landing, the lake was flooded with two inches of rain. This quite impossible, because average rainfall for last five years has been 4.3 inches and we have had almost this much in the last two weeks.

STAT

Celebrated first flight night of August 4th.

August 7, 1955

Bissell and Ozzie out here at my home. Worked all day on various project problems.

August 8, 1955

Took off at 6:00 am in the C-47 for the [] STAT Had Hibbard, Gross and Monesmith aboard. They had walked through shop and seen airplane for the first time on August 5th. After landing at the [] I announced the program for the day. We STAT got into our parachutes and took off at three minutes after nine. Flew to 31,000 feet. Had good flight. Tail gear didn't come down on first attempt but did on second. Bob Mayte and I chased in the T-33. After an hour's flight, we came in, and Ray Goudey and Bill Bryden escorted him in to land. Made good landing, but put up gust control too soon and stalled left wing. We put airplane on display. General Power was brought in from [] STAT and we had a short session with him. Dick Horner and Gary Norton were there, but Trevor Gardner could not come. We met the schedule.

In May of 1956 two U-2A aircraft were deployed to [] England STAT for a short period. They caused the British to scramble many interceptors to try to get up to the U-2's which they were unable to do. To complicate the situation further, Russian frogmen caught a British diver examining one of their cruisers in an English harbor so a tense political situation developed. The U-2's left England for other parts of the world and began their design missions of overflying the USSR. These were stopped four years later when Gary Powers was shot down May 1, 1960.

THE POWERS INCIDENT

Mr. Powers was to have flown over the USSR from Pakistan to Norway. He was flying a U-2C with the Pratt & Whitney J-75 engine which had a cruising altitude of three to five thousand feet higher than the original U-2A's. In other overflights, pictures taken from the U-2's showed as many as 30 Russian fighters trying to climb to intercept the U-2 which they could not do. During the time of the U-2 operations, the Russians worked very diligently on improving their SA-2 missile and radar systems which finally shot down Powers west of Sverdlovsk. Mr. Krushchev promptly announced their victory to the world and published a photograph purported to be of the U-2 wreckage. I was certain that the wreckage shown was not the U-2 at all. In fact I believe they shot down one or more of their own fighters which were trying to get up to the U-2. I was instructed to make public my views on the subject because we did not know whether Powers defected or landed the airplane safely in Russia. This operation was successful in that the USSR put on public display in Moscow the complete wreckage and equipment of the U-Bird. Life magazine took such excellent photographs of the display that we made a very accurate story of the whole shoot-down event. When Powers was returned to the United States, I interviewed him on February 14, 1962, and recorded my comments to our government on February 21, 1962 as noted below.

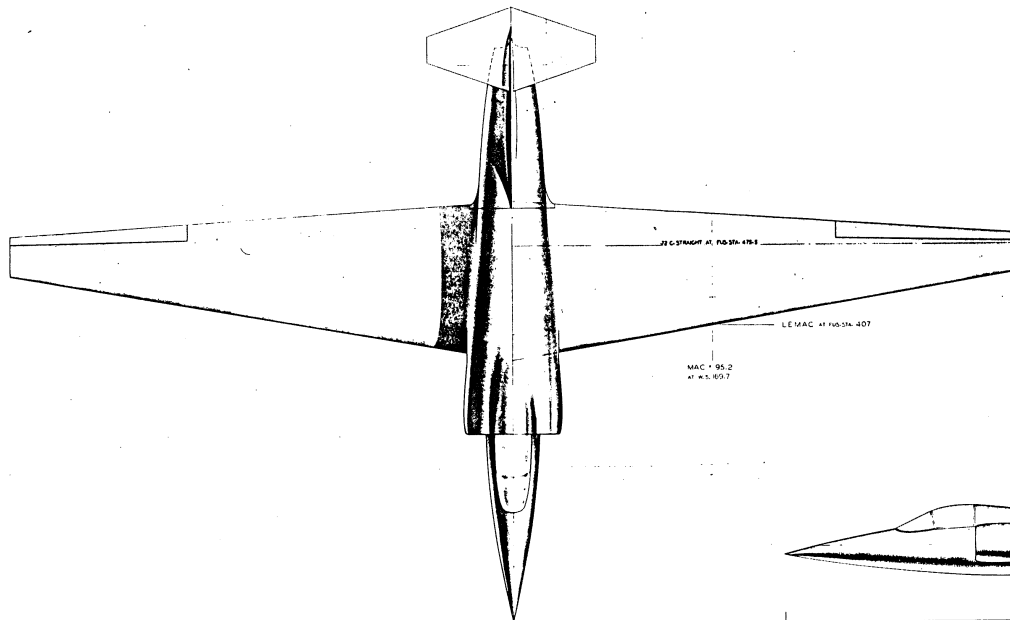
"The following report covers my observations and further study on the U-2 incident involving Francis Gary Powers on 1 May 1960. I would like to summarize my thoughts regarding the cause and sequence of failure in the aircraft in which Powers was shot down. In our visit to Powers on 14 February, he described to us his reactions to the incident. All statements he made correlate extremely well with results of my studies made immediately after the May 1960 incident and reviewed again during this last week.

"As you know, in May 1960 we simulated Powers' flight mission and studied what aircraft components could fail at altitude to cause him to lose cruising altitude. We were particularly concerned at that time as to whether a hydraulic system failure could have lost him boost pump pressure and caused him to have a flameout and descend to a vulnerable altitude. Results of this and other tests are included in our report SP-173. We were unable, even with the boost pump failed, to get a blowout in cruising flight, such as would have occurred in the earlier type U-2's with the J-57 engines. We found nothing basically wrong in the aircraft or its systems which would have been likely to cause the 1 May incident. After these studies, my conclusion was that we had to assume that the aircraft had been hit at high altitude by a missile, as stated by the Russians at the time.

"We were provided with many excellent photographs of the wrecked U-2 on display in Moscow, particularly shots made by Carl Mydans of Life Magazine. These pictures were of a sufficient quality that we could determine a number of interesting things about the wreckage and compare it to other U-2 crashes. Following are the important conclusions from the photographic study:

1. Both wings failed due to down-bending and not due to penetration of critical structure by shrapnel from the missile.
2. In none of the pictures was there evidence to show that the horizontal tail was recovered. Mydans photograph 858-C6-18 shows clearly that the left horizontal surface broke off in up-bending. It also appears from the position of the aft end of the fuselage in a corner that the right section of the stabilizer is also missing. I have one other photograph which you provided me with--a print approximately 4 x 5 entitled "the fin and the rudder," in which it appears that the right stabilizer is very severely damaged and can be considered absolutely ineffective.
3. The latter photograph also shows the parachute can which was housing the Grainger Box to be demolished.
4. While the damage to the stabilizer could have taken place conceivably on landing, it does not seem very likely, because of the relatively undamaged status of the vertical tail itself.
5. I repeat that it is interesting that nowhere in the exhibit was there any sign of the horizontal tail. Refer also to photograph USSR WAC 167B Moscow 55 45 N 37 35 E. This photo also carries a number 435411. This photograph indicates that the fuselage probably hit on the right lower side in a manner that would not damage the lefthand stabilizer as badly as the picture indicates.
6. Life photograph 858-C6-12 was studied very carefully by us to determine whether or not an attempt had been made to fire the seat. We concluded that it had not been. We did note that the Russians had made a very complete study of the seat and in the process of disassembling it had reconnected the lap belt initiator and had not reassembled it properly for the display.
7. In our discussions with Frank Powers on 14 February, he described his flight, making the following points:
 - a. He was a cruising altitude below the maximum obtainable but above 68,000 feet, and the engine was throttled back and running smoothly. His statements of the cockpit instrument readings in terms of tailpipe temperature and other details were as they should have been for his distance out after takeoff and the altitude he was flying.
 - b. His first indication of trouble resulted in the aircraft gradually rolling to the right, which he corrected readily; then nosing down to an attitude that broke off both wings.

- c. The aircraft spun with great violence, so that the engine blew out or was thrown out. His suit then inflated and he attempted to escape. He did not fire the seat and immediately prior to leaving the aircraft he was so far forward in his harness that he could not reach the destructor switches.
8. This series of events would come about by anything which resulted in loss of half or all of the horizontal tail. The U-2 wing is very highly cambered and without a tail surface to balance the very high pitching moment, the aircraft immediately goes over on its back and, in severe cases, has broken off the wings in down-bending. This occurred once in the early testing days when the pilot inadvertently extended the wing flaps at high cruising speed, which resulted in a horizontal tail failure. It has resulted in two other cases where the aircraft exceeded its design speed after the pilot passed out due to lack of oxygen. In all these cases, the wing failures are similar to those shown in the U-2 photographs. This type of failure is common not only to the U-2 but to all aircraft which balance out the pitching moment by use of the horizontal tail. The failure takes place in general in a very few seconds, creating high accelerations and generally leaving the fuselage spinning inverted.
9. I was able to correlate all of the Powers' statements with our studies of the photographs, our knowledge of the aerodynamic characteristics of the aircraft, and experience in flight test with all the miscellaneous gear involved in attempting an escape from the cockpit as he described.
10. I am still unable to confirm that the Grainger Box was not acting as a beacon for a missile guidance system. You have made studies of this possibility and I know that in the early days when we were first given the device for test it did exhibit such tendencies. Powers stated he had the box turned on, as he was told to do; so this is one question that remains in my mind as a very important one to settle in connection with this accident.
11. I was so impressed by the very clear description of the incident by Frank, and having direct knowledge of what he was ordered to do in case of capture, that I will gladly contribute to a fund for decorating this officer for the fine job he did under the most difficult circumstances. He satisfied me, by detailed questions, that the Russians could not have brainwashed him on detail matters of his escape from the aircraft."



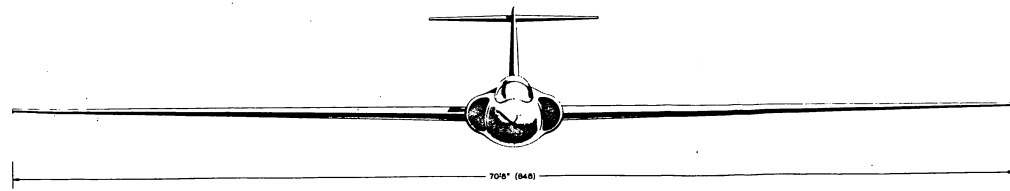
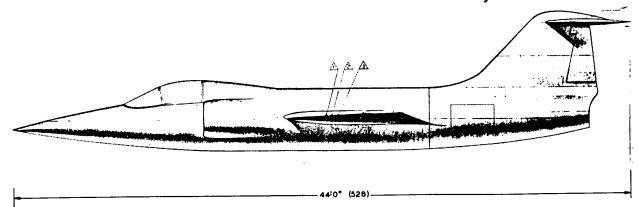
	WING	HORIZONTAL TAIL	VERTICAL TAIL
AREA	500 SQ. FT.	47.5 SQ. FT.	34.7 SQ. FT.
ASPECT RATIO	10.	2.98	1.10
TAPER RATIO	.25	.31	.50
ROOT CHORD	136 IN.	73 IN.	112.5 IN.
TIP CHORD	34 IN.	22.7 IN.	43 IN.

SECTIONS

WING: ROOT NACA 64A400 INCIDENCE +5°
TIP NACA 64A406 INCIDENCE +1°
TAIL SURFACES NACA 64A008

BALANCE

△ MOST FORWARD *C.G. 13% MAC @ F.S. 419.4
△ DESIGN GROSS WT. C.G. 18.4% MAC @ F.S. 424.5
△ ALTERNATE GROSS WT. C.G. 23.2% MAC @ F.S. 429.1



PRELIMINARY DESIGN DEPARTMENT
GENERAL ARRANGEMENT
CL 282
282-1-1