

Louis C. Setter
661-265-7736
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Notes for 15 minute talk at U2 50 year meeting, Beale AFB and Skunk Works talk

Cold war.

- The Cold War was on during the summer of 1955. This was just after Korean war.
- US and Russia had many atomic weapons and tension was very high.
- Our B-52's, loaded with hydrogen bombs, were orbiting over Greenland 24/7.
- I was flying F-84 jet fighters equipped to drop Mark 7 atomic bombs. Other fighters had the same capability. These were 20 kiloton bombs.
- Pentagon and CIA had no clue as to size of Russian air force or missile capability; estimates were high but of very low confidence.
- Pentagon was pressuring Pres. Eisenhower to greatly increase bomber and missile production, at a very great cost, to balance presumed Russian bomber and missile force.
- Eisenhower, at CIA's urging, approved the U-2 program (over the AF program) for a reccy aircraft that could overfly Russia and other Red nations at altitudes considered safely above Russian fighters.
- He needed facts before committing to large increases in US weapons production.

Formation of B.Gen. Yancey's 4070 Provisional Training Organization

- I was the Operations Officer of the 517th Fighter Squadron, Great Falls AFB, Montana, flying F-84F aircraft, assigned to SAC (Strategic Air Command under General LeMay).
 - I had been trained by a Pan Am pilot, Charlie Blair, in celestial navigation, while assigned to 31st Fighter Wing at Turner AFB, Georgia. Col Schilling was Commander.
 - An aeronautical engineer, I had designed a number of cruise control computers for the F-84E, G, F, T-33 and T-39.
- In the summer of 1955, I received a call from SAC Headquarters asking me to report immediately to interview for a new assignment. (no details)
- The Colonel who interviewed me knew nothing about the program, but strongly recommended I volunteer for it. I did, and was assigned to March AFB to report to Brig. General Yancey.
- About eight of us met in a room behind the Base Theater. Gen. Yancey knew only that we were to report to Kelly Johnson at the Lockheed Skunk Works in Burbank for a briefing.
 - Gen Yancey, Lt. Col Phil Robertson, Maj Lou Garvin and Cpt Hank Meierdierck had been fighter and reccy pilots in World War II, flying F-6 (P-51 reccy), F-5 (P-38 reccy), P-39 and P-61 aircraft.
 - Majors Bob Mullen and Jack DeLap were highly experienced B-47 crew members who were instrumental in setting up the U-2 ground school classes.
 - Col Schingler and LCol Art Lien were logistics officers responsible to establish the supply system for the three U-2 detachments. We also had about two admin enlisted men and two aircraft mechanics assigned.

(If I missed someone here I apologize.)

Disclaimer: These comments on the early days of the U-2 program are strictly from my memory of things that happened, 50 years ago. I do not speak for the Air Force nor the CIA nor Lockheed Aircraft. Nor do I claim to have perfect recall as to details. My intent is to set the scene at the Ranch as I remember it. This will be a “worms eye view”.

Although the CIA has stated that our flying at the Ranch has been declassified (relating to our altitudes and flight duration, the Air Force continues to operate the U-2, so my comments will reflect the Air Force guidance of “over 70,000 feet and over 9 hours”.

Our meeting with Kelly Johnson at the Skunk Works in Burbank

- Our ground school on the “article” lasted about 2 hours, as I remember, including coffee break.
- Kelly told us we would be flying a high altitude single seat aircraft with a single engine that “looked something like an F-104 with Gooney Bird (C-47) wings”.
- We would need a pressure suit at cruising altitude. We would be checking out experienced CIA pilots.
- He said the “articles” fuel system was very simple; all fuel was in the wings except for a small header tank.
- The airplane uses a special fuel to reduce boil-off at high altitudes. It smelled like fly spray, so for a while we called it “flit”.
- The airplane had a single strut main gear with a tail wheel. Droppable steel spring bogies held up the wing tips on the ground, and were dropped electrically after takeoff.
- The J-57 engine did not have an afterburner.
- Kelly would not let us on the factory floor; he didn’t want any interruptions at all to the workers.
- He said we could see the “article” at the “Ranch” or “Watertown”, the names they used for the dry lakebed we would operate from.
 - (Note: Kelly was quoted as telling his workers: “Be here, be on time, be quiet.”)
- There was no pilots handbook.
- The name “U-2” was not used at all at this time.
- Everything Kelly told us and everything we knew was highly classified. No badges were issued. No paperwork was done.

Our first trip, via C-54, to the Ranch

- A few days after our visit to the Skunk Works, we were loaded into an Air Force C-54 for our first visit to the Ranch, but were not told where that was.
- We landed on a dry lakebed in a very remote area; this was the Ranch, or Watertown.

The scene at Groom Lake

- The lakebed was very hard and smooth, about 5 miles across.
- At that time, October 1955, there was no runway and no taxiway.
- As I remember there were two hangars, used to assemble U-2s, which were flown in via Air Force C-124 transports and unloaded at night.

- The Lockheed test pilots were: Tony LeVier, Ray Goudey, Bob Matye, Bob Schumacher and Bob Sieker (later killed in a U-2). Ted Limmer arrived later.
- Tony LeVier had made the first few flights, then departed.
- Kelly Johnson ran the place; Glenn Fulkerson was his Test Manager.
- This was a CIA base operated by Lockheed. It was not an Air Force Base.
- I didn't see Tony back there until he and Fish Salmon came in to help search for Bob Sieker after Bob went down. These proved to be some of the most skilled test pilots I have ever known.
- Our Lockheed civilian security guards were well trained and patrolled the area 24 hours per day. Since we had no security badges, the guards were instructed to "arrest anyone they didn't know", which they did. If a visitor or new pilot showed up, the first thing to do was to introduce him to all the guards. There were no women there, as I remember.
- We had a medical building, complete with our own flight surgeon, where our pressure suits were stored and where we did our two hours of "pre-breathing" 100% oxygen prior to a high altitude flight, to prevent the bends in case of a flameout.
- We soon found that flameouts were a regular--frequently a daily-- occurrence. Flameouts occurred on nearly every flight, sometimes more than one. We got pretty good at gliding.
- One day when I was on IP duty in the station wagon on the lakebed, I remember having three U-2s returning to land, all with flameouts. All landed or got airstarts.
- Our mess hall was very well equipped and served outstanding food at nearly all hours.
- We were housed in trailers near the edge of the dry lakebed, four to a trailer.
- We flew home to March AFB on weekends. We all lived in the Riverside area.
- We used two T-33 jet trainers to conduct initial orientation training, and at various times had a number of propeller aircraft for U-2 chase in the traffic pattern: a Navion, a C-45, a Cessna L-27 (twin engine) and eventually a Beech Twin Bonanza.
- The Twin Bonanza worked out but the others did not. Engine overheating was a severe problem. For transport we had a C-47 and the Air Force provided the C-54 for supply and personnel transport to and from Burbank, and the C-124 for transporting U-2 assemblies.
- The C-54 later crashed into the top of Mt. Charleston, west of Vegas, killing all 14 people aboard.
- The CIA project engineer (which I later became) had a DeHavilland L-20 Beaver bush airplane, capable of landing almost anywhere. Lockheed used their Twin Bonanza for personnel transport and for chase.
- An important point is that we all were one team. There was no discrimination between Lockheed, CIA or Air Force personnel. We all lived, worked and flew together. It was the closest and most skilled group of people I have ever worked with. There were no formalities.
- Kelly was the boss and everyone accepted that. In total, there were about 50 to 60 people at the Ranch when we first arrived. This was prior to any detachment people arriving.

Our U-2 Checkout and orientation flights

- The Lockheed pilots checked us out when there were probably only two or three U-2's in existence. As I recall, three of us Air Force instructor pilots checked out on the same day, in October 1955 probably in the same airplane. First flight had been in August 1955, about 8 weeks before.
- Checkout was a short low altitude orientation flight, just to get used to the airplane, do a stall series because the airplane had to be stalled to land it, then a landing on the lakebed, with a lot of help from

your instructor pilot, who was driving right behind you in a Mercury station wagon equipped with an aircraft radio.

- His guidance was a great help in telling you your height above the lakebed, in telling you to “hold it off” to achieve a full stall right at touchdown, and to tell you if your tail wheel was not exactly lined up, to preclude a ground loop.
- Landing on the lakebed was much like a seaplane landing; there was nothing to tell you your height above the ground, as there is when landing on a runway.
- The airplane had to be in a full stall for landing, which can be unnerving for a pilot used to a nose wheel aircraft, because a U-2 landing is seldom a smooth one, and quick and precise rudder inputs are needed right after touchdown.
- You can usually tell a good U-2 pilot by watching how quickly his rudder moves on landing. Rudder corrections had to be small and quick.
- Many U-2s have been wrecked in landing. It is one of the most difficult airplanes to land, and to make it worse, the pilot has to land it after an exhausting long flight with restricted visibility because of the pressure suit. To add to this, we often had engine oil mist on the inside of the canopy, because of leaky engine seals allowing oil mist into the pressurization system.
- While cruising at high altitude our cabin altitude was about 35,000 feet. During a flameout, we lost pressurization instantly and the pressure suit blew up.
- Robby, Hank, Lou and I did a number of high altitude flights to develop navigation, cruise control and engine power management techniques suitable for long endurance flights in a partial pressure suit.
- A couple of test pilots flying rocket propelled aircraft (X-1, X-2, X-15, etc) had been to these altitudes before, but for only a few minutes or seconds at a time, not hours.
- A British B-57 held the world altitude record at that time, at a little over 63,000 feet.
- Major Jack DeLap, our navigator, planned one flight for me, using grid navigation, suitable for the arctic regions near the magnetic north pole, because the magnetic variation changes so rapidly there that the magnetic compass becomes unuseable in some areas.
- The plan was that near the magnetic pole, I would select “gyro only” on my magnetic compass, then measure the sun angle using my sextant to correct my heading for gyro drift. Jack had worked out some celestial shots to get correct heading information from sun shot (sun compass).
- When I got to cruise altitude, I had two problems: my engine oil pressure was in the yellow zone (a “no-go”), and my autopilot didn’t work, so, with no autopilot, I could not do any celestial work.
- I had to abort the trip to the arctic.
- So, since I had a full fuel load, I decided to continue flying locally by going to El Paso and back, twice. When I returned the second time, I was well above 70,000 feet, because the airplane cruise-climbs about 1000 feet per hour (not feet per minute) throughout the mission, as the fuel burns off, but when I was about to land, I found I had lost all feeling in my arms and hands.
- With no autopilot, I had been hand flying the airplane, maintaining airspeed to within 5 knots, for well over nine hours. During landing, the IP in the station wagon literally saved my airplane by telling me every move to make to land; I had to look at the control wheel and say to myself, “right 2 inches, back 1 inch, etc”.
- Without his instructions, I probably would have ground looped, which would probably have done serious damage the main landing gear support structure, to say nothing of my career.
- That flight made me realize that the U-2 could push a pilot beyond his limits. I believe that might still be true today.

- I understand that Lt. Col. Robby Robertson, our Ops Officer, successfully flew the grid navigation flight to the arctic.
- Another quick story: I remember one day when Hank had a total of three flameouts during one mission.
- At that time our medical experts did not realize that the physical effects on the pilot's body of a high altitude flameout and the subsequent hard squeeze by your pressure suit was cumulative. Later, after one high altitude flameout, the rule was to stay low and land if possible. (By the time Hank got back, he was not in good shape---.)
- Glenn told me one day—I don't know if he was joking or not—that the program had had over 900 flameouts when he finally stopped counting. I do know-- we had hundreds of flameouts.
- Ray Goudey tells me that in the early days, he had one or more flameouts on every flight. I had three; The pressure suit saved my life three times.
- So I thank the people who designed and built my pressure suit, and I also thank the Lockheed people, the Pratt & Whitney people and the Perkin-Elmer people for their amazing skills and dedication.

U-2 ground school and checkouts for the CIA pilots (American and foreign)

- Some of the CIA pilots were fighter pilots from F-84 squadrons that Hank and I had known before, so were well trained and used to being in the cockpit by themselves, with no one else to operate equipment, navigate or help make decisions. These were very fine experienced pilots and required only that training peculiar to the U-2. Most had flown tail wheel airplanes before.
- We would take them out in the T-33s, in the back seat with the hood up, and give them exercises in maintaining airspeed, within 3 or 4 knots, while we would pop the speed brake or move the flaps to a different position, simulating flying a U-2 in unstable or turbulent conditions.
- We also would set them up over the lakebed, on final approach, using about 85% RPM power setting, to simulate a very flat U-2 approach and landing (called a “drag in” approach) (is this where “Dragonlady originated?”).
- In the end, I think we all developed a fine appreciation for the fact that the U-2, whether at high altitude or in the traffic pattern, demanded extremely accurate airspeed control. An extra 2 knots of airspeed on final would result in floating an additional 1000 feet down the runway. And, you could not force the U-2 to land. It had to stall, then and only then would it stay on the ground.
- I remember that Gary Powers tried to make a wheel landing on his first U-2 flight, and found out that the airplane just kept bouncing back in the air. Gary learned to make a full stall landing.
- This same problem happened on the first flight: at Kelly's insistence, Tony tried and failed to make a wheel landing. He finally made a successful full stall landing.
- All of us instructors had trained in the T-6 or World War II tailwheel aircraft; we knew about ground-loops.
- Jack DeLap and Bob Mullen ran the U-2 ground school for the detachment pilots, covering the U-2 subsystems, navigation and recy procedures. They had both been lead bomber crew members in SAC, so knew their business very well.
- At one point, I was assigned to check out a Greek pilot—don't remember his name. He was one of three for training. His English was not very good, so this made communication quite difficult.
- When I put him in the U-2 for a cockpit checkout, he grabbed the control wheel and tried to move it laterally left and right, instead of rotating it a circle, as you do in an automobile. Then I found he had never driven a car. He said he knew how to “ride a bicycle and fly a Spitfire”. The Spitfire (WWII

British fighter) had a round wheel on top of the control stick, so the pilot could get both hands on the stick to help maneuver better, but the wheel was fixed; it did not rotate.

- So I first taught him how to drive our station wagon out on the lakebed, which he enjoyed very much, then I took him for a ride in our L-20 and let him fly it, which had a control wheel like the U-2. On his first landing in the U-2, he stalled it about 10 feet in the air and hit hard on the main gear and one wing tip. I can still see that sight—there was a big cloud of dust. That was the end of his U-2 flying. It is surprising how much the U-2 wing will bend without failing, during a “wing tip first” stall landing.
- I don’t recall many difficulties in training the detachment pilots. They were skilled pilots when they arrived, and understood, just as we all did, the great importance of our mission and further, the very serious impact of any accidents.
- I recall that Carmen Vito, an old F-84 friend of mine from the 31st Fighter Wing, made a forced landing in his U-2 at Palm Springs. Later, Carmine made the first overflight over Moscow.
- I was later told that this one flight “paid for the whole U-2 program”, it was that important.
- And there was another U-2 forced landing at Kirtland AFB, I think Marty Knudsen was the pilot. Both aircraft were returned to the Ranch.
- In spite of the publicity involved in these forced landings, program security was maintained under close control for a long time. The CIA did an excellent job on security.
- I don’t remember filling out any training paperwork for the students, except for one handwritten page recommending each student for U-2 checkout.. When we felt they were ready for a U-2 checkout, they were scheduled and they checked out, followed by longer and more difficult navigation flights.
- It’s possible that someone else did additional paperwork, but I did not. No formalities. No stan eval. No flying rules or regulations, at least not at first.
- Any such paperwork would have to be classified, and we did not want to bother with handling classified information. I remember we drafted up the pilots handbook, then were told it would have to be considered top secret, so it didn’t get much use. No one wanted to bother with TS procedures.
- In those days, the U-2 subsystems were so simple that a pilot could learn everything about it in a couple of hours. It had no redundant systems, including the oxygen system. A failure of the single oxygen valve in the pressure regulator at high altitude meant the pilot had 6 seconds to live. (That’s what I was told, and I believe it.) Later, a dual valve oxygen regulator was developed.
- Early in the program I remember asking one of the CIA managers what were the flying rules, because we were ready to begin cross country flying and in the Air Force we complied with the many rules in AFR 60-16 and FAA directives.
- He thought for a minute, then said, “there are no rules, you can decide”. At that point, if we had done a teardrop climbout to arrive back over the base above 60,000 feet with the engine still running OK, we would make a call to Glen Fulkerson in the tower to check out, then turn off our radio and head out on course.
- We might fly a number of hours with no position calls.
- We were told we could not be seen from the ground nor picked up by radar, so we believed we were truly invisible. Later, the detachment pilots found out that was not true. Russian radar could pick them up in most cases.
- The agency didn’t want any radio calls made that might arouse suspicion. Later, we began making standard “VFR on top” position calls to FAA stations, without disclosing our altitude.

- As the junior instructor pilot, one of my duties was to respond to UFO or “flying saucer” reports that came in to the Air Defense Center in Norton AFB, in San Bernardino. So, one day, I was directed to fly in to Norton in my dirty T-33 and my dirty flying suit, salute the General on duty, and simply give him a “yes” or “no” answer to his question.
- He didn’t know who I was or where I came from. I remember one time he asked me if I knew anything about a high speed radar return reported over Seattle at extremely high altitude, and all I had to say is “no sir”, and leave.
 - During one trip to Norton, my T-33 was grounded because the wheel wells were full of sand and dust from all the lakebed landings we had been making. I didn’t mind, I just went home to Riverside to spend the night with my family and returned to the Ranch the next day.

Flameouts and pressure suits

- On probably my second U-2 orientation flight, I started a stall series at about 45,000 feet, by pulling the power back to idle, then did stall approaches with flaps up and down and gear and speed brake up and down. This is standard training when checking out in a new airplane.
- Toward the end of the stall series, the engine suddenly flamed out. Only then did I notice that while I was doing stalls at idle power, the altitude had “creeped up” to about 53,000 feet. Even at idle power the airplane would climb. The J-57 had a strong dislike for the altitude band between 50 and 60,000 feet.
- At high altitudes, when the partial pressure suit “blew up”, it inflated to a very high pressure—sufficient to leave you with black and blue marks, and sufficient to leave “patekeii” black and blue pinch marks over your chest and neck area where the high pressure in the helmet bladder was squeezing. Pressure breathing meant the oxygen pressure would inflate your lungs, but you had to FORCE the oxygen out of your lungs during exhaling. Transmitting on the radio was very difficult.
- My pressure suit “blew up” and I proceeded to glide down to 35,000 feet and got a good airstart. 35,000 feet was the maximum altitude for an airstart for the J-57.
- Another flameout at about 68,000 feet was one I will never forget. The engine quit without warning. In very quick succession, the following things happened:
 - I heard a loud BANG,
 - then saw the RPM rapidly unwind
 - and felt my suit blow up and squeeze me hard
 - while my helmet lifted about 4 inches off my head, so I couldn’t see.
- I had to strain to bend my arms to pull the helmet straps down so I could see again,
 - and noticed the canopy had instantly frosted over so I couldn’t see out,
 - and I had a number of warning lights on.
- Now I was pressure breathing.
- I knew the battery wouldn’t last long so called the base and told them I had flamed out and where I was—about 80 miles north.
- Then I turned the radio off to save it for later.
- The attitude gyro and compass had failed, so I was gliding on the old “needle, ball and airspeed”. At that point, you cannot trust any of the instruments.
- I turned south toward the base and soon entered a high cirrus cloud deck. Luckily it was not very thick because I was in a near vertical bank (unplanned) when I broke out of the bottom, indicating that my turn needle was not working either. I was very near to overstressing the airplane.

- I learned then that gliding through a cloud deck with a flameout was not a smart thing to do.
- The engine airtstarted OK below 35,000 feet, so I radioed back that I had a good start and continued on with the mission.
- This happened on a Friday, and the others were anxious to get back to March AFB for the weekend, so I just climbed out of my pressure suit, got into a flying suit, and rode home in the Twin Bonanza with the others.
- When I got home, I tried to sneak into the shower without my wife seeing me, but she saw the black and blue patechii (pinch marks) around my neck and shoulders (from my pressure suit), and started asking questions—she is a nurse, and they can ask questions! I couldn't tell her where the marks came from.
- During my recent talk at the Skunk Works (August 1, 05) is probably the first time she knew where those pinch marks came from.
 - When the pressure suit blows up, the high oxygen pressure in the rubber bladder covering our head, neck and shoulders causes pinch marks. For a couple of years, our wives did not know where we spent the week or what we did.
- Lockheed spent a lot of test time in the early days attempting to find the best combination of speed and power setting to get through the 50 to 60,000 foot altitude band without flaming out.
- Once above 60,000 feet, the engine did better, but still would flame out if you were 5 knots below the proper airspeed, or made any sudden maneuver, such as yawing.
- You could tell—the engine was just on the edge of flaming out all the time, and had to be nursed very carefully.
- There was a correct airspeed for each altitude (equivalent to about 415 knots true airspeed), and you had to stay within plus or minus 5 knots of this speed all the time, and had to maintain engine EGT just below the redline by making very minute power reductions with the throttle vernier wheel. You would make a very small throttle adjustment with the vernier wheel to keep the engine from “overtamping”, then hold your breath waiting to see if it would flameout.
- The J57-P31 engine was better than the P37 engine for flameouts. The P31 engine was used by the detachments in their overflights.
- We always cruised at maximum engine power for the full time at altitude. You never did pull the power back to a cruise setting. I guess we went through a lot of engines. I know there was a two foot high pile of burned and warped turbine blades laying on the ground just outside my trailer.
- The U-2 had only airspeed, altimeter (which sometimes would stick), rate of climb and engine RPM.
 - no EPR (engine pressure ratio),
 - no GPS,
 - no Mach meter,
 - none of the nice modern stuff.
- Navigation was done by dead reckoning (speed and heading), map reading (pilotage), celestial and ADF (automatic direction finder). The attitude gyro plus needle and ball completed the basic instrument flying layout.
- We had an autopilot, but in the early days, it seldom worked and when it did work, could not be trusted.
- This was basically World War II flying equipment.
- From high altitude, you could look outside, of course, but could not see many details on the ground because of your altitude. We saw about the same view of the earth as astronauts see today—a truly

beautiful sight. We could see about 200 miles in every direction. There were no clouds at our altitude and, surprisingly, little or no wind.

- The detachment pilots told me they did find winds at cruising altitudes up to about 50 knots at high latitudes, plus some turbulence.
- We could see the curvature of the earth, a startling sight the first time you noticed it, and the sky above was absolutely black. I wondered why I couldn't see stars in the daytime.
- Since each pound of weight costs us one foot of altitude, Kelly was absolutely against any aircraft gain in weight unless he approved of it.
- He said that altitude is the pilot's only protection, and he is not going to give up even one foot unless there is a sound reason for it.
- Many improvements came later and are still coming, I hear, such as a glass cockpit, an autopilot that really works and an engine that never flames out!
- I had previously designed a cruise control plot for other aircraft, so developed one for the U-2 also. It was simply a plot of fuel remaining in gallons versus hours of flight time. It was printed on a large piece of green cardboard, so was called the "green card".
- Later I found we were more likely to run out of oxygen than fuel, so I added an oxygen line to the card, which would indicate an oxygen leak—very dangerous. A "green card" is still in use, I understand, but now it has a lot of added information on it.
- A large lens (drift meter) directly in front of the pilot was for two purposes: you could see the ground directly below you or to the left or right side of your flight path by moving a small control stick.
- This mode was planned so you could find your target and aim the large C camera to get photos (I don't think the C camera ever showed up; it was a flying telescope).
- You could pull a knob to move a mirror so now you are looking up at the sky through the small bubble on the nose in order to obtain celestial shots.
- One of the test airplanes I flew had a very large water manometer mounted vertically on the right side of the instrument panel to accurately measure pressure, in inches of water, at one of the compressor blade positions.
- As long as the U-2 was powered with the J-57 engine the flameout problem was a threat. I don't know how serious a problem flameouts were for the detachment pilots. I know the J-75 engine was installed, but never flew it. The J-75 is a big engine, it must have been a tight fit.
- When we started training the detachment A pilots, we attempted chasing them in a T-33—the T-33 would be at 35,000 feet and the U-2 about 30,000 feet above it, at 65,000 feet or higher, so the T-33 pilot had a difficult time just keeping the U-2 in sight. I doubt we helped the U-2 pilot much by doing this, so soon stopped.
- We did chase the U-2 in the traffic pattern with a Twin Bonanza during the first few flights, but I feel that by far the biggest help were the radio comments and instructions given by the instructor pilot in the Mercury station wagon, which was driven a few yards behind the landing U-2; the station wagon pulled into formation behind the U-2 as soon as it passed the dry lakebed shore and radioed instructions as to wheel height above the ground and rudder corrections to prevent groundloop.
- At this point the U-2 would be flying at about 65 knots (about 75 mph), slowing down to touch down in a stall at around 55 knots. (This is about the same speed as today's light planes land.)
- This practice of having the station wagon right behind the landing U-2 saved many airplanes from ground looping, which often results in severe damage to the aircraft structure and probably some damage also to the pilot's career as a U-2 pilot.

- You have to be aware that the U-2 was not only difficult to land under the best conditions, but that the pilot was usually returning from a very long mission in an exhausted state and couldn't see through the canopy very well because of oil mist on the inside of the canopy.
- There is no doubt in my mind: it takes two pilots to land the U-2, one in the cockpit and one in the station wagon.
- Landing in even a slight cross wind was much more difficult. On the lakebed we could always land into the wind, luckily.
- We were not able to drink water or eat during these missions, so got quite dehydrated.
 - I would lose 5 or 6 pounds weight on a long flight. For this reason, we were grounded for 24 hours or so after a long flight.
- We were told that a status report on the U-2 program was sent to President Eisenhower every Wednesday.
- Mr. Bissell was the program director in the CIA, who reported to Allen Dulles, head of the CIA.
- Mr. Dulles visited us at least once during the program.
- We had very few visitors because the program was SAR (Special Access Only), which kept the Congressman and other executives out.
- We did see two Air Force Lt. Colonels fairly often. They came from the SAC B-57 development program, and were looking for clues as to how to improve the B-57 altitude performance.
- As far as I know, the B-57 never achieved the altitudes or ranges that we did. I know that a B-57 did collect some bullet holes during an overflight in 1953, so their overflights were cancelled.

Snow day –

- One day we woke up to find it had snowed 3 or 4 inches and U-2 flying was cancelled. So, having nothing else to do, I took the L-20 Beaver up for some local flying. I was doing touch and go landings in the snow on the lakebed when I noticed a skier on the lakebed (one of our detachment commanders, who shall remain unnamed). He waved me down and asked if I could give him a tow.
- I said OK, so he found a long rope, attached it to my left wing strut, and I towed him around the lakebed for a while. During a break, he said it was great, but the prop wash was blowing a lot of snow in his face.
- I said "I can fix that". So on the next tow, I took off -- and cruised about 20 feet in the air, with him still on the lakebed at a good speed. I could feel the rope tugging on my wing strut; we were going about 85 mph or so and traveling in a big circle.
- He must have been pulling some G's in that turn. (The Germans have towed skiers behind race cars, with the skier in the ditch, getting a rather rough ride.)

What made the U-2 program at the Ranch such a success?

1. Kelly Johnson and his Skunk Works team and the decisive CIA leadership.
 - Kelly was a brilliant designer and manager, and was not constrained or delayed by Air Force or FAA specifications in his design and manufacturing of the U-2 aircraft. He would allow no one to slow down his engineers or workers, including the CIA customer.
 - I cannot imagine an Air Force test manager allowing operational instructor pilots to check out in his prototype test aircraft a few weeks after first flight in order to begin the pilot training program. This would be unthinkable.

- But this is what Kelly did. He was a master at balancing risk at against the urgent need for getting the U-2 over its target on operational overflights.
 - The CIA leadership, having no experience with aircraft acquisition, wisely put the decision making and flight testing entirely in Kelly's hands.
2. The U-2 design would not have been acceptable if it had been an Air Force development program. (my opinion---)
 - Landing gear design: *unacceptable*. (When I saw the B-57 landing gear struts, I said to myself, “no wonder they can't get that thing to U-2 altitudes—the steel struts looked the size of telephone poles”. High altitude means very light weights. Remember: 1 pound of weight = 1 foot of altitude.)
 - The U-2 is a single seat, single engine long range reccy airplane: *unacceptable*. (to SAC).
 - Development and test program schedule: *unacceptable*. (AF would have taken many years and large amounts of money.)
 3. The Pratt and Whitney (J-57 and J-75) engines, which continued to be structurally reliable and able to take the terrible beating of full throttle high altitude flight over long periods of time. Without the J57, this program could not have been successful when it was, in 1955.
 4. The Perkin-Elmer camera design and fabrication of the B camera was an amazing accomplishment, and very successful. It was as advanced as the U-2 aircraft design.
 5. The great motivation and skill of the three detachment Commanders and their staffs and the CIA pilots who volunteered to fly these dangerous and very difficult and exhausting missions. They used their operational experience and judgment and took risks where they felt it was acceptable, and it paid off, big time. (For some truly amazing tales of missions the detachment pilots flew, read Chris Pocock's latest book “50 years of the U-2”.

In closing-----

I salute the Skunk Works, its leaders, pilots, engineers and technicians who originally developed and have continued to develop the U-2 over the years into what is still today, after 50 years, a very cost effective, efficient, productive and safe operation.

Kelly Johnson will always be one of my heroes.

And I salute all the people who worked and flew at the Ranch in the early days—the managers, pilots, navigators and planners, test and subsystem engineers, mechanics, technicians, security people, medical staff, cooks, truck drivers and all others for their skill, devotion, dedication and ability to keep their mouths shut.

And I also salute all those who are no longer with us. A few names are: Mr. Bissell, Kelly Johnson, Glenn Fulkerson, Tony LeVier, Bob Sieker, Frank Grace, Gary Powers, Benny LaCombe, and many more.

You people started a revolution in aerial reconnaissance, which is still improving to this day.

And I salute all U-2 people who came after, over the following 50 years. You have done and are doing a truly amazing job which is appreciated by many but is fully comprehended by only a small number of people.

Postscript: Of the 55 U-2A aircraft manufactured (20 for CIA, 30 for USAF, 5 for others), 37 crashed, 6 were shot down (one was Gary Powers), and 11 are now in museums. The larger U-2s bought and operated by the Air Force and NASA are not included in the above numbers.