

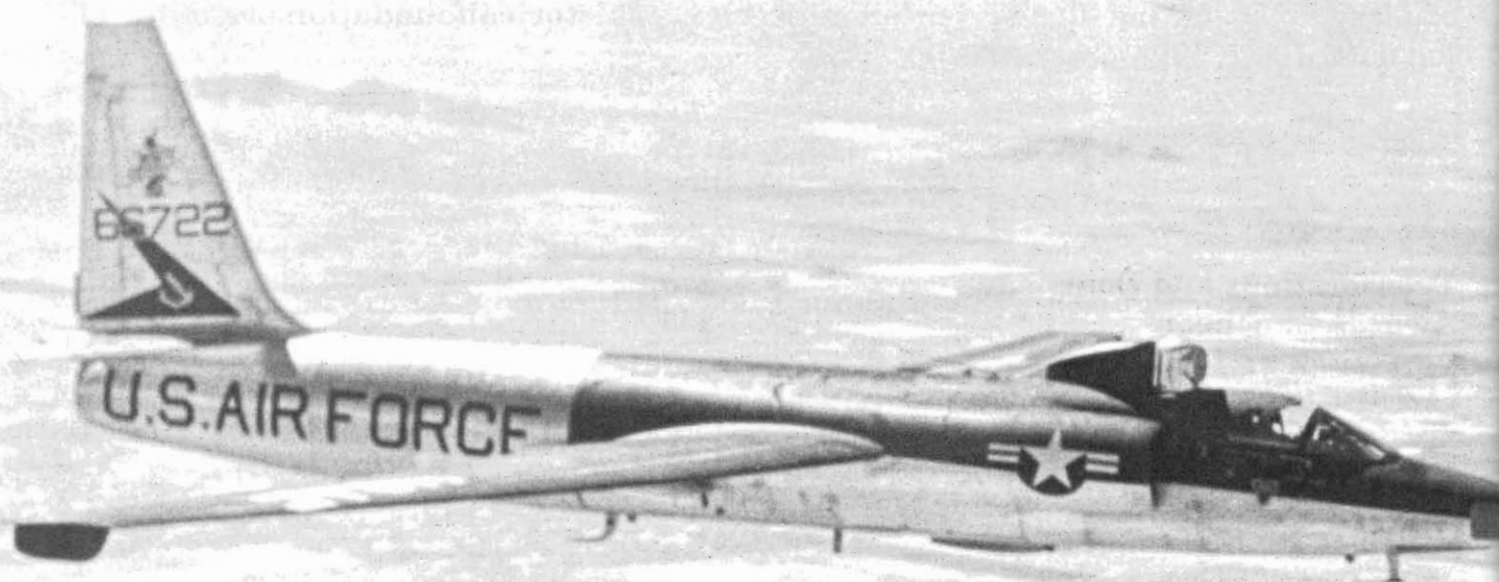
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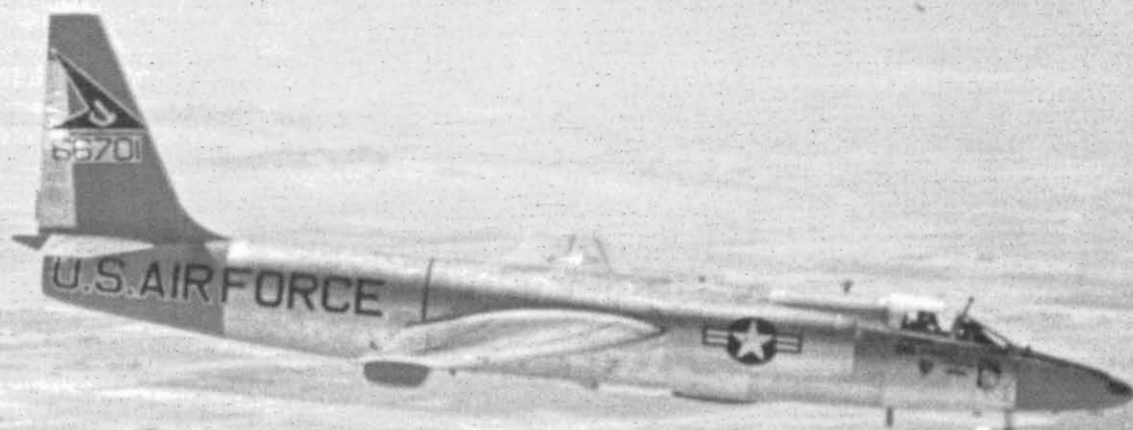
FALL 2011 - Volume 58, Number 3
WWW.AFHISTORICALFOUNDATION.ORG

History



U-2 Spy Planes: What You Didn't Know About Them!





David Reade

(Overleaf) Special scientific research U-2 aircraft from AFCL/Edwards AFB. (USAF photo)

(Right) Within days of the 1960 Powers CIA U-2 shoot-down, NASA presented the press with a U-2A aircraft in fictitious NASA markings, to bolster the government's cover story that Powers was on a scientific weather research mission. (NASA Photo.)



**PUBLIC
KNOWLEDGE
OF THE U-2
CAME
CRASHING
INTO THE
WORLD'S
COLLECTIVE
CONSCIOUS-
NESS ON
MAY 1, 1960,
WHEN
FRANCIS
GARY
POWERS
WAS SHOT
DOWN,
WHILE
FLYING IN HIS
U-2C OVER
SVERDLOVSK,
USSR**

We know that U-2 spy planes were designed and built by Lockheed Aircraft for the Central Intelligence Agency (CIA) in the early 1950s, to conduct clandestine overflights of the Soviet Union, China, Cuba, and other denied areas of the world. At that time, these planes became our most important source of intelligence on the Soviet Union. Public knowledge of the U-2 came crashing into the world's collective consciousness on May 1, 1960, when Francis Gary Powers was shot down, while flying in his U-2C over Sverdlovsk, USSR.

Within days of the shoot-down, Dr. Hugh Dryden, director of the National Aeronautics and Space Administration (NASA), reiterated the agency's May, 1956, statements that the U-2 aircraft was a new research tool for high-altitude atmospheric and meteorological research, flown with the logistical and technical support of the United States Air Force.

Historians have pointed to these and subsequent statements by NASA and its predecessor agency, the National Advisory Committee for Aeronautics (NACA) as the U.S. government's first "cover story" to mask the covert operational use of these new U-2 aircraft.

Subsequently, declassified government documents now reveal that at the time Dryden made those proclamations, in May 1956, the first U-2 aircraft were just becoming operational. Within a month, the CIA conducted its first operational overflights of Poland and East Germany. By July 4, 1956, the CIA had flown three more overflights of eastern Europe, including the very first clandestine overflight of the Soviet Union. It is important to note, that the U.S. Air Force would not receive its first five U-2 aircraft until June 1957, and NASA would not get its first two U-2 aircraft until June 1971.

Looking back to when Dr. Dryden announced the peaceful scientific research purposes of the U-2 to the press in May 1960, after the Powers shoot-down, it is now evident that he was not actually lying. By that point, Air Force U-2s were conducting peaceful, high-altitude atmospheric and meteorological research flights throughout the world and would continue to do so until 1968.

U-2 Research Aircraft

Almost from the beginning of the clandestine spy plane program, early U-2 aircraft were utilized for atmospheric sampling and high-altitude weather research. Slightly more than a year after the CIA received their first U-2 the U.S. Air Force received some of its own U-2 aircraft, which became operational in October 1957, and were assigned to the High-Altitude Sampling Program (HASP). Running between 1957 and 1963, the HASP could detect and monitor the scientific advancements being made in Soviet nuclear weapons development and testing. The U-2 was incorporated into this mission with several aircraft specially modified and equipped to collect atmospheric air samples to detect radioactive debris at high-altitude. Known as Operation Crow Flight, five U.S. Air Force U-2As were modified with nose radomes, encompassing a hole or air intake valve mechanism to permit the capture of air gasses for sampling.

Unofficially known as WU-2A, and operating under the guise of weather sampling aircraft, these particular U-2s were additionally equipped with air scoops mounted on the port and starboard sides of the fuselage to collect radioactive particulate debris in the upper atmosphere.

David Reade is an author, writer, freelance journalist, aerospace consultant, and a leading authority on maritime patrol and scientific research aircraft. His book, The Age of Orion, is generally recognized as the most authoritative history on the development of the P-3 Orion. Mr. Reade has written more than 100 magazine articles on military maritime patrol aircraft and research aircraft worldwide. He has worked for some of the leading aerospace companies in North America. His expertise encompasses marketing and strategic business development as well as technical support to aircraft maintenance and modification programs for the U.S. Navy, and various international operators. Reade is currently writing a history of hurricane reconnaissance and research aircraft that specifically examines the developmental use of military aircraft for weather reconnaissance during World War II and their progression into the hurricane reconnaissance and hurricane research aircraft used by various operators today.

Francis Gary Powers (right, with Lockheed's U-2 designer Kelly Johnson in 1966.) (Photo courtesy of the National Museum of the U.S. Air Force.)



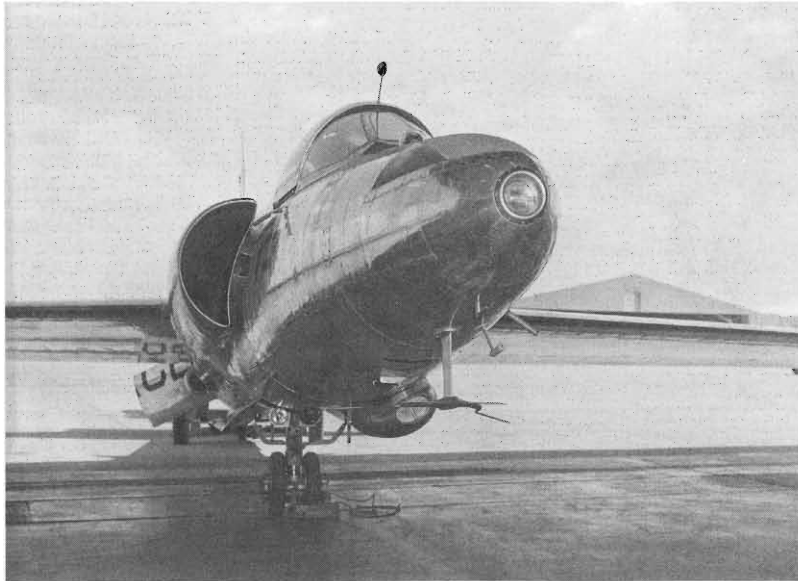
First Lockheed production U-2. (Photo courtesy of the National Museum of the U.S. Air Force.)



One of the U.S. Air Force's early strategic reconnaissance squadrons, the 4028th of the 4080th Strategic Reconnaissance Wing, was involved in flying the U-2 HASP flights. Detachments from the 4028th deployed all over the world, flying HASP missions from bases in the United States, Europe, Alaska, Australia, and Puerto Rico.

HASP sampling flights actually originated with CIA U-2, beginning in 1956, in support of the (then) Armed Forces Special Weapon Project or AFSWP—(later) Defense Nuclear Agency.

These ultra-secret flights, even within the CIA, not only supported monitoring of Soviet nuclear weapons programs, but also supported the establish-



(Above) HASP U-2 aircraft; close-up of nose. Notice the nose air-valve and air intake scoops on the lower starboard and port sides of the fuselage. The scoops collected high-altitude atmospheric debris particles that provided detailed knowledge of nuclear weapons tests conducted by the USSR and other nations. (USAF photo.)

ment of AFSWP worldwide nuclear fallout pattern charts that were developed in association with future nuclear weapons policies and planning.

CIA U-2s carried out covert HASP missions throughout the 1960s, inclusive of the one-known Project Seeker mission, to collect nuclear intelligence data during the French nuclear weapons tests carried out on Mururoa Atoll, French Polynesia, in May 1964.

(Above right) HASP U-2 aircraft preparing for take-off. (USAF photo.)

The Air Force's U-2 HASP flights ended in March 1963, with the signing of the Above Ground Test Ban Treaty between the U.S. and the USSR. In the subsequent U-2 aircraft investigation, in the



wake of the Powers shoot-down, congressional scrutiny revealed that more than 200 U-2 Flights were conducted between 1956-1960, under the auspices of the NACA/NASA weather research "cover" missions.

Although a portion of these 200 flights (including twenty-four overflights of the USSR) were covert CIA flights, the remaining majority of the flights were mostly atmospheric and meteorological research flights flown by the CIA and Air Force for various U.S. government organizations.

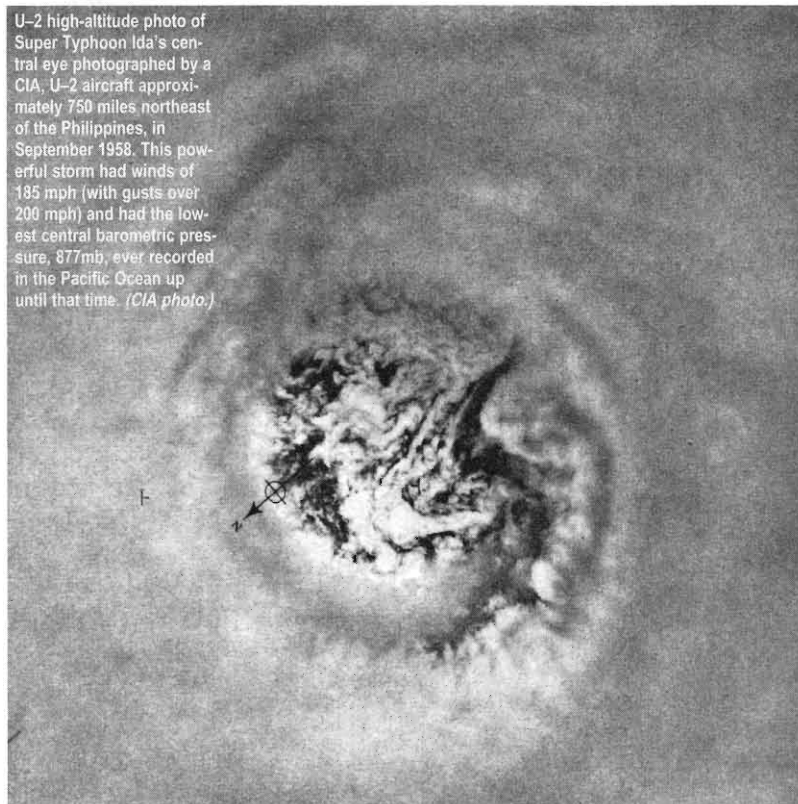
Some of these U-2 research flights included milestone high-altitude missions over the tops of typhoons and hurricane in support of the Air Force's Air Weather Service (AWS) and the U.S. Weather Bureau.

U-2 Typhoon Flights

On November 14, 1957, a U-2 over-flew the top of typhoon Kitt, in the western Pacific Ocean, just north of the Philippine island of Luzon. The aircraft photographed the typhoon's cloud formations and inner eye dynamics from high altitude - looking straight down from approximately 65,000 feet. This U-2 flight produced the first high-altitude, high-resolution images of the upper tropopause region of a tropical cyclone.

Between July 14 and 16, 1958, several more U-2 overflights were conducted into Super Typhoon Winnie off the coast of Formosa - now Taiwan. Winnie had developed into a particularly powerful typhoon with winds in excess of 175 mph, striking the western-most end the island of Taiwan, causing severe damage. The storm continued on across the Formosa Strait and impacted the southeast coast of mainland China. Later in September 1958, additional U-2 flights were flown over the tops of super typhoons Ida and Helen - photographing spectacular cloud features and structures, looking down into the storms' eyes from the lower stratosphere.

These early Pacific typhoon U-2 overflights were actually flown by the CIA's "Detachment C" (under a fake cover designation as the USAF's 3d Weather Reconnaissance Squadron-Provisional), publicly stated to be supporting AF AWS typhoon research, and based at NAS Atsugi, Japan. The typhoon flights helped in an effort to bolster their *weather reconnaissance* cover story, while providing area tactical reconnaissance coverage of the region,



U-2 high-altitude photo of Super Typhoon Ida's central eye photographed by a CIA U-2 aircraft approximately 750 miles northeast of the Philippines, in September 1958. This powerful storm had winds of 185 mph (with gusts over 200 mph) and had the lowest central barometric pressure, 877mb, ever recorded in the Pacific Ocean up until that time. (CIA photo.)

IN AUGUST 1958, THE PRC BEGAN SHELLING OFF-SHORE TAIWANESE ISLANDS

CIA U-2s BEGAN OVER-FLIGHTS OF THE REGION TO MONITOR PRC TROOP MOVEMENTS AND NAVAL OPERATIONS... [USING] WEATHER RECONNAISSANCE FLIGHTS OF TYPHOONS AS A COVER STORY IN THE MEDIA



including the "Offshore Island Crisis"; an armed confrontation between the People's Republic of China (PRC) and Taiwan's Nationalists Chinese - in the summer of 1958.

In August 1958, the PRC began shelling offshore Taiwanese islands, with U.S. concern that the mainland Chinese would invade Taiwan. As these tensions heated up, CIA U-2s began overflights of the region to monitor PRC troop movements and naval operations. The CIA used the weather reconnaissance flights of Typhoons as a cover story in the media.

AFCRL U-2 Projects

As the U-2s continued their covert reconnaissance missions with the CIA and operational Air Force strategic reconnaissance squadrons, a number of early U-2A aircraft were utilized in various atmospheric and meteorological research projects under the control of the Air Force's Cambridge Research Laboratory (AFCRL). AFCRL was located at L.G. Hanscom Field, Bedford, Massachusetts, and operated in cooperation with the Air Force's Geophysical Research Directorate (GRD).

Some of the early AFCRL U-2 science projects encompassed high-altitude atmospheric pressure and air gas sampling measurements, moisture studies, ozone concentration research, electrical field measurements and severe thunderstorms research as well as clear air turbulence research. These AFCRL scientific research U-2s were flown by

flight test crews from the Special Projects Branch (the 6512th Test Squadron) of the Air Force's Flight Test Center, located at Edwards AFB, California.

A group of early (ex-CIA) U-2As were permanently assigned to the test center at Edwards, specifically for atmospheric systems testing and scientific research projects. One of the Edwards' research U-2As was utilized in an AFCRL project called Rough Rider (1960-1968). Since 1946, The Rough Rider project was a continuation of previous severe thunderstorm (Tornado) research projects under the direction of the U.S. Weather Bureau. Like the previous thunderstorm research projects, the Rough Rider missions were to collect comprehensive atmospheric and cloud dynamics data of severe thunderstorms and their surrounding environments to advance our knowledge of these powerful storms and develop improved forecasting techniques.

At that time, Project Rough Rider was a new tornado research project of the Weather Bureau's National Severe Storms Project (NSSP); in cooperation with, and coordination from the Weather Bureau's Research Flight Facility (RFF), the Air Force's AFCRL, GRD and Aeronautical Systems Division (ASD) laboratories as well as NASA and the FAA. Additional support was provided by area Air Force Reserve and Air National Guard units and facilities. Under this project, AFCRL U-2 flew in, around, and over severe, tornado-producing, thunderstorms to collect vital high-altitude meteorological research data and take panoramic cloud

This aircraft was one of the first U-2As built for and operated by the CIA in 1956. It later came under the control of the AFCRL and utilized in various scientific research projects throughout the world. It is currently on display at the U.S. Air Force's SAC Museum at Offutt AFB, Nebraska. (USAF photo.)



IN 1956, THE WEATHER BUREAU... RECEIVED CONGRESSIONAL FUNDING TO ESTABLISH THE NATIONAL HURRICANE RESEARCH PROJECT (NHRP), TO CONDUCT RESEARCH ON TROPICAL CYCLONES

photography at levels near the tops of the storm clouds.

Simultaneously, in a related project, called the Lightning Research Project (1964-1966), sponsored by the AFCRL's Cloud Physics Division, in cooperation with the Aeronautical Systems Division of the Air Force's Sandia Corporation laboratory (also in association with the U.S. Federal Aviation Administration) AFCRL utilized a specially-equipped U-2 aircraft to fly in and around severe thunderstorms to study and measure their electrification dynamics and intensity. These Rough Rider U-2s captured impressive lightning photography of these powerful storms.

Another AFCRL U-2 atmospheric research project, conducted in 1961, in support of New York's Dudley Observatory, flew space particle sampling missions for the collection of micro-meteorites at high-altitudes. The AFCRL U-2s were equipped with collection scoops, similar to the HASP that pushed air through very fine mesh filter materials to collect microscopic meteorites that constantly penetrate earth's atmosphere.

Between 1962 and 1967, AFCRL used a specially-equipped U-2 aircraft to verify the heights of cloud tops during the development of the Weather Bureau's WSR-57 Weather Radar Network. The U-2s verified the heights of clouds relative to the heights being reported by the prototype radar units. This type of proof-of-concept verification still goes on today with NASA ER-2 and NOAA aircraft verifying data provided by space-based satellites.

Also, from 1964 to 1966, the Jet Stream Cirrus Research Project was conducted by the AFCRL in support of Sandia Labs. The AFCRL controlled U-2 aircraft investigated the radiation characteristics of high-altitude jet stream Cirrus clouds. In this project, a research U-2 was equipped with three different airborne thermal radiation thermometers or radio-meters and a Rosemont temperature probe. The aircraft was also equipped with various reconnaissance-type cameras. The U-2 flew above, in and below cirrus cloud formations to take thermal temperature measurements and aerial cloud formation photographs. Between April 1964 and February 1966, twenty-three U-2 jet stream cirrus cloud flights were conducted at altitudes over 65,000 feet.

U-2 Hurricane Flights, 1960-1968

In 1956, the Weather Bureau—reacting to the devastation of three consecutive hurricane strikes along the east coast of the United States, received congressional funding to establish the National Hurricane Research Project (NHRP), to conduct research on tropical cyclones that would advance our scientific understanding of these storms and provide the means to improve the accuracy of future hurricane forecasts.

During this process, the NHRP began to ponder the horizontal thermal and vertical wind structures in the upper troposphere/lower stratosphere region of tropical cyclones. At the time, there were no high-altitude aircraft adequate to probe regions over the

U-2 Timeline: Research U-2 Milestones

- 1955** - (Aug) Lockheed delivers the first U-2 spyplane to the CIA after a successful flight test of the "article 1" prototype aircraft.
- 1956** - (May 7) Dr. Hugh Dryden of NACA (the predecessor of NASA) announces the existence of the U-2 aircraft, to be flown by the US Air Force's Air Weather Services. Dryden reports the aircraft will be used as a high-altitude research tool for meteorological investigations, including: jet stream studies, high-altitude temperature and wind structures (at jet stream altitudes), and cosmic ray research above 55,000 feet. (*Regarded as the first cover story for CIA operations of the U-2.*)
- (June 20) the U-2 flies its first operational clandestine mission over Poland and East Germany for the CIA.
 - (July 2) the U-2 flies its second and third operational clandestine overflight missions of eastern Europe (Czechoslovakia, Hungary, Bulgaria, Romania, Poland and East Germany) for the CIA.
 - (July 4) the U-2 flies its fourth operational clandestine mission for the CIA – the first overflight of the Soviet Union.
- 1957** - (June 11) the USAF's 4028th Strategic Reconnaissance (Weather) Squadron receives the Air Force's first six U-2A for operational use.
- (Sept) the USAF's 4080th Strategic Reconnaissance Wing receives five U-2A aircraft, modified for HASP air sampling - including atmospheric gases and particulate sampling devices.
 - (Oct) U-2 HASP flights begin with detachment units to Ramey AFB, Puerto Rico and Plattsburgh AFB, New York.
 - (Nov 14) a CIA U-2 flies over "typhoon Kitt" conducting high-altitude photographic surveillance of the storm to bolster their weather recon cover story and support the Air Force's Air Weather Service's typhoon research.
 - (Nov 28) U-2A #56-6722 is delivered to the Air Force, for modification into the one and only HICAT U-2.
- 1958** - (July 14-16) a CIA U-2 flies over "typhoon Winnie" conducting high-altitude photographic surveillance of the storm to bolster their weather recon cover story and support the Air Force's Air Weather Service's typhoon research.
- (Sept 14) a CIA U-2 flies over "super typhoon Helen" conducting high-altitude photographic surveillance of the storm to bolster their weather recon cover story and support the Air Force's Air Weather Service's typhoon research.
 - (Sept 24-25) a CIA U-2 flies over "super typhoon Ida" conducting high-altitude photographic surveillance of the storm to bolster their weather recon cover story and support the Air Force's Air Weather Service's typhoon research.
 - (Oct) NACA is dissolved; NASA is established and replaced by NASA.
- 1960 – 1968**; AFCRL makes a research U-2 available to the Weather Bureau's HRP and its component "Stormfury" experimental hurricane modification project. Over the next eight years, AFCRL research U-2 will fly over and into countless Atlantic hurricanes for direct and indirect hurricane research.
- 1960** - (May 1) Francis Gary Powers is shot down over Sverdlovsk, Russia (USSR)
- (May 6) a U-2 aircraft, with fictitious NASA serial number and NASA markings, is shown to the news media to bolster the pre-planned cover story of NASA conducting weather research flights with the U-2.
 - (May 7) NASA Director Dr. Hugh L. Dryden issues a press release stating that a U-2 aircraft, conducting high-altitude weather research, has gone missing during a flight over Turkey – potentially due to oxygen difficulties.
 - (May 22) a second NASA press release is issued with the cover story of a NASA U-2 aircraft gone missing, while operating overseas, and presumed lost.
 - (June) NASA, concerned that its reputation has been damaged in the wake of the Powers U-2 Affair, disengages from the CIA and will no longer provide them the cover story support for their covert U-2 operations.
- 1961** - an AFCRL controlled research U-2 is used for high-altitude space particle (micro-meteorite) collection.
- 1962 – 1967**; AFCRL controlled research U-2 aircraft support the U.S. Weather Bureau's WSR-57 weather radar network development.
- 1962 – 1966** AFCRL controlled research U-2 aircraft are utilized for the Ozone Research Project and are flown over and into Atlantic hurricanes.
- 1963** - (March) the U-2 HASP program comes to an end with the signing of the Above Ground Test Ban Treaty between the U.S. and USSR.
- (22 Oct) a AFCRL U-2 flies up, over and into the eye of hurricane Ginny. Equipped with specialized ozone instruments, the aircraft conducts Ozone sampling, concentration measurements and cloud photography over the top of the storm and into the hurricane's eye. (*This is the first ever high-altitude ozone research probe of a tropical cyclone.*)
- 1964 – 1966** AFCRL controlled research U-2 aircraft is used in the Lightning Research Project (in association with Project Rough Rider) and is also utilized for the Jet Stream Cirrus (Cloud) Research Project.
- 1965** - (Feb 15) the HICAT U-2 (#56-6722) conducts its first clear air turbulence research flights.
- 1964** - (Oct 14) AFCRL U-2 flies over hurricane Isbell, and with specialized Ozone instruments, conducts Ozone measurements and cloud photography over the hurricane's eye.
- 1967** - (Sept 21) the HICAT U-2 flies over and around the eye of hurricane Beulah. Equipped with specialized thermal instruments, the aircraft conducts hurricane surveillance and high-altitude aerial photography of the hurricane's eye, as it makes landfall in southern Texas.
- 1968** - (Feb) the U-2 flown HICAT Project comes to an end.
- (June) Air Force and AFCRL U-2 scientific research flights come to an end.
- 1971** - (April) NASA gets approval for the use of U-2 spy planes for scientific research.
- (June 3-4) NASA receives two ex-CIA U-2C aircraft (#6681 / N708NA and #6682 / N709NA) for high-altitude research.
- 1974** - (Aug 1) CIA's U-2 manned reconnaissance operations come to an end, with the advent of improved satellite coverage. All CIA U-2 aircraft, equipment, and logistical support parts are transferred directly to the U.S. Air Force.
- 1981** - (May 11) NASA receives its first of three ER-2 (N706NA) aircraft to replace older U-2C aircraft. The ER-2 is based upon the improved TR-1A, which was later converted to and re-designated U-2S model.

A U-2 aircraft, participating in the AFCRL Ozone Research Project, flew into hurricane Ginny (1963) and over Hurricane Isbell (1964). (USAF photo.)



ON OCTOBER 22, 1963, THE AFCRL OZONE U-2 FLEW UP AND OVER THE TOP OF HURRICANE GINNY AND DOWN INTO ITS EYE TO MAKE OZONE MEASUREMENTS

tops of tropical cyclones, except the U-2.

Beginning in early 1960, the AFCRL made available a U-2 to the Weather Bureau's HRP and its component Project Stormfury, an experimental hurricane modification project, providing high-altitude photographs and meteorological data in the troposphere region over the hurricanes. Storms flown by the AFCRL U-2 included hurricanes Donna (1960), Carla and Esther (1961), Flora and Beulah (1963), Ginny and Isbell (1964), Betsy (1965), and Beulah (1967), to name just a few. Although these U-2 hurricane flights were flown in direct support to hurricane research, several other of these U-2 flights were carried out in association with other research projects not directly related to hurricane research.

Also, between 1962 and 1966, AFCRL research U-2 aircraft were utilized in a high-altitude Ozone Research Project to sample and measure ozone concentrations in the upper atmosphere. As part of this project, a specially equipped U-2 aircraft probed the eye of hurricane Ginny to take the first ever ozone measurements in a tropical cyclone.

On October 22, 1963, the AFCRL Ozone U-2 flew up and over the top of Hurricane Ginny and down into its eye to make Ozone measurements. The aircraft also captured horizontal thermal (temperature) structure measurements and 180-degree panoramic cloud photographs for the Weather Bureau.

A similar ozone sampling, thermal measuring, and cloud photo reconnaissance mission was flown about a year later into hurricane Isbell. The AFCRL U-2 penetrated into the upper region of hurricane Isbell at approximately 55,000 feet - as the storm was off the coast of Florida, near Key

West. The flight plan included a vertical probe of Isbell's eye, similar to Ginny, but was terminated early before a deeper probe of the eye was made, due to a thick layer of dense cirrus-like clouds in the eye's center and increasing turbulence at various flight levels around the storm.

Another U-2 hurricane flight was conducted during hurricane Beulah in September 1967. This research flight was conducted in association with the Flight Dynamics Laboratory, of the Air Force's Systems Command.

The High-altitude Clear Air Turbulence (HICAT) Project (1964-68); was established to provide fine scale, true wind gust, velocity measurements in continuous wave length, clear air turbulence at altitudes between 45,000 and 70,000 feet—as correlated with meteorological and geophysical conditions. This project introduced the U-2 aircraft into another existing Air Force Clear Air Turbulence (CAT) program to scan various areas of the world for clear air turbulence. Operating from U.S. Air Force and allied air bases around the world, the HICAT U-2 flew missions from the U.S., eastern Canada, Alaska, Hawaii, Australia, New Zealand, Puerto Rico, Panama, France, and the UK.

One of the Edwards AFB Flight Test Center's upgraded U-2Ds (aircraft #56-6722) was modified with a specialized nose-mounted, fixed vane, gust probe and a Rosemont Lozeal temperature sensor, connected to a digital pulse code modulation recording system. Of the 285 clear air turbulence flights flown between 1962 and 1968, the U-2 flew 232 flights at HICAT altitudes above 65,000 feet.

On September 22, 1967, this HICAT U-2 flew a hurricane surveillance mission into hurricane

Receiving its first U-2 Aircraft in 1971, NASA nearly duplicated every U-2 research project previously conducted by the Air Force research laboratories including; high-altitude micrometeorite collection, severe storms—lightning research, Ozone concentration measurement studies and tropical cyclone research support. (NASA photo.)



BY 1968, THE U.S. AIR FORCE SLOWLY BEGAN TO PRIVATIZE ITS ORGANIC RESEARCH LABORATORIES AND TO DECREASE ITS DIRECT SUPPORT OF SCIENTIFIC RESEARCH WITHIN ITS OPERATIONAL COMMANDS

Beulah to record the stratospheric conditions around and over the storm—including any clear air turbulence within the surrounding environment. As the hurricane made landfall in southern Texas, the HICAT U-2 made several counter-clockwise descending loops around the top of hurricane Beulah's eye, from 65,000 feet down through 55,000 to 45,000 feet or to the tops of the hurricane's eye wall clouds. The U-2 took detailed temperature, wind, and air motion measurements throughout the flight.

NASA U-2 Aircraft

By 1968, the U.S. Air Force slowly began to privatize its organic research laboratories and to decrease its direct support of scientific research within its operational commands. It was at this point that NASA, cognizant of the capabilities and contributions that the early Air Force research U-2 provided over the years, lobbied the U.S. government for the acquisition of its own U-2 research aircraft to carry on similar research. In 1971, NASA was granted authorization to operate U-2 aircraft for scientific research purposes. On June 3 and 4, 1971, NASA's Ames Research Facility received two ex-CIA U-2C aircraft on permanent loan from the U.S. Air Force, as high-altitude scientific research aircraft.

Fifteen years after it said that it was the U-2 aircraft program manager, and would be operating these new U-2 aircraft as scientific research tools, NASA finally received U-2 aircraft for that very purpose. ■

Bibliographical Source Notes

The bibliographical sources for the U-2 article, comprise those collected during the research effort towards the author's current book project on hurricane reconnaissance and research aircraft. The U-2 information was derived from numerous scientific technical articles, papers and reports issued by several U.S. government agencies, the U.S. Air Force, and professional meteorological technical journals and publications, including:

American Meteorological Society (Publications)
Journal of Applied Meteorology
Monthly Weather Review
Bulletin of the American Meteorological Society
NASA technical reports; on Clear Air Turbulence (CAT Project)
U.S. Air Force Cambridge Research Laboratory (AFCRL) technical reports;
High-Altitude Clear Air Turbulence (HICAT Project)
Project Jet Stream
Ozone Project
U.S. Air Force Geophysical Research Directorate; "A 50 Year Anniversary Retrospective"
CIA Historical Document; "The CIA and the U-2 Program 1954-74"
U.S. Defense Threat Reduction Agency (Defense Nuclear Agency) historical Series (1947-1997)
And a couple of science articles found in scientific publications such as *Discovery Magazine* and *Natural History*.