Appendix 1
Internet links

This appendix takes the place of a list of references. These Internet links will take you to websites that discuss the subjects covered in this book. The links are broken down into categories and then listed in alphabetical order. They can be used to gather even more information about the subjects included; for example, if you want to know more about the meteorological science behind the Perlan Project's decision to fly out of Argentina for their sailplane altitude record attempts, you can go to their website.

COMPANIES

Air-Lock Inc. (Pressure suit connectors)
www.airlockinc.com

ATA Aerospace (Red Bull Stratos balloon launch and recovery)
www.ata-aerospace.com

Buran-Energia (Volga gondola)
www.Buran-Energia.com

David Clark Company (Pressure Suits including Stratos suit)
www.davidclark.com

Lockheed-Martin (U-2, A-12, M-21, SR-71)
http://www.lockheedmartin.com/us/aeronautics/skunkworks.html

Mountain High (Perlan Project oxygen systems)
www.mhoxygen.com

Micropore (Perlan Project CO_2 scrubbers)
www.extendair.com

M. von Ehrenfried, *Stratonauts: Pioneers Venturing into the Stratosphere*, Springer Praxis Books,
DOI 10.1007/978-3-319-02901-6, © Springer International Publishing Switzerland 2014

Perlan Project 501(c)(3) (Perlan Project Sailplane record attempts)
www.perlanproject.com
Please make donations to: EWarnock@PerlanProject.com

Red Bull Stratos (Felix Baumgartner flight)
www.redbullstratos.com

Sage Cheshire Aerospace (Red Bull Stratos capsule)
http://sagecheshire.com

Titan Dive Gear (Perlan Project oxygen rebreather)
www.titandivegear.com

Windward Performance Ltd. (Perlan Project Perlan II sailplane system)
www.windward-performce.com

Weather Extreme Ltd. (Perlan Project weather analysis)
www.weatherextreme.com

PILOT ORGANIZATIONS

www.blackbirds.net

Black Cat Squadron (ROC U-2 pilots and history)
http://www.hmhfp.info/sg_09e.html (can access through Roadrunners)
http://www.hmhfp.info/sph/u2_china.html
http://www.taiwanairpower.org

Order of the Daedalians (High altitude crews)
http://www.daedalians.org

The Habu Organization (For data and links on the Blackbirds)
www.habu.org

Jet Pilot Overseas
www.jetpilotoverseas.wordpress.com

Road Runners Internationale
(For data on the U-2, A-12, YF-12 and pilots during the Cold War)
www.roadrunnersinternationale.com

Soaring Society of America (Perlan Project)
www.ssa.org

The U-2 Dragon Lady Association
www.u2dla.org

U.S. Parachute Association
www.uspa.org

MILITARY

Beale AFB, CA. (U-2C and SR-71A)
www.beale.af.mil/index.asp

Davis-Monthan AFB, AZ (U-2C)
www.pimaair.org
www.dm.af.mil

Edwards AFB, CA (SR-71A)
www.edwards.af.mil

Society of Experimental Test Pilots
www.setp.org

USAF Test Pilot School
www.edwards.af.mil/library

GENERAL RESEARCH

Aerospace Medical Association
www.asma.org

American Institute of Aeronautics and Astronautics
http://www.aiaa.org

American Meteorological Society
www.ametsoc.org

Commercial Space flight Federation
www.comercialspaceflight.org

General search engines
www.bing.com
www.google.com

Facility for Airborne Atmospheric Measurements
www.FAAM.ac.uk

Fédération Aéronautique Internationale
http://www.fai.org

International civil Aviation Organization (ICAO)
www.icao.int/pages/default.aspx

National Aerospace Training Center
www.nastarcenter.com

The Space Review
www.thespacereview.com

Wikipedia (Please make a donation when you visit this site)
http://en.wikipedia.org/wiki/main_page

Stratocat/Stratopedia (Stratospheric balloons)
www.stratocat.com.ar/indexe.html

GOVERNMENT AGENCIES

CIA

http://www.cia.gov

CIA Library (Publications, reports, declassified info, A-12, museum)
http://www.cia.gov/library/index.html

Area 51
www.area51specialprojects.com

NASA

Ames Research Center (U-2C)
http://nasa.gov/centers/ames/home/index.html

Dryden Flight Research Center (U-2 and Experimental Aircraft)
www.nasa.gov/centers/dryden/home/index.html

Goddard Flight Research Center Library Repository of Balloon Technology
http://gsfcir.gsfc.nasa.gov/balloontech

Lyndon B. Johnson Space Center, Houston, TX (Various aircraft projects)
www.nasa.gov/centers/johnson/home/index.html

WB-57F
http://jsc-aircraft-ops.jsc.nasa.gov/wb57/contact.html

Langley Research Center, Hampton, VA (Aerodynamics, prototypes, testing)
www.nasa.gov/centers/langley/home/index.html

MUSEUMS

Armstrong Air and Space Museum
www.armstrongmuseum.org

Aviation Museums search site
http://www.aero-web.org (Search hundreds of museums by State)

Air Force Armament Museum (SR-71A)
www.afarmamentmuseum.com

Air Force Test Center (A-12) (Formerly the Air Force Flight Test Center)
www.edwards.af.mil

Blackbird Air Park (A-12) (Nearby the Air Force Test Center)
www.afftcmuseum.org

California Science Center (A-12)
www.californiasciencecenter.org

Castle Air Museum (SR-71A)
www.castleairmuseum.org

Cold War Museum (From the Berlin Airlift, to the Cuban Missile Crisis)
http://www.coldwar.org

Imperial War Museum/Duxford Museum, England (U-2C & SR-71A)
www.iwm.org.uk/visits/iwm-duxford

Intrepid Sea-Air-Space Museum New York City (A-12 and others)
http://intrepidmuseum.org

Kalamazoo Air Zoo, MI (SR-71 and others)
http://www.airzoo.org

Kansas Cosmosphere and Space Center, KS (SR-71A and others)
www.cosmo.org

March Field Air Museum, CA (SR-71A and others)
www.marchfield.org

Maryland Aviation Museum (Martin B-57)
www.marylandaviationmuseum.org

Museum of Aviation (Warner Robbins AFB-SR-71A)
http://www.museumofaviation.org

Museum of Flight, Seattle, WA (M-21 and others)
www.museumofflight.org

National Air and Space Museum, Washington, DC (U-2C)
http://www.nationalairandspacemuseum.org

National Atomic Testing Museum (Area 51 lectures)
www.nationalatomictestingmuseum.org

National Museum of the U.S. Air Force (U-2A, SR-71A and YF-12A)
www.nationalmuseum.af.mil

Nevada Aerospace Hall of Fame (Info on people and projects at Area 51)
http://nvahof.org

Norwegian Air Museum, Bodo, Norway (U-2C)
www.avinor.no/en/airport/bodo

Otto Lilienthal Museum
http://www.lilienthat-museum.de/olma/ebarchi.htm

Pima Air Museum, AZ (SR-71A)
www.pimaair.org

San Diego Aerospace Museum Balboa Park, San Diego, CA
http://www.sandiegoairandspace.org

Steven F. Udvar-Hazy Center, Dulles A/P VA (SR-71A, Concorde, others)
www.airandspace.si.edu/visit/udvar-hazy-center/

Southern Museum of Flight, AL (A-12)
www.southernmuseumofflight.org

Strategic Air & Space (SAC) Museum, (U-2C, SR-71 and others)
www.sasmuseum.com

Air Force Historical Research Agency (Hundreds of photos)
www.afhra.af.mil

USS Alabama, AL (A-12)
www.ussalabama.com/aircraft.php

U.S. Space & Rocket Center (A-12)
www.ussrc.com

National Museum of the U.S. Air Force (U-2A, SR-71A and YF-12A)
www.nationalmuseum.af.mil

Virginia Aviation Museum, VA (SR-71A)
www.vam.smv.org

Appendix 2
Feeding stratonauts

Liquids and special foods are required to keep crews flying long duration missions in full pressure suits at their peak of performance in stressful situations. This appendix describes the difficulty of eating in a full pressure suit and how this problem has been solved.

What do you eat when you get hungry during a long mission at high altitude? Do you open your helmet visor and take out a ham sandwich and pop open a beer? I don't think so! If the cabin decompresses while you have your visor open, they'll find your body with a piece of ham stuck in your grimacing teeth. In the early days, the helmet was equipped with a tube to accommodate a plastic straw for liquids. In the late 1960s and 1970s I would take perhaps just one small bottle of water or tomato juice and squeeze it through my helmet port. Never would I even consider opening my visor. The longest mission I flew was 7 hours 30 minutes. Some U-2 pilots have gone 12 hours, but that is unusual. You can urinate in a modern pressure suit, but you had better also be hydrating and getting some nourishment in order to function at your peak performance.

This problem was solved by the Department of Defense Combat Feeding Directorate (CFD) at the Natick Soldier Research, Development and Engineering Center located in Natick, MA. While this Army group has been involved with feeding soldiers for years, they have also been feeding pilots for decades. Currently they prepare food for about 100 pilots, which results in making about 28,000 tubes per year. This food has a shelf life of about 3 years.

Until 2010 the CFD had no direct communication with the pilots, but that problem was solved by food technologist Dan Nattress and chef and physical science technician Deborah Haley (**Fig. A.2.1**) paying a visit to Beale AFB. In addition, some pilots have visited the CFD directly and had the menu changed for the better.

The current menu has about 15 items, including the following relatively new dishes: Peach Melba, beef stroganoff, key lime pie, bacon and hash browns, and chicken tortilla soup. There is also a variety of juices and puddings, some with caffeine to provide an additional boost. All of these dishes must fit into a metal tube similar to a tooth paste tube, as shown in **Fig. A.2.2.** Pilots eat about one tube per hour.

M. von Ehrenfried, *Stratonauts: Pioneers Venturing into the Stratosphere*, Springer Praxis Books,
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Fig. A.2.1 Dan Nattress and Deborah Haley at the CFD kitchen. Photo courtesy of the Department of Defense CFD at Natick, MA.

Fig. A.2.2 The special metal tube that holds the food for the pilot. Photo courtesy of the Combat Feeding Directorate at Natick, MA.

Fig. A.2.3 Air Force S/Sgt. Suzzett Stalesky, 9th Physiological Support Squadron, demonstrates the use of the food tube. Photo courtesy of USAF and photographer Airman 1st Class Drew Buchanan.

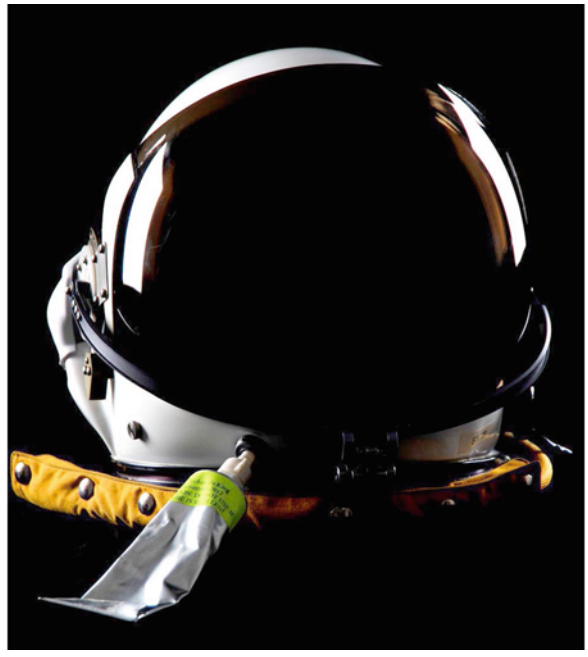

Fig. A.2.4 This shows a typical helmet port to accept the food tube. The pilot moves his mouth over to the plastic tube and squeezes. Photo courtesy of the DOD Combat Feeding Directorate.

Flying long hours in a tense and often challenging environment in a very tight and rather claustrophobic cockpit, sometimes in the dark, and on 100% oxygen, takes its toll on a crew. Having something to eat and drink really takes the edge off. Many thanks to the people who care for the health and well-being of the pilots.

Appendix 3
Area 51

There is so much false information about Area 51 that the place has been turned into legend. This appendix will describe it as a secret test site for the experimental aircraft that have pushed the state of the art and have gone on to provide the country with the intelligence capabilities and assets it needed in very perilous times. It is also a place where the aviation assets of our enemies were exploited and factored into our designs and countermeasures. In particular, it is where the science of stealth was examined and added to our arsenal of capabilities.

WHY IS THERE AN AREA 51?

There is not an area on any map in the world that can conjure up more curiosity and myths than the area called 51. What has caused this? A search for books on the subject will give you a list of everything from aliens to games to some that are factual. There is an entire industry geared around using the number 51 to sell anything from T-shirts to even blow-up dolls. If you believe in aliens, then you are likely to believe some of the sensational stories about Area 51. The curious nature of man will, in some people, lead to conspiracy theorists. People who have little scientific or technical knowledge have a tendency to put information together in a manner that will support their inherent beliefs. There is not a lot of scientific method to their madness. This has been true for millennia, and will probably remain so for millennia to come.

Now, in the digital age, information saturates our world. The term "TMI" comes to mind. During the Cold War this was not the case, and any tidbit of information could be coupled with other information to obtain different conclusions. The need for secrecy is real. The "art of war" and its history clearly tell us that the enemy will go to extremes to gather and utilize information against its adversary. To this day, military men still study Sun Tzu, who wrote on this subject 2,500 years ago. This is just as true today as it was in the truly scary 1950s.

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DOI 10.1007/978-3-319-02901-6,

After World War II, all the super powers wanted the atomic bomb and a means to deliver it. President Eisenhower was very concerned about the Russians, who had their own bombs and were working on new aircraft to deliver them. While we got Wernher von Braun (whom I once briefed for Apollo 7) and many of his team of scientists and engineers, the Russians got their hands on a lot of German scientists for their programs. They detonated their first atomic bomb on August 29, 1949 and their hydrogen bomb on August 12, 1953.

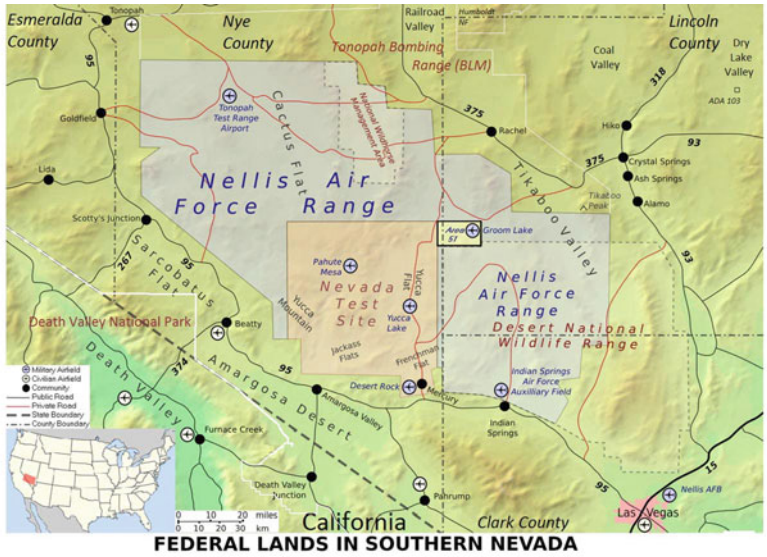
It was the desire to know what our former ally (but now new enemy) was doing that spawned the need for a means of finding out just how far had they advanced. This led to the concept of a high altitude aircraft that could conduct reconnaissance well inside the Soviet Union and fly higher than their interceptors. Of course, you need a new aircraft and a secret place to test it. This is the fundamental reason that the place called Area 51 came to be. And it was the degree of secrecy around the whole project that eventually prompted the curiosity of those not in the knowledge loop. Keep in mind that there were many Soviet spies in the U.S. during this period. Julius and Ethel Rosenberg and Klaus Fuchs were just the most well-known. There were many more. There still are. All kinds of secrets were being passed to the Soviets during this period involving atomic secrets, aviation secrets, weapons secrets; hell, you name it. When the government realized the extent of this spying, it is no wonder that they imposed such a degree of secrecy on the new aircraft and systems that were being sent for testing at Area 51.

It was only logical that the CIA would head up this new project. It seems that when the CIA passed off the programs to the Air Force in 1979 (a quarter of a century after the first program was conceived) the classification process became rather distorted. This may well have contributed to the myths and conspiracies that exist to this day.

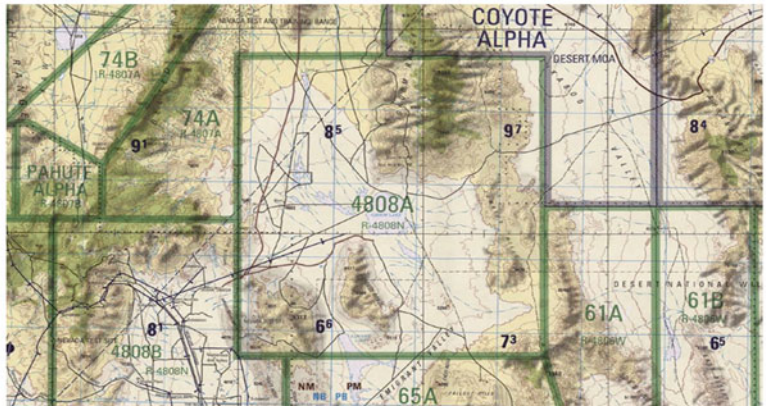
WHAT GOES ON THERE?

For this book about stratonauts, I went to the pilots who flew experimental aircraft to extreme heights out of Area 51. They are leaving this world pretty fast. Fortunately, the Roadrunners Internationale Associates website www.roadrunnersinternationale.com documents many of their fascinating stories. I also went to some recently declassified articles. Much of what went on at Groom Lake is now history, and is available to the public. The following lists some significant dates from the Roadrunners Internationale website and other sources, and clearly identifies what has gone on at Area 51 (shown in **Fig. A.3.1**) as well as the associated restricted air space (**Fig. A.3.2**). The people that worked at Area 51 know what really went on there. This includes not only the pilots, but the contractors, technicians, and support personnel. It seems clear that there was public knowledge of the site for at least the last half century. It also seems clear that the more the government tried to make something secret, the more the facts were distorted. There is clearly a time to declassify, but this must be balanced to the threat.

Today the threat is much different and even more sophisticated. The new digital age has created the cyber war, a war which has many players and many battlefields. Russia is still a player of course, as are the Chinese, the Iranians and the terrorists who reside in many



FEDERAL LANDS IN SOUTHERN NEVADA



Figs. A.3.1 and A.3.2 (top) On this map Area 51 is the small yellow box near the Nevada Test Site and Nellis AFB areas. Las Vegas is in the lower right, and (bottom) the FAA restricted area 4808N is centered on Groom Lake. Photos courtesy of Wikimedia Commons.

countries. The world is not safer, it's more complex and the battlefields are other people's computers. With the power of computers today, entire systems are potentially at risk. In the good old days of the Cold War you might worry about a secret subsystem being stolen or compromised. Today an entire system can be stolen or compromised overnight.

The following significant dates in the history of Area 51 are offered to show you just what happened there and when. It is apparent that knowledge of Area 51 has been in the public domain for a long time.

December 9, 1954	The Killian Committee of President Eisenhower's Scientific Advisor Group gives the go-ahead for Project CL-282 "Angel." Kelly Johnson starts work.
April 1955	Lockheed's Kelly Johnson, Chief Pilot Tony LeVier, CIA program director Russell Bissell, and Air Force liaison Col. "Ozzie" Ritland check out the areas around Nellis Auxiliary Field No. 1 near Groom Lake area for Project AQUATONE.
May 4, 1955	First survey for a new runway for the U-2 at the site.
May 18, 1955	An Atomic Energy Agency (AEC) press release is issued to 18 media outlets in Nevada and Utah announcing the establishment of a small Nevada Test Site installation that became Area 51.
July 24, 1955	First U-2 arrives from the Lockheed plant to Area 51.
August 1, 1955	First U-2 flight.
October 17, 1955	AEC's Col. Alfred Starbird releases a statement to the Las Vegas *Review-Journal* that the construction of the previously announced site was continuing by REECo and was expected to be complete in 1956.
May 7, 1956	NACA Director Hugh Dryden issued a press release announcing the U-2 program with the Air Force to conduct high altitude weather research at the Watertown Strip, Nevada.
November 17, 1956	A C-54M transporting AQUATONE personnel crashes killing all 14 aboard. Press releases link the secret project to the Groom Lake site and the Watertown Airstrip.
May 1, 1957	AEC releases an information booklet again related the U-2 flight to Watertown and Groom Lake.
June 1957	U-2 operations move to Edwards AFB. Operational U-2s move to Laughlin AFB, Texas.
June 18, 1957	Nuclear fallout from AEC Nevada Test Site hits Watertown.
July 28, 1957	An employee of Douglas Aircraft Company makes an emergency landing at the Watertown Air Strip. Another press release relates to the site.
August, 1957	NACA releases press reports about a year's worth of U-2 flights from the Watertown base.
June 20, 1958	Public Land Order 1662 removed 38,400 acres from public access and mentions Area 51 and the Watertown base.
September 10, 1959	EG&G moves its Radar Cross Section facility to the site.
November 17, 1959	AEC spokesman makes a public call for sheet metal workers at the Groom Lake Area 51 Nevada Test Site.
January 15, 1960	An unclassified Nevada Test Site bulletin publishes a telephone directory for Area 51 workers.
October 1, 1960	REECo begins construction of the A-12 facilities.
January, 1961	Unclassified Nevada Test Site road maps clearly identify Area 51.
August 1961	Essential facilities completed, but other construction continues. An unclassified newsletter published by REECo announces that "Area 51 Wins Slow-Pitch tournament" and lists some members by name.
January 1962	FAA expands restricted air space R-4808N.
April 25, 1962	First unofficial A-12 flight by Lockheed pilot Louis Schalk.
August 7, 1963	First YF-12A flight by Lockheed pilot Jim Eastham.
December 22, 1964	First launch of the M-21/D-21(drone captive, not launched).

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March 5, 1966	First launch of the D-21 drone from the M-21.
1968	First MiG-21 evaluated. Testing went on for decades; evaluated foreign aircraft and Soviet radar tracking and missile control radars.
May, 1971	Air Force Headquarters officials are still trying to deny the existence of Area 51.
November, 1977	First HAVE BLUE aircraft Article 1001 arrives at the site.
December 1, 1977	First flight of Article 1001 was monitored by the White House Situation Room.
1979	CIA transfers control of the site to the Air Force Flight Test Center (AFFTC) at Edwards AFB. The area is now called Detachment 3, AFFTC.
January 17, 1981	First YF-117A delivered.
June 18, 1981	First YF-117A flight.
February 5, 1982	First flight of the TACIT BLUE technology demonstrator for low-observable surveillance aircraft. Nicknamed the "Schamu" because of its whale-like characteristics.
April 26, 1984	Lt. Gen. Robert M. Bond is killed flying a MiG-23; part of the testing of foreign aircraft at Groom Lake. This was reported in the press as part of Area 51.
September 29, 1992	President Clinton exempts the Air Force from disclosing classified information regarding Groom Lake. This affectively recognized Groom Lake as a secret facility.
September 11, 1996	First flight of the Boeing "Bird of Prey" technology demonstrator for low-observable aircraft design; program concluded in 1999.

For further information try reading "My Odyssey to Area 51" by Thornton D. Barnes and "Images of Aviation: Area 51" by Peter W. Merlin. For information on current projects see www.roadrunnersinternationale.com, www.area51specialprojects.com or www.dreamlandresort.com. However, when looking for books be aware that there are many science fiction as well as other sensational books that use Area 51 in their titles.

"YOU CAN'T GET THERE FROM HERE"

If the secret aircraft were built at the Lockheed Skunk Works in Burbank, CA., how did they get to Area 51 in Nevada several hundred miles away? Would you believe that this was also secret! A-12 pilot and Roadrunners Internationale historian Frank Murray has penned the story of how they transported the A-12. You can read the full story on their website; here is a shortened version.

Thanks to former Lockheed Manager, Dorsey G. Kammerer, this story has not only been told, there are also great once-secret photos on the website. Once there, click on "War Stories" and you see the full article including the photos at the bottom of the third column.

The planning to transfer the first A-12 to Area 51 began in 1959. This was no minor effort. It necessitated determining the routes, clearing them of obstacles, constructing the

carriage system, dovetailing the manufacturing of it with the Skunk Works aircraft manufacturing schedules, acquiring and modifying the transport vehicles, and of course coordinating with the California State Police. This activity went on until the transport system was ready to move the first aircraft on February 26, 1962.

The A-12 was disassembled into pieces that could be carried in two large boxes that would fit on the trailers. The largest was 35 feet wide and 105 feet long, far beyond the typical "wide load." The tractor that carried it required steerable tail wheels. It would carry the main part of the airplane on its landing gear, tail first, in the 35 foot wide box. The smaller box was 22 feet wide by 60 feet long and carried the outer wing/nacelles, rudders, forward fuselage section, and various bits and pieces. The route for this large secret load still had to be cleared of obstacles, including some earth, trees, and signage. All of this was coordinated well in advance with the police. The detailed trip plan is also on the website, which goes into such detail as to include where and when to make lunch and potty stops. Some stop-over areas were prepared for their arrival. The convoy included about a dozen vehicles. The trip took 3 days, arriving at Area 51 at the end of February.

Once the aircraft reached its hanger, work began to disassemble the carriage system and packaging, and that was returned to Burbank for the next trip. Then the Lockheed crews worked around the clock to assemble the aircraft, check out its systems, perform engine runs, and conduct taxi tests. Lockheed Test Pilot Lou Schalk made the first test flight on April 26, 1962. This process was repeated many times as each aircraft rolled off the production line.

BASE OPERATIONS AND SUPPORT CONTRACTORS

The Air Force 1129th Special Activities Squadron ran the base on behalf of the CIA projects. Other Air Force squadrons provided the aircraft refueling support. The flights out of Area 51 were supported by many contractors, including the following:

Major Contractors

Reynolds Electric & Engineering Co.
Base construction

Lockheed Aircraft (codename C&J Engineering)
Aircraft, assembly and checkout

EG&G (code name Special Projects)
Prime contractor

Pratt & Whitney (codename American Can Company)
Engines and maintenance

Other Supporting Contractors (alphabetical order)

Applied Technology Inc.
Big Blast, a barrage noise jammer for Chinese tracking radar

Baird Electronics (codename The Boyd Company)
Navigational aids

Collins
Radios and navigation systems

David Clark Company
Pressure suits

Firewel Corp.
Oxygen regulators and supply systems

General Precision
Doppler Radar navigation

HYCON
Technical Objective Camera

Kodak
Film and processing

Magnavox Research Labs (codename Vose Company)
ARC 50 radios

Minneapolis Honeywell
Aircraft systems

Perkin Elmer (codename United Aircraft Co.)
Camera system

Sylvania (Electronic Defense Labs)
Sensors and Missile Jammers

TRW
ELINT Analog Receiver and Recorder

Westinghouse
Chinese Radar Tracking-Threat Warning System

AREA 51 CODE NAMES

Secret projects have secret names. The projects at Area 51 were numerous and so there were many codenames; there still are. Thornton D. "TD" Barnes from the Roadrunners Internationale Association has summarized the declassified ones and they are included in this Appendix (with his permission) because they are relevant to all the stratospheric flights that occurred here.

There is a history and protocol for codenames. This differs between the CIA and the USAF, and other services and government agencies. Some protocols for selecting the codenames are handed down from World War II and others are handed down within a given agency or military organization. Some are just part of the security classification culture and that varies

between agencies. Some are made up on the spur of the moment and some are named by individual commanders. In the case of the programs flown out of Area 51 they are predominately CIA and USAF names. The following lists those that have been declassified.

CIA Codenames

CIA	Nicknamed The customer, The Agency, and The Company.
Area 51	The CIA never had a codename for Area 51 or the facility/base.
U-2 project	AQUATONE.
CIA Security Office	An office was set up near the Los Angeles airport named the Western Industrial Liaison Detachment (WILD).
U-2 aircraft	Angel (nicknames include the Dragon Lady and the Deuce).
A-12	OXCART (ironically, this is one of the slowest animals for the world's fastest aircraft). For this reason, some preferred the name Cygnus; Latin for swan.
Pilots	Each had a "Dutch" number; e.g. CIA pilot Frank Murray was "Dutch 20" while flying, but used Alex P. Vanuatuans otherwise. Ken Collins was "Dutch 21." CIA pilot Jack Layton was "Dutch 27" while flying the A-12 but "Dutch 72" flying the YF-12A. At other times he was Jack Dickhurst. The same was true for all the others.

USAF Codenames and nicknames

	This includes the various squadrons; e.g. 4070 Special Activities Squadron (SAS) and the 1129 SAS and the Air Force Flight Test Center at Edwards AFB.
Area 51	The nickname for Area 51 was once DREAMLAND. It is purportedly from an Edgar Allan Poe poem which describes lakes (i.e. Groom Lake) lone and dead and the separation between fantasy and reality. There certainly has been a lot of fantasy about Area 51. Here are some other nicknames: • Pilots called it "The Box" and "The Container." Flight maps call it "Homey." • USAF and FAA designation; R4808N (for the 24 square mile area). • Later, when the MiGs were there, it was called "Red Square" by the Nellis AFB pilots. • Although Groom Lake is part of the area, many people who worked there would call it just that. Other original nicknames were: Out at the Range, Elsewhere, St. Elsewhere, Nowhere, The Test Site, or just The Site. • Security would often refer to it as "Home Plate" or "C-Base." • The initial mailing address was Pittman Station, Henderson, Nevada.
Development projects	The first code word for an Air Force project that was to develop a concept or a prototype but not a production article, had the word HAVE as its first word; e.g. HAVE BLUE was the development aircraft for what eventually became the F-117. Its nickname was "Wobbly Goblin." The YF-117D was called TACIT BLUE and nicknamed "Shamu" and the "Whale."

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Production projects	The first code word for an Air Force project intended to go into production would have the word SENIOR (sometimes in lower case, Senior). For example, SENIOR TREND would be the code word for the F-117.
Exploitation projects	This involved evaluation of Soviet aircraft, and these also had the first word HAVE.
MiG- 21	HAVE DOUGHNUT.
MiG-17	HAVE DRILL and HAVE FERRY.
Aggressors	Air Force squadrons flying MiG-17s, MiG-21s and MiG-23s had various codenames including CONSTANT PEG. They served as the Bandits and called themselves Red Hats and Red Eagles.
YF-12A	KEDLOCK.
M-21	Modified A-12 to carry the D-21 drone (M for mother).
D-21	The drone (D for daughter).
SR-71	SENIOR CROWN (nicknames; SR, Lady in Black, Sled, Habu, Blackbird).

Lockheed nicknames

Area 51	"Paradise Ranch" or just "The Ranch."
Any aircraft	"Article" then its number.

Personal nicknames

CIA Site Manager	German born Werner Weiss was known as the "Desert Fox."
CIA Operations Officer	John "Hank" Meierdierck used the name Rufus Gelzaines.
CIA Special Ops Officer	McKinsey was probably a nickname for a person unknown.
USAF OXCART	Col. Hugh Slater used "Dutch 11" when flying, but the name
Detachment Cdr.	Harold Charles Straffin.
Radar/ECM	Thornton D "TD" Barnes codename was "Thunder."
Roadrunner	Deputy Commander Col. Maynard "AM" Amundson formed a closed social association called Roadrunners Internationale. This was based upon the 1129th Squadron, identifying themselves as Roadrunners. Membership grew to include anyone affiliated with the OXCART project. This included CIA personnel, contractors, YF-12A, D-21, and associated personnel. Thornton TD Barnes is the current President. For more information go to their website at www.roadrunnersinternationale.com.

Appendix 4
Interesting trivia

While doing the research for this book, I uncovered what I thought were some very interesting stories and trivia; many having to do with being the first to do this or that. Some have nothing to do with being the first; just interesting stories about the people who made things happen. Some have to do with the equipment used by the stratonauts or about their aircraft. These are tidbits that few people know about. Here they are for your next game of aviation "Trivial Pursuits."

AGE

As you get older and look about you, you just can't believe that today's young people can accomplish anything, let alone be responsible for a major project. But they have and they always will. Here are examples of the generation of youngsters that either became stratonauts or supported their efforts.

Kelly Johnson led the design effort of the P-38 at age 29, then went on to design the P-80, F-104, U-2, A-12, M-21, SR-71, and others.

NACA engineer Walter C. Williams became head of the X program at Muroc Army Field (now the NASA Dryden Flight Research Center) at age 26.

Chuck Yeager broke the sound barrier at age 24.

The average age of the flight controllers in NASA's Mercury Control Center at Cape Canaveral, FL, in 1962 was 27; I was 25 when I joined NASA. Many of the astronauts were stratonauts before they came to the space program. Many of them served as Flight Controllers before they made a space flight.

Gene Kranz ("White Flight" of Apollo 13 fame) flew F-86s in Korea at age 23 and joined the NASA Space Task Group at age 27.

Joe Kittinger made his first high altitude flight on Manhigh I at 29 years of age.

Clifton McClure made his flight on Manhigh III at 26 years of age.

Neil Armstrong flew F9F Panthers in Korea at age 21, flew the Bell X-1 at age 27, and had more aircraft incidents than most people know about; including hitting a pole and ripping

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3 feet of wing off his plane (while airborne), ejecting twice, and a few other interesting events. He flew the X-15 at age 32 but did not achieve astronaut status; his first space mission was Gemini 8 in 1966. He was 38 when he became the first man to walk on the moon.

WOMEN

The first women to take to the air were the Marchioness and Countess of Montalembert, the Countess of Podenas, and Miss de Lagard in a tethered balloon in Paris on May 20, 1784; a mere 6 months after the first untethered flight by de Pozier and D'Allandes. The first woman to fly in an untethered balloon was the opera singer Elizabeth Thible, who flew over Lyon, France on June 4, 1784. While feeding its fire box she sang two songs, making her the first aeronaut diva! The first woman to parachute from a balloon was Jeanne Genevieve LaBrosse on October 12, 1799; she jumped from an altitude of 2,952 feet.

The first woman to fly a powered aircraft was Rose Isabel Spencer on July 14, 1902 at the Crystal Palace in London, England. There was an advertisement on the side of the airship for "Mellin's Food." The first women to solo in a balloon, believed to be Sophie Blanchard, was also the first to lose her life flying; albeit some years later. She died on July 6, 1819 when her hydrogen balloon caught fire and crashed. The first woman to die in a powered aircraft was Denise Moore on July 21, 1911. Sadly she would not be the last.

The first woman to get a U.S. pilot license was Harriet Quimby in 1911. She went on to become the first to fly across the English Channel on April 16, 1912. She died when her Bleriot monoplane crashed during the Boston Aviation Meet on July 1, 1912. Prior to her short aviation career she was a successful journalist and playwright.

The first known woman to be a military pilot was Russian pilot Eugenie Mikailovna Shakhovskaya who was ordered into military service on November 19, 1914 to fly as a reconnaissance pilot. The first woman test pilot and the first to fly a jet was the German Hanna Reitsch.

The first women stratonaut was Jeannette Piccard, who ascended to 57,579 feet on October 23 1934. This record lasted 29 years until Valentina Tereshova was launched into space on June 16, 1963. The first woman to fly in an SR-71 was NASA engineer Marta Bohn-Meyer in October, 1991.

"Behind every great man there is a great woman," or so the saying goes. Well there certainly was a great woman behind all the activities at Area 51 from 1965 to 1996; a period of 31 years. That woman was Denise (Rodreick) Haen; wife of David Haen, who also worked there. She started out as a secretary with EG&G and over the decades held various jobs such as Security Officer, Safety Manager, Human Resources Manager and, finally, Director of Administration for Special Projects; the first woman with that title. You can imagine how much she knows!

While not stratonauts, the aviation world had some great women pilots including Amelia Earhart, Jacqueline Cochran, and Louise Thaden. Louise's daughter Patricia Thaden Webb once helped me put fabric on my biplane. Jacqueline Cochran set many records, including being the first woman to exceed Mach 1 and Mach 2, and making a blind instrument landing. She was also a President of the FAI. She was a proponent of women astronauts but was repeatedly refused. Now there are many women astronauts; she was just decades before her time.

PRISONERS OF WAR

Max Cosyns flew with Auguste Piccard in the early 1930s. During World War II he was a member of the resistance against the Germans, but was caught and imprisoned in the Dachau concentration camp until the war's end.

Hervey Stockman, the first man to fly a U-2 over the Soviet Union was shot down in Vietnam and spent almost 6 years in the Hoa Loi prison nicknamed the "Hanoi Hilton." Joe Kittinger also spent 11 months there after being shot down during his third tour of duty in Vietnam.

U-2 pilot Gary Powers spent 2 years in a Soviet prison before he was traded for a Soviet spy.

Two Republic of China U-2 pilots were shot down and imprisoned in a Communist Chinese prison; Chang-Di "Robin" Yeh for 19 years and Li-Yi Chang for 17 years.

Famed World War II and Korean War pilot Bob Hoover was shot down in 1944 and spent 16 months in the German prison camp Stalag Luft 1. He escaped, stole a Fw-190 fighter, and flew to the Netherlands. After the war he became Chuck Yeager's backup and chase pilot.

HUMAN BODY

Contrary to popular belief, if you were exposed to the outside air at 63,000 feet (the Armstrong Limit) your blood would not boil so long as your heart was beating. This is because your blood pressure prevents that. But the water in your lungs, mouth, and eyes would start to boil. Since you'll still die if you don't get pressurized oxygen, the point is moot.

When you take a breath, you inhale 13 billion trillion oxygen molecules. They force their way into 300,000 air sacs in your lungs, each a mere 1/50,000th of an inch thick. If removed from your lungs and spread out on a flat surface they would cover about half a tennis court. There are approximately 35 trillion red blood cells in the body, each with 250 million hemoglobin molecules. A hemoglobin molecule can carry 4 molecules of oxygen, so each red blood cell can carry approximately 1 billion oxygen molecules.

While high g-turns make the pilot's blood flow to the legs and away from the brain causing blackouts, RAF pilot Douglas Bader had a slight advantage in a dogfight since he had no legs.

ANIMALS

The first animals to fly were in a Montgolfier hot air balloon on September 19, 1783 in a display for the court of King Louis XVI and Marie Antoinette. The king had wanted to put prisoners in the balloon but the Montgolfier brothers decided on a sheep, a duck, and a rooster. The sheep was given the name "Montauciel" but the duck and the rooster remained anonymous.

Jeannette and Jean Piccard carried their pet turtle "Fleur de Lys" with them on their "Century of Progress" balloon flight to 57,579 feet on October 23, 1934. This makes the turtle the first animal stratonaut!

For two years, the CIA required five Air Force K-9 handlers and their dogs to patrol Area 51; they patrolled from dusk to dawn in two shifts.

CERTIFICATION OF RECORDS

There is a stringent verification process to confirm aeronautical records such as the one achieved recently by the Red Bull Stratos team. There are some interesting side stories to this. The governing body is the Fédération Aéronautique Internationale (FAI) but the official observer on site was Brian Utley of the National Aeronautic Association. He was the person responsible for certifying that all requirements for a World Record were satisfied, including analyzing and verifying data captured during Felix Baumgartner's jump and submitting it for confirmation by the FAI. Many new sensors were developed to measure all of the pertinent parameters. The FAI recognized a new category for this mission: Maximum Vertical Speed. While three FAI world records were recognized (as discussed in Chapter 13) there are many more unofficial records that fall outside of the FAI official categories:

First person to break the speed of sound in freefall without a vehicle.
Highest untethered altitude outside a vehicle.
Largest balloon ever flown with a human aboard.
Highest manned balloon ascent.
Fastest overland speed of a manned balloon.

AIRCRAFT

All four variants of the Blackbird required special fuel due to the high temperatures that occur at Mach 3. The engines built by Pratt & Whitney were designated J-58 but were known within the company as the JT11D-20. The fuel designed for this engine was also used in the engine hydraulic system and as a heat sink for other aircraft components and accessories exposed to high temperatures. The fuel had to have a high thermal stability, specific burning qualities, and minimal sulfur impurities. It also had a cesium additive which aided in disguising the radar signature of the exhaust plume. Triethylborane (TEB) was injected into the engine in order to initiate combustion and facilitate afterburner operation in flight. Ground crews filling up the TEB tank wore silver fire suits because the additive was pyrophoric; that is, it would ignite spontaneously upon exposure to air. Because the JP-7 fuel could not be distilled, it had to be specially blended. Even the KC-135 tankers that refueled the Blackbirds had to be modified (Q-model) to carry JP-7 in addition to the JP-4 or JP-8 fuel that the tanker needed. These aircraft and crews had to be pre-positioned for each flight, as all variants were refueled shortly after taking off and often again later in the flight. A typical Blackbird mission consumed 36,000 to 44,000 pounds of fuel/hour. In that hour, the aircraft could fly up to 2,300 miles.

The engine start-cart for the SR-71 had two Buick Wildcat V-8 engines connected to an automatic transmission, with one vertical drive shaft to start the aircraft. It would rev up one of the J-58 engines to about 4,000 r.p.m. to start it. Then the ground crew would move

the cart over to the other engine and then start that. Eventually they received an improved pneumatic system, but the carts were retained for deployments.

The tires on the Blackbirds were critical to flight safety, and were a major concern. They were made by B.F. Goodrich and were impregnated with aluminum powder to reject the airframe heat. From the side they resembled "white sidewall tires." They were pressurized with nitrogen to 425 psi. They were 22 ply rated with 3 ply tread. When the gear was retracted, the tires went into a metal can in case they exploded from the heat in flight.

The flat, square nose and tail of the TACIT BLUE aircraft resembled a platypus bill and the air inlet on its back resembled a whale's "blow hole," so it was nicknamed the "Whale" or "Shamu." The team members referred to themselves the "Whalers."

Development of pressurized aircraft cabins was very slow. The USD-9A biplane is considered to be the first aircraft to have a pressurized cabin. It was originally a British design by Airco. One was specially modified by the U.S. Army Air Corps with this new capability in 1921. The second was the Junkers 49 which first flew in 1931. By 1935 it was routinely flying at 41,000 feet. The third was the Boeing 307 Stratoliner. It took the wings, elevators, rudder, engines, and landing gear of a B-17C and mated them to a new pressurized fuselage. The first demonstration flight in 1938 resulted in rudder lock, with the loss of the aircraft and all aboard. The cause was found and fixed. Howard Hughes purchased the first such aircraft in order to fly around the world but he abandoned that idea when World War II began in 1939; instead, he made it into a "Flying Penthouse."

PEOPLE

The first aeronaut to send a message to a president was Thaddeus Lowe. In June, 1861 he transmitted a telegraph message from his balloon to President Lincoln, who promptly saw the military applications of the technology. Lowe soon became the Chief Aeronaut of the Union Army Balloon Corps.

It is thought that Russian engineer Yevgeny Chertovsky designed the first pressure suit with a helmet in 1931 for the USSR-3 balloon that burned on the launch pad. When inflated, the pilot could hardly move because it had no joints.

Ferdinand von Zeppelin became interested in lighter-than-air aircraft when he visited Thaddeus Lowe in 1863, during the Civil War. He went to St. Paul, Minnesota and was given a ride in a tethered balloon. At that time he was 25 years old. He didn't get fully involved in making dirigibles until he was 52 years old.

The creators of codenames have strange ideas about naming aircraft and missions. For example, the concept of the drone on the back of another aircraft gave the "code man" a great idea. He named the drone, which was originally codenamed Q-12, the new name D-21 and designated the A-12 that was modified to carry it the M-21, where the "D" stood for "daughter" and the "M" for the "mother."

For his high altitude flight on May 26, 1929 German pilot Willi Neuenhofen used a Dräger high altitude rebreather with a mouth piece to ward off hypoxia. But there was concern that he still might lose consciousness, and so Junkers designed and added an "attention button" to the control wheel. The pilot had to hold this button in or the engine would stop. The idea was that if he fell unconscious he would let go of the button, the

engine would stop, and the airplane would glide to a lower altitude at which he would regain consciousness and press the button again to restart the engine. It sounds crazy today, but that is exactly what happened!

In the late 1930s Canadian scientist Dr. Wilbur Rounding Franks was experimenting with ways to fend-off the "blackout" effects of high g-forces. He noticed that when he put some of his test tubes in the centrifuge that they broke but when he put some water in them they didn't break. He was also experimenting with mice. He put some of the mice into condoms that were filled with water and they didn't pass out in the centrifuge. He did extensive testing on himself. This led him to develop the first g-suit using water filled bladders. The "Franks Flying Suit" was first worn by the Royal Navy Fleet Air Arm pilots in North Africa in 1942. It was also used by the RAF Hurricane and Spitfire pilots. Although the development of g-suits moved from water to air pressure, the Red Bull Race pilots wear g-suits which have water bladders. A new design by a Swiss and German team called the Libelle uses water filled bladders. It is being considered for the Eurofighter Typhoon and by the U.S. Air Force. What was old is new again!

I once had the opportunity to meet Alexey Leonov in Washington, D.C. He was with astronaut Tom Stafford, who flew with him on the Apollo-Soyuz Test Project mission in 1975. As an Apollo Pressure Suit Test Subject and a Flight Controller on Ed White's EVA flight on June 3, 1965, I was curious about the flight of Voskhod 2 on March 18, 1965. In particular, I was interested in Leonov's EVA and the difficulty he had getting back into the spacecraft. His pressure suit was a modification of the SK-1 suit worn by Yuri Gagarin; it was made by NPP Zvezda and was called the Berkut "Golden Eagle." When fully inflated, the suit had little mobility. It had two pressure settings; 5.8 psi and 3.9 psi. He gave me a good description of how he lowered the pressure so that he could physically reenter the outer hatch of the airlock. In flight, he didn't tell mission control that he was having trouble and was lowering the suit pressure. He didn't say how much lower he went, but I would guess it was lower than the lowest setting. That flight had a lot of serious problems which have been described in various books. Leonov and NASA astronaut David R. Scott coauthored *Two Sides of the Moon: Our Story of the Cold War Space Race* and you can read about their missions there.

Reverend Theodore M. Hesburgh, President Emeritus of Notre Dame, received a ride in an SR-71 in 1979. Now 96 years of age, he must surely be the oldest living person to have flown in a Blackbird.

QUOTES

- "Sacrifices must be made," Otto Lilienthal on his death bed after a glider crash in 1896.
- "Of all the men who attacked the flying problem in the 19th century, Otto Lilienthal was easily the most important," Wilbur Wright.
- "The discovery of the stratosphere is the most surprising discovery in the whole history of meteorology," Sir Napier Shaw in 1926.
- "Human performance in an environment equivalent to space is now known to be possible," Col. Dr. John Stapp after the 1957 flight of David Simons in Manhigh II.

- "This is a truly experimental test program," Kelly Johnson to the Skunk Works team, circa 1959.
- "Be quick, be quiet and be on time," Kelly Johnson to the Skunk Works team.
- "Starve before doing business with the damned Navy. They don't know what the hell they want and will drive you up a wall before they break either your heart or other exposed parts of you anatomy," Kelly Johnson's unwritten 15th rule for management.
- "I think the time has come for the bird to leave the nest," Kelly Johnson to Gen. Jack Ledford in November, 1965 regarding the A-12's readiness for operational deployment.
- "Mr. President, the termination of the SR-71 was a grave mistake and could place our nation at a serious disadvantage in the event of a future crisis. Yesterday's historic transcontinental flight was a sad memorial to our short-sighted policy in strategic aerial reconnaissance," Senator John Glenn addressing the Senate after the cancellation of the SR-71 and the historic records achieved in 1990.
- "The U-2 was indeed one of the CIA's greatest intelligence achievements. In fact, it may be one of the greatest of any intelligence services achievements of any nation," George J. Tenet, Director of the CIA, September 17, 1998.
- "I can think of no greater honor for myself, or for this team, than to know that people informed by our mission will use the data to take aerospace safety to the next level; or to spark children's interest in science; or simply as inspiration to pursue their own goals. I look forward to seeing what the realization of their dreams hold for all of us," Felix Baumgartner after his record breaking flight in 2012.
- "In my opinion, Bill Park was truly the unsung Skunk Works hero. He was a damn good pilot," Ken Collins, a fellow Oxcart A-12 and SR-71 pilot.

William C. "Bill" Park was the second Lockheed test pilot to fly the A-12 in 1964. He was a decorated Korean War F-80 pilot with 112 combat missions prior to joining the Lockheed Skunk Works. He flew and tested the F-102, F-104, U-2, A-12, SR-71, M/D-21, and the HAVE BLUE prototype that crashed and caused the injuries which grounded him. He had to eject on four other occasions. He also flew the A-12 a total of 10,198 miles in 6 hours in order to demonstrate its readiness for operations. In addition to numerous decorations, he had a Distinguished Flying Cross and two Iven Kincheloe Awards. He is in the Aerospace Walk of Honor.

Fighter pilots have some great humor. Oxcart Detachment Commander Col. Hugh "Skip" Slater gave his A-12 pilots strict flying instructions:

1. Try to fly in the middle of the air.
2. Do not go to the edges of it.
3. The edges can be recognized by the appearance of ground, buildings, sea, trees, and interstellar space. It is much more difficult to fly there.

To which I say Amen.

Credits

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M. von Ehrenfried, *Stratonauts: Pioneers Venturing into the Stratosphere*, Springer Praxis Books,
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Glossary

ADP	Advanced Development Project (at Lockheed)
AEC	Atomic Energy Commission
AFB	Air Force Base
AG	German abbreviation for a company with shareholders
A/P	Apparel/Personal (pressure suit designation)
AFFTC	Air Force Flight Test Center (Edwards AFB) Now called the Air Force Test Center
AIM	Aircraft, Intercept, Missile e.g. AIM 47A Falcon
ANGEL	The U-2
Ansari	Anousheh Ansari was the sponsor of the X Prize
Archangel	The A-12
AQUATONE	CIA code name for the U-2 Project
BASE	*B*uiding, *A*ntenna, *S*pan, *E*arth (parachuting)
Berkut	A modified SK-1 Soviet pressure suit worn by Alexey Leonov
BLACK SHIELD	Code name for A-12 flights from Kadena, Japan over North Vietnam and North Korea in 1967-1968
Brass Knob	U-2 flights over Cuba
BS	Bachelor of Science
CAPCOM	Capsule Communicator
CARE	Cabin Altitude Reduction Effort. An Air Force effort to lower the effective cabin altitude in U-2s
CL-282	Lockheed initial U-2 design
CSIRO	Commonwealth Science and Industrial Research Organization (of Australia)
CDR	Commander in the Navy
CFD	Combat Feeding Directorate (of the DOD)

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Churchy	Code name for an Office of Naval Research project to launch unmanned balloons for atmospheric research in the late 1940s
CIA	Central Intelligence Agency
Coffin Corner	Shape of a group of curves-stall speed versus altitude
CONSTANT PEG	Code name for an Air Force Aggressor Squadron
Cygnus	Alternative codename for the A-12
D-21 and D-21B	The drones launched from the M-21 and B-52
Detachment 3, AFFTC	The USAF designation of Area 51 when, in 1979, they took control of Area 51 from the CIA
DREAMLAND	Nickname for Area 51 around late 1960s
Deuce/Dragon Lady	Nicknames for the U-2
DOD	Department of Defense
D.O.D.	Date of Death
Dutch	Code name for a CIA pilot while flying an A-12, YF-12
ECM	Electronic Counter Measures
EG&G	Edgerton, Germeshausen & Grier- the base prime contractor. Conducted radar cross section (RCS) experiments
EPA	Environmental Protection Agency
ER-2	Earth Resources U-2
EVA	Extra Vehicular Activity
FAA	Federal Aviation Administration (established the restricted air space R-4080N around Area 51)
FAI	Fédération Aéronautique Internationale
FNRS (1 and 2)	Fonds National de la Recherche Scientifique; the Belgian research institute that supported Auguste Piccard's balloon flights (1) and bathyscaphe (2)
FSD	Full scale development (of a prototype into an operational aircraft)
G-1	Gradient Pressure Suit 1
G	Grob (a German aircraft company)
G	gravity (acceleration as in g-loads)
GmbH	German for a limited liability company
GPS	Global Positioning System
GRAND SLAM	U-2 flights from Turkey and Pakistan over the Soviet Union; Gary Powers flight was one
Groom Lake	The dry lake in Area 51 used as emergency runways
HAVE	The first word of a code name for a developmental aircraft
HAVE BLUE	Code name for the first experimental stealth aircraft (leading to the YF-117)
HAVE DOUGHNUT	Joint USAF and USN effort to evaluate pilots flying various aircraft against the MiG-21
HAVE GLIB	Area 51 tests of Soviet Tracking and missile radars
IAS	Indicated Air Speed
JSC	Johnson Space Center in Houston, TX

Kármán Line	Theodore von Kármán's 100 kilometer (62 mile) altitude line to define the upper boundary of the atmosphere from an aerodynamic point of view
KEDLOCK	Air Force codename for the YF-12A
KGB	Komissariat Gossudarstuvennoy Bezopasnosti (Commission for State Security)
KINGFISH	Code name for Convair's design to compete with Lockheed's A-12 design
KWF	Killed While Flying
LCDR	Lieutenant Commander
LCO	Launch Control Officer
LIDAR	Light (Laser) Detection and Ranging
LOROP	Long-Range Oblique Photography
LUSAC	Lepere United States Army Combat (aircraft)
M-17/M-55	Myasishchev design bureau aircraft
Mach	The ratio of the aircraft's speed to the speed of sound
Mach Tuck	A term applied to a rapid pitch down; see Coffin Corner
Me	Messerschmitt (German aircraft designer)
MiG	Mikoyan-Gurevich (Soviet aircraft design bureau)
MS	Master of Science
MSC	Manned Spacecraft Center in Houston, TX (now the Johnson Space Center)
NACA	National Advisory Committee on Aeronautics
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NOAA	National Oceanographic and Atmospheric Administration
NPP	Russian for Research, Development & Production Enterprise (life support systems company)
NSF	National Science Foundation
NTS	Nevada Test Site (formerly the Nevada Proving Ground)
OILSTONE	USAF code name for the U-2 program
ONR	Office of Naval Research
Osoaviakhim	Russian for a society for assistance to the military
OXCART	Code name for the A-12 project
Paradise Ranch	Nickname for Area 51 to lure workers to the area sometimes shortened to just "The Ranch"
PRC	Peoples Republic of China
PSI	Pounds per square inch
RAF	Royal Air Force
RAINBOW	CIA project to reduce the radar cross section (RCS) of the U-2
RQ-4	Global Hawk drone
RAZOR	Code name for the ROC U-2 program
RCS	Radar Cross Section (a stealth parameter)
RB	Reconnaissance Bomber

REECo	Reynolds Electrical and Engineering Company (an early base construction contractor)
RMI	Reaction Motors Incorporated
ROC	Republic of China
Roadrunners	1129th Special Activities Squadron-the original A-12s were under this command
Roadrunners Internationale	The current Association of U-2, A-12, YF-12A pilots, contractors and support staff
RSO	Reconnaissance Systems Officer
SA/SAM	Surface to air (missile)
SAS	Special Activities Squadron
SENIOR BOWL	Code name for the B-52 launched D-21 drones
SENIOR CROWN	Codename for the SR-71 missions out of Okinawa
SENIOR TREND	The full scale development of the HAVE BLUE into the YF-117A
Sheep-Dipped	The process of decommissioning an Air Force pilot in order to fly as a civilian with the CIA
SIGINT	Signal Intelligence
SK-1	Skafandr Kosmicheskiy (Russian for a model of a space suit worn by Yuri Gagarin and others)
Skybolt	Astro inertial navigation system
Skyhook	Office of Naval Research code name for an unmanned research balloons in the late 1940s
Skystreak	Douglas D-558-1
Skyrocket	Douglas D-558-2
Sqdr.	Squadron
SR	Strategic Reconnaissance
SST	Super Sonic Transport
Starbuster	Bell X-2
STG	Space Task Group (based at NASA Langley Research Center)
STS	Space Shuttle System
Tabasco	Code name for the Chinese U-2 program
TAS	True Air Speed
TACTIC BLUE	A prototype aircraft nick named “The Whale” and “Shamu” that researched technology related to low observability and low probability of detection
TAGBOARD	Code name for the project to launch the D-21(originally designated Q-12) drone from the back of the modified version of the A-12 designated the M-21
TEB	Triethylborane (the pyrophoric additive to the fuel)
TU	Tupolev (Russian designer of their SST)
U	Utility; as in U-2 to disguise the true application
USAF	United States Air Force
USN	United States Navy

USS	United States Ship
Voskhod	A series of Soviet spacecraft
VVA-1	Russian balloon of 1938. All four crew killed.(Not sure of the Russian translation)
WB	Weather Bomber
Watertown	The CIA renamed the Area 51 base Watertown after CIA Director Allen Dulles' birthplace in Watertown, NY
Whale Tail	Code name for the modification to aircraft carriers and the U-2 to operate off the carriers at sea
WILD	Western Industrial Liaison Detachment (CIA Security for Area 51 projects)
WRS	Weather Reconnaissance Squadron
X	Experimental
Zvedza	Russian for "star" (also the name of the company NPP Zvedza)

About the author

Manfred "Dutch" von Ehrenfried II had the very good fortune to be a Sensor Equipment Operator and Mission Manager on the high altitude RB-57F that was loaned to NASA by the USAF 58th Weather Reconnaissance Squadron. This was in support of the Earth Observations Aircraft Program which continues to this day out of Ellington Field near Houston, TX. This allowed him to experience the challenges of stratospheric flight. In other duties at the NASA Manned Spacecraft Center (now the Johnson Space Center) he was an Apollo Pressure Suit Test Subject. This afforded him the opportunity to test pressure suits in a vacuum chamber to over 400,000 feet and experienced high g-loads in the centrifuge and zero-g in the "Vomit Comet." He was also a Flight Controller in Mission Control for many Mercury, Gemini, and Apollo missions. These experiences, coupled with his interest in the history of flying, prompted him to write this book for his family, friends, and fellow aviators.

He was also a coauthor of *From the Trench of Mission Control to the Craters of the Moon* (ISBN 978-1-105-53844-5, published in 2012). It was written by the NASA Flight Controllers who sat in the front row of Mission Control, which was known as the "Trench." He also authored *Nuclear Terrorism – A Primer* (ISBN 978-0-615-68675-2, published in 2012) based on his experiences with the Nuclear Regulatory Commission's efforts to guard uranium and plutonium facilities.

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Figs. AA.1 and AA.2 The author in an A/P22S-6 full pressure suit as used in the RB-57F aircraft (left), and an A7LB full pressure suit as used by later Apollo missions (right). Photos courtesy of NASA and Manfred "Dutch" von Ehrenfried.

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