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ROBERT J. GILLILAND AND SKUNK WORKS:

BEYOND THE ENVELOPE

by

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Preface

The story and accomplishments of Robert J. Gilliland epitomize the human characteristic of can-do and perseverance. His contributions as a world-class aviator and test pilot established a forward leaning trend in aeronautical accomplishments yet attained elsewhere. Specifically, his role as the first man to pilot the SR-71 Blackbird aircraft launched an era of flight operations clearly changing the character and utility of manned flight. Robert Gilliland's story, reflections and accomplishments are an astounding and effective portrait of the man. Robert Gilliland has lived a life full of challenge, opportunity, dedication and commitment and has tackled each head-on. It is with great pleasure that his rise to aviation icon, at least in part, is presented in this paper.

I would like to thank Dr. Michael Grumelli, Air Command and Staff College professor and Gathering of Eagles advisor, as well as Wing Commander James Hunter (RAF) and Major Tom Burtschi, Gathering of Eagles advisors, for their support, confidence and advisement during the preparation of this paper.

Abstract

Test pilot Robert J. "Bob" Gilliland entered the annals of aviation greatness on 22 December 1964 when he took to the California skies as the first pilot of the SR-71 Blackbird aircraft. This sortie marked the first flight of the world's highest and fastest flying aircraft. At the controls, Gilliland flew the aircraft to speeds of Mach 1.5 and an altitude of 50,000 feet. As remarkable as the famed Blackbird itself, the story of the man who initially tested and flew the Blackbird is just as compelling. Bob Gilliland's life story exhibits early and continuous academic discipline, admirable military service, and unique military flying opportunities, all which ushered in new and continuous challenges. Ultimately, he lived an aviator's dream, piloting the most advanced systems in the world. Gilliland is a perceptive, studious and remarkably astute test pilot who had the distinct honor and privilege of working for the world's most pre-eminent aircraft designer, Kelly Johnson, as part of the Lockheed Skunk Works. Moreover, he is humble and attributes much of his success to upbringing, education and strategic opportunities. Gilliland's service to both country and mission are harrowing and exciting, and through examination of his unique story, it is possible to personify the true aviation legend that he is. Bob Gilliland's dedication and determination capture the American spirit of innovation, danger, and success during a generation of technological greatness.

Chapter 1

The Early Years

"Reason and calm judgment, the qualities specially belonging to a leader." [1]

-Tacitus

The aeronautical achievements of the United States during the 20th century unquestionably hailed a period of great creation and development. Aviation evolved from simple wood frames and fabric coverings to supersonic and space-based flight. With this newfound capability came military applications never before seen such as aerial combat, reconnaissance, and surveillance. The Cold War period specifically benefited in technological advancements, and the US Air Force in particular capitalized on emergent technology in aircraft design and performance. The pioneers who piloted these aircraft were men of toughness and grit coupled with raw talent and intelligence. One of these early aviators was Robert J. "Bob" Gilliland, the first person to fly the highly acclaimed and previously top-secret SR-71 Blackbird. His rise to aviation icon came about from a disciplined childhood and education, challenging military service, and influence from people of legend. In the process, Gilliland helped pave the way for testing, evaluation and subsequent operational certification of the world's fastest and most capable strategic-reconnaissance aircraft. A thorough examination of the remarkable achievements of Robert Gilliland and the elements that shaped him helps frame the character of

the man, the machines he flew, and the circumstances that propelled him there.

Upbringing and Education

Robert J. "Bob" Gilliland was born in 1926 in Memphis, Tennessee, the son of a successful lawyer and WWI combat veteran. His upbringing consisted of strict yet caring parents who instilled in him enthusiastic drive and determination, fostered by demanding standards of achievement. He describes his mother as serene and gracious, with a tender heart and affection for her family, but considers his father his most notable inspiration and hero. His father was a Vanderbilt University graduate, lawyer and had three sons, but his actions during WWI truly set him apart in Gilliland's eyes.[2] He served as a member of the Army's 30th Division, comprised of National Guard troops from North Carolina, South Carolina and Tennessee. His unit was responsible for breaking through the infamous "Hindenburg Line" in Bellicourt, France on 29 September 1918, ultimately contributing to the end of the war.[3] Resultantly, Gilliland placed great recognition on the significance of duty, studious achievement and hard work all resulting from his father's influence.

Gilliland attended boarding school during high school where he performed well, excelling in both academics and athletics. As graduation approached, WWII was raging and he knew his options for the future were military service or the draft. He had received an early application to the US Naval Academy, so he applied and continued his academic and athletic endeavors followed by enlistment in the US Navy. He was at the Great Lakes Training Center training as a submariner when his appointment to the US Naval Academy arrived, sponsored by Senator Clifford Davis of Tennessee.[4] Gilliland readily accepted the challenge and performed admirably, graduating in 1949 with a degree in engineering.

Military Training

By Gilliland's graduation, the US military had entered a period of transformation, and he was among the initial class offered the opportunity to accept a commission in the US Air Force and the chance to undergo pilot training. Aviation had always "sounded interesting" so he made his way to the Air Force to train as a pilot.[5] Flight training was conducted in the T-6 Texan, known as an excellent training aircraft. He relished the challenges and demands of aviation training and successfully earned his wings at Randolph Field, Texas in 1950. Immediately following he proceeded to advanced flight training in the speedy Lockheed F-80 Shooting Star, known for its speed capabilities greater than 500 miles per hour in level flight.[6] As a result, the challenges of flight and the intricacies of operating aircraft at high speeds set well with the young pilot, and he settled into his role as an Air Force aviator. He finished his training shortly thereafter and followed with his first overseas assignment flying P-47 Thunderbolts and F-84 Thunderjets in Germany.

Combat Time and Flight Test

In 1952, the Korean War was well under way and Gilliland aimed to be a part of it. He quickly volunteered for combat duty and left for Taegu to fly the F-84. Combat flying, however, was short-lived and Gilliland returned to Germany in 1953 to fly the F-86F Sabrejet. His flight experience then led to opportunities in the flight test realm, followed by an assignment to Eglin AFB, Florida. While there, additional opportunities surfaced including the task of flying nearly every aircraft in the US Air Force inventory, thereby providing him instrumental and desirable experience flying primarily jet aircraft. During his endeavors, he proved vital performing many advanced tests including wing loading of the F-104; coincidentally, the same aircraft that would provide him many future opportunities.[7]

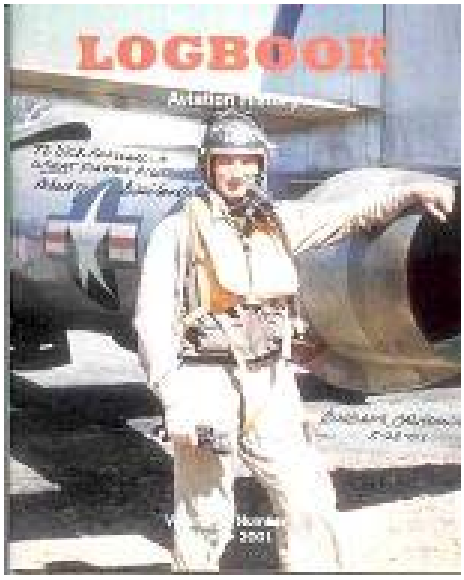

Figure 1. Robert Gilliland next to an F-84 while stationed in Taegu, Korea.
Source: roadrunnersinternationale.com/gilliland.html

Gilliland decided to leave active duty in 1954 and returned home to Memphis, Tennessee where he joined the Tennessee Air National Guard. As a highly qualified fighter and test pilot, he flew the P-51, B-26, RF-80, RF-84 and the F-104A until 1960, at which time he decided to depart the military altogether to pursue flight test opportunities. After leaving, he joined the ranks of Lockheed as a civilian test pilot flying all models of the F-104 Starfighter. Initially, his primary duties included flight evaluations of F-104 aircraft coming off the production line.[8] Additionally, based on the export status of the Starfighter, he worked closely with several international programs and spent time qualifying and certifying many pilots in the F-104. Consequently, he performed flight evaluations on some of the world's leading pilots such as Luftwaffe flying aces Gunther Rall and Johannes Steinhoff, Canada's Wing Commander Kenneth Lett, and USAF Brigadier General John Dunning.[9]

The international program efforts of the F-104 spanned to the Air Forces of the Republic of China (Taiwan), Canada, Japan, Germany, and Italy. One such effort was his work on the F-104S fighter, produced in Italy under license from Lockheed. Gilliland made the first flight of

the aircraft, effectively continuing a long line of successive Starfighter programs. Ultimately produced in eight variants, the F-104 logged over a million flight hours spanning 42 years of flight operations, a testament to its durability and versatility.[10]

Gilliland's talents and abilities gained quick recognition, and by 1962, he was recommended to Kelly Johnson of Lockheed's Skunk Works Division who invited him to come on board as a test pilot. His military experience had earned him a solid wartime reputation with credentials, and as a seasoned test pilot, he had nearly three times the jet aircraft experience of many of his contemporaries.[11] Gilliland also had the redeeming quality of being eerily intelligent. Long-time friend and fellow Air Force pilot Colonel (retired) Joe Kittinger, himself a decorated combat pilot and pilot of *Project Manhigh* said of Gilliland: "I have been friends with Bob Gilliland for 57 years. He is a remarkable stick, a classy guy and a true friend. His IQ is off the charts and I must say he is probably the smartest person I have ever met."[12] Bob Gilliland's credentials were solid, indeed, but his resume was about to grow even more…he was now a Skunk Works pilot.

Notes

[1] Military-Quotes.com Web Site, Military Quotes and Citations, Tacitus, 55-177, http://www.military-quotes.com/privacy.htm, (c)2002-07 Military-Quotes.com – military forums.

[2] Robert J. Gilliland, interviewed by the author January and March, 2007.

[3] Old Hickory Web Site, Origins of the 30th, The Thirtieth Infantry Division, http://home.nc.rr.com/oldhickory/index.shtml.

[4] Gilliland interview.

[5] Gilliland interview.

[6] Global Aircraft .org Web Site, US Fighters, P-80 Shooting Star Info, http://www.globalaircraft.org/planes/f-80_shooting_star.pl, (c) 2004 Charles E. Munson (JetWhiz).

[7] Gilliland interview.

[8] Gilliland interview.

[9] Gilliland interview.

[10] Aeronautica Militare Web Site, "The Starfighter (The F-104 in the Italian Air Force)," http://www.aeronautica.difesa.it/SitoAM/Default.asp?idnot=5386&idsez=68&idarg=265&idente=1675.

[11] Gilliland interview.

[12] Joe W. Kittinger, Colonel, USAF (retired), interviewed by author February, 2007.

Chapter 2

Skunk Works

"Be quick, be quiet, and be on time." [1]

-C.L. "Kelly" Johnson

History and Evolution

Whether he knew it or not, Bob Gilliland became synonymous with the most highly revered aircraft manufacturer of the day when he joined Lockheed, and more specifically, the Skunk Works Division. When it came to advanced aviation technology and aircraft design, Skunk Works stood above all others. Most notable were its tremendous leader, Clarence L. "Kelly" Johnson, and the many aircraft designed in its super-secret facilities. Kelly Johnson ran a tight ship, and underachievers periled quickly or simply faded away. For those that survived, the work was undeniably rewarding provided one never forgot who was in charge. According to Gilliland, Skunk Works was a "one man show…it was all Kelly Johnson."[2]

Skunk Works came to be in 1947, the result of Lockheed Corporation's bid to win the first jet fighter contract.[3] The aeronautical needs of speed and range during and following WWII had spawned the age of jet-powered aircraft; however, the unrelenting issues of limited range and fuel-thirsty jet engines made jet technology difficult. Compounding the efforts were very limited net gains realized from jet engine propulsion. At the time, the P-38 Lightning was the

premier advanced fighter and, coupled with the P-51 Mustang, the world of high performance fighter aviation seemed relatively intact. That changed in 1941 when British Pilot Officer and engine designer Frank Whittle created a jet propelled engine that altered previous misconceptions about speed capabilities of jet aircraft, proving its capability and utility.[4] The US Army Air Corps quickly gravitated to the immense capability this emergent technology represented based largely on successful German development and production of the Me-262 jet-powered fighter. The German program also gained the attention of military decision makers in Washington, and as a result, Bell Aircraft won an initial bid at jet aircraft design. The XP-59 was the result following agreement by General H. H. "Hap" Arnold. The airplane was successfully developed and flown, but never achieved any appreciable performance characteristics over existing propeller driven aircraft. Resultantly, the XP-59 never entered production and was relegated to training roles. Its significance is notable though, as the lessons learned from the program helped usher in the US's move to the jet age.[5]

XP-80 Program

With the XP-59 program underperforming, Kelly Johnson of Lockheed gained the opportunity to quickly develop and create a jet fighter.[6] The details were the same as the XP-59; create an all-jet fighter aircraft capable of speeds greater than 600 miles per hour, at least 200 miles per hour faster than the P-38, and close to the speed of sound.[7] Within one day, Johnson had a confirmed contract from the War Department signed by Gen Arnold himself. Not surprisingly, pressure began mounting to build an aircraft capable of out-flying and out-performing the Me-262 with the result quickly entered into war-effort production. The primary stipulation for Johnson was to build the airframe around the British de Havilland engine designed by Major F.B. Halford, who himself had collaborated with Frank Whittle. Halford's design,

however, differed from Whittle's decision to use a reverse flow design, instead using a centrifugal flow method. The resulting engine, named the H1 Goblin, proved more powerful and would eventually power both the Gloster Meteor and Johnson's new aircraft.[8]

The initial jet fighter aircraft was designated the XP-80 Shooting Star.[9] The War Department gave only 180 days to Kelly Johnson and crew to produce the prototype, and Johnson delivered in 143.[10] The development and ensuing flight tests were so significant and impressive that during its initial demonstration on 8 January 1944, Bell Aircraft Company test pilot and witness Tex Johnston sent an immediate telegraph to his corporate office proclaiming: "Witnessed XP-80 initial flight STOP Very impressive STOP Back to the drawing board."[11] An impressive statement, considering it came from the man that would one-day barrel roll a Boeing 707 over Lake Washington to impress prospective buyers.

In the case of the Shooting Star, the secret band of engineers, technicians and test pilots quietly and efficiently launched the first of many successful aircraft. It was also significant in that the project became the first successful "black" program, a sign of the need for secrecy. To that end, the fact that the new team of employees working on the project did not have a name or title only added to its secrecy. Quickly, the organization sought a name, which it received from Lockheed's Irv Culver, a fan of the Injun Joe character of the L'il Abner comic strip. According to Culver, the similarities of their respective work conditions, in particular the smell (Injun Joe's brew smelled bad and Johnson's work-tent was based near a plastics factory) helped forever name the organization.[12] The organizational construct now complete, the transition to jet aircraft production, and the XP-80, began. Upon completion, the XP-80 became the P-80 Shooting Star and T-33 trainer, both incredibly successful in their own right. Thus, the P-80 officially became the US's first jet fighter.

Figure 2. The legendary trademark of the Lockheed Skunk Works.
Source: www.lockheedmartin.com/skunkworks.

Shortly after the success of the XP-80 program, tensions in Eastern Europe escalated, ushering in the early days of the Cold War. The lessons learned from Korea, for example, showcased the need for overflight capability to perform critical surveillance and reconnaissance missions and efforts began to fill the need. By 1953, the US military recognized a need for a specialized aircraft that would fly at altitudes above enemy interceptors and surface to air missile (SAM) detection envelopes. The aircraft in need would conduct covert missions at altitudes in excess of 70,000 feet, with a range of 3,000 miles, and with a payload of sophisticated reconnaissance equipment. By that time, jet engine technology had matured to the point where it could now operate in the upper atmosphere, the primary need was to build an airframe to go with it.[13]

Major John Seaberg, a US Air Force reservist called up to act as assistant chief of the New Developments Office at Wright Patterson Air Force Base, Ohio submitted a detailed report in March, 1953 detailing a formal design study to meet the specialized aircraft need(s). Having worked as an aeronautical engineer at Chance Vought, he was able to formulate a needs analysis consisting of a single-place aircraft using existing engine technology. His seminal study was particularly influential in that it noted two key areas that influenced many subsequent

generations of "black" airplanes. First, the new aircraft design had to take into account detectability, thereby creating an air vehicle minimized in size to thwart enemy radar. Second, the air vehicle design had to evaluate vulnerability based on elements such as altitude and speed. Ultimately, both categories were considered significant enough to overcome guided missiles, the primary threat of the time.[14]

The US government decided to choose a small contractor for the development of the new aircraft to increase its priority and to ensure a more innovative design. The program, named *Bald Eagle*, enlisted efforts to create the specialized aircraft in limited numbers. The result of the decision ensured bypassing of all major manufacturers while Bell, Fairchild and Martin Aircraft companies were asked to submit designs using either new or modified existing platforms.[15] In the process, the Fairchild model was rejected while the Bell and Martin products were given portions of the production contract. Bell created a new aircraft from the ground up, the X-16, thereby positioning the aircraft for future operations. Martin, on the other hand, created the RB-57D based largely on the existing B-57, ensuring a quick fill to the immediate need and awarding of a six-aircraft contract.[16]

Although excluded from the initial contract and bidding process for the new aircraft, Johnson and Skunk Works created a design on their own for submission. By March of 1954, Kelly Johnson rolled out the prototype aircraft design known as CL-282, essentially an XF-104 fuselage with long-span wings. Using the F-104 as a baseline, the wingspan was widened and lengthened, the engine changed to a non-afterburner variant, larger fuel tanks added, and jettisoned-wheeled takeoff dolly landing gear used to save weight. The CL-282 concept was short lived and optimistic, but Johnson went back and created an entirely new design, code-named the "Article," or the "Angel."[17] The change utilized a new fuselage to better

accommodate camera bays and equipment, bicycle-style landing gear with small outrigger wingtip support gear, and a switch to the Pratt and Whitney J-57-P-37 engine.[18]

The Skunk Works submission made its way to Trevor Gardner, then Assistant Secretary of the Air Force for Research and Development who formed a panel of scientists to query Johnson and the design proposal. The result was CIA-sponsored *Aquatone*, a contract for 20 aircraft with spares for the cost of $22 million, requiring the first rendition flying inside eight months.[19] Meanwhile, the Bell and Martin Aircraft companies continued their respective efforts with the *Bald Eagle* project, and Skunk Works pressed development and subsequent flight test operations at Groom Lake dry lake bed in Nevada. The Skunk Works product, Article 341, initially flew on 4 August 1955 with all test requirements met or exceeded. In fact, so successful were the initial *Aquatone* tests that *Bald Eagle* was cancelled and all efforts shifted to *Aquatone*. In the end, the aircraft was ultimately designated the U-2 with over 100 airframes delivered during the course of production ending in 1980.[20] The U-2 continues to fly today.

SR-71 Program

The capability the U-2 brought to the reconnaissance and surveillance community was breathtaking, even by today's standards. The first operational flight in 1956 yielded images and capabilities never before seen and its usefulness was sealed. Overflights, specifically, ensued to capture much-needed data, including the Soviet Union. Not surprisingly, overflights of the Soviet Union infuriated Party Secretary Nikita Khrushchev, who was both paranoid and mistrustful of the West. Khrushchev had already turned down "Open Skies," a plan presented by President Eisenhower calling for limited annual reconnaissance overflights intended to gauge one-another's declared force status. Khrushchev's refusal to agree with "Open Skies," and President Eisenhower's decision to continue overflights created additional tension(s) in US-

Soviet relations. The overflights also precipitated Soviet fighter launches and many unsuccessful intercept missions, as the U-2's altitude created a relative, albeit temporary, bubble of protection. The missions continued successfully without incident until the Francis Gary Powers shootdown of 1960, contributing to the challenges of the Cold War and increasingly deteriorating US-Soviet relations. The Powers shootdown made it clear that the susceptibility of the U-2 underscored the need for higher altitudes, increased speed and smaller radar cross section airframes.[21]

Ironically, the U-2 had only just become operational when efforts began to replace it. Its life expectancy was surprisingly short, and Air Force senior officials indicated a need for a high-speed replacement. The resulting program began as project *Suntan*, where experts raced to create the next high and fast aircraft. By this point, Johnson from Skunk Works theorized that liquid hydrogen fueled aircraft could (and would) provide the requisite fuel source for next-generation high altitude flight. The result, CL-400, used liquid hydrogen as its fuel source and thorough testing declared it stable enough for use. Projections for fuel consumption, however, fell drastically short indicating the range element would meet specifications only if the aircraft became significantly larger and thus beyond design specifications.[22] Ultimately, the project was cancelled.

Meanwhile, CIA efforts for a U-2 replacement were being conducted as well. Project *Gusto* stemmed from similar CIA requirements necessitating greater speed, but also the inclusion of radar absorbent materials (RAM) to mitigate enemy detection. Essentially, the craft was to incorporate RAM in conjunction with a small radar cross section (RCS) design. The combination of RAM, RCS, supersonic speeds, and high-altitude flight regimes was theorized to reduce enemy detection or thwart it all together.[23] This is mind, Skunk Works and General Dynamics received no-contract design opportunities to design the aircraft, with the US Navy also

preparing a submission. To oversee the project, a board of consultants known as the Land Panel formed to ensure maximum connectivity with modern research and development efforts, and to monitor program funds. For secrecy, all funds moved through the CIA special Contingency Reserve Fund as with the U-2 program, thereby masking the existence of the program.[24]

The Land Panel briefed President Eisenhower and Chief Scientist Dr James Killian in November 1958 after they determined that definitive studies should be pursued. Funding was appropriated for both General Dynamics and Lockheed to conclude their findings and by early 1959, Skunk Works had a prototype. Driving the requirements was the president, insisting that the final product be zero RCS, something Johnson repeatedly announced as impossible. Upon completion, 11 prototypes were developed, with edition A-11 reducing RCS 90 percent using wedge-shaped chines attached to the fuselage.[25] Following, the updated drawings were refined and finalized and Johnson briefed the CIA about the prototype. Finally, in August 1959, the Lockheed and General Dynamics prototype plans were submitted for final consideration, and in September 1960, Lockheed Skunk Works won source selection to produce five aircraft (named A-12) with a contract cost of $96.6 million. Although similar in many respects to the General Dynamics "Kingfish" prototype, the Lockheed product had, among other things, greater range. The program was simplistically code-named *Oxcart* for cover, and work began.[26]

Figure 3. A-12 (foreground) and SR-71 Blackbird Aircraft on Static Display.
Source: http://www.serve.com/mahood/a-12/a12-sr71.jpg.

Notes

[1] Clarence L. "Kelly" Johnson with Maggie Smith, *More Than My Share of it All* (Washington, DC: Smithsonian Institution Press, 1985), 161.

[2] Gilliland interview.

[3] Paul F. Crickmore, *Lockheed Blackbird: Beyond the Secret Missions* (Oxford, United Kingdom: Osprey Publishing, 2004), 15.

[4] Johnson and Smith, 95.

[5] Curtis Peebles, *Dark Eagles: A History of Top Secret US Aircraft Programs* (Novato, CA: Presidio Press, 1995), 13-16.

[6] Johnson and Smith, 98.

[7] Ben R. Rich and Leo Janos, *Skunk Works* (New York, NY: Back Bay Books, 1994), 111.

[8] Steve Pace, *Lockheed SR-71 Blackbird* (Ramsbury, Marlborough, England: The Crowood Press Ltd., 2004), 10.

[9] Johnson and Smith, 99.

[10] Ibid, 99.

[11] Peebles, 16.

[12] Rich and Janos, 111.

[13] Peebles, 19.

[14] Peebles, 19-20.

[15] Peebles, 20.

[16] Pace, 16.

[17] Peebles, 23.

[18] Pace, 17.

[19] Johnson and Smith, 121.

[20] Pace, 17-18.

[21] Crickmore, 19-20.

[22] Peebles, 50-51.

[23] Crickmore, 24-25.

[24] Crickmore, 27-28.

[25] Peebles, 52-54.

[26] Rich and Janos, 200-201.

Chapter 3

Flight Test of the SR-71

"The meetings were tedious and in great danger of causing analysis-paralysis."[1]

-Robert J. "Bob" Gilliland

Testing the Blackbird

There is mettle inherent in someone willing to be a test pilot. Most aviators consider the opportunity of operating test aircraft a distinct and relatively unattainable dream, and few ever make the leap separating them from ordinary pilots. Not surprisingly then, flight test is dangerous and often veiled in mystery. It is questionable then, why any highly trained, educated and presumably sane individual would voluntarily strap into a strange craft and leave the relative safety of terra firma. Robert Gilliland is one of those who not only recognized the distinction, but also willingly and successfully made the transition.

Gilliland's involvement with the Blackbird program began shortly after he came on board with Lockheed in 1960 as an F-104 Starfighter test pilot. Originally, he was hired by Lockheed at the behest of company test pilot and friend Lou Schalk, as well as Tony Levier, both heavily involved in testing of the Starfighter. This was very dangerous yet exciting work, and Gilliland thoroughly enjoyed testing, flying and delivering F-104's to consortium nations despite the dangers. In fact, he cites "staying alive in the Starfighter" as his greatest overall challenge as a

test pilot.[2] He also spent time performing activities such as aircraft evaluations, operational checkouts and export duty functions such as initial test flights of the Italian variant F-104S. Additionally, he did advanced work making the Starfighter engine more reliable, and conducted new efforts on the flight ejection seat system. Notably, he was revered for his exceptional piloting skills and excruciating attention to detail. Gilliland's reputation as a test pilot, in particular, was that of being personally and technically perceptive to the point of having near-perfect recollection of technical details and facts.[3]

In 1962, Schalk convinced Kelly Johnson to consider Gilliland for support of the A-11 and A-12 program(s). Schalk, the only pilot at the time, was contracted to fly the first 13 test sorties of the aircraft, indicating a need for additional pilots. The screening process was normally arduous and long, however, so Johnson dug in and hired Gilliland without the requisite background checks, based largely on his service in the Air Force and solid character assessment from Schalk. Shortly thereafter, Gilliland was joined by fellow Lockheed test pilot William Park and former Hughes test pilot James Eastham. Thus, Gilliland became a test pilot for the world's most highly-secret and advanced aircraft based on his recognizable and admirable test pilot background, and good 'ol-fashioned word of mouth.[4]

The SR-71 arrived on the heels of the CIA-sponsored A-12 *Oxcart* program, the initial version of several forthcoming Blackbird variants. The A-12 was similar in many respects to the SR-71, but was single-seat, lighter, presumably faster, and had a specific high-resolution camera for surveillance photography. The A-12 required, for instance, overflight of its area of interest due to its look-down-only camera, while its successor the SR-71 had a side-look capability, distancing itself from potential adversary weapons systems. The A-12's operating altitude and triple-sonic speed were seen as a protection measure, highlighted during the contested days

following the Powers U-2 shoot-down. As a result, quick preparations for aircraft production began with the aircraft re-located to Groom Lake, also known as Area 51, a remote desert complex approximately 90 miles north of Las Vegas, Nevada. Next, massive upgrades took place strengthening and lengthening the runways, building appropriate structures for the aircraft, and providing housing for on-site personnel who worked around the clock; coincidentally, this was the same area used for secret flight test operations of the U-2.[5]

The A-12 was scheduled to fly for the first time in May, 1961 but significant problems and ensuing delays with the Pratt and Whitney J-58 power plant caused the date to slip. Additionally, engineers struggled with titanium shortages and structure failures, machining difficulties, and stability considerations with the aircraft fuel system(s) considering the extreme temperatures anticipated during operating altitude.[6] At the same time, Kelly Johnson was under intense pressure from the CIA to get the aircraft airworthy, ensuring its continued viability as a high-priority government program. Johnson realized the J-58 engines would not be operationally sound in time for programmed flight test, so he directed Pratt and Whitney J-75 engines used as interim replacements. It was a stroke of genius since J-75 engines were already used in the F-105, F-106 and U-2C, thus establishing a viable substitute in plentiful supply. However, using J-75 engines for flight test operations required aircraft speed restrictions of Mach 1.5 and altitudes of 50,000 feet. Resultantly, it took an additional eleven months for the aircraft to be ready for operation, and it flew for the first time on 24 April 1962.[7]

The A-12 continued to fly before and during the development of its siblings, the YF-12A interceptor and the SR-71, ensuring valuable national efforts became reality. As a CIA platform, the A-12 *Oxcart* program aircraft performed overflight duty in Vietnam while deployed to Kadena Air Base, Japan, providing needed information to military planners. Flights typically

lasted only minutes, with the aircraft coming under ground missile fire. Ultimately, the program was considered successful and highly beneficial but was phased out due to fiscal competition between the CIA and US Air Force, and intense pressure from the Bureau of Budget.[8]

The other off-shoot of the *Oxcart* program was also short-lived. The YF-12A was designed to perform as a triple-sonic, high altitude, strategic interceptor, equipped with infra-red sensors, modified radome, and weapons bays carrying three AIM-47 missiles. Congress appropriated $90 million for construction of 93 YF-12A's, with operational designation F-12B. The aircraft were slated for assignment with then-Air Defense Command in conjunction with NORAD, and would sit alert at designated bases throughout the US. Upon notification, the F-12B's would scramble for intercept operations against incoming threats within minimum time. However, the program met the fate of Secretary of Defense Robert McNamara, formally ending in February, 1968 with priority going to the less costly F-106X program proposed by Convair. Upon reflection of the F-12B program, one Air Defense Command officer was later quoted saying, "It was the best interceptor that we *never* built."[9] Following the cancellation of the programs, McNamara ordered all the manufacturing tooling sets destroyed to avoid sabotage or espionage. According to Gilliland this infuriated Kelly Johnson, who saw this decision as nothing short of outright treason.[10]

Flight test of the Blackbirds often proved tedious and demanding. Considering the flight test environment was un-chartered, much of the data were theoretical and speculative. Engineers realized that simulation was not an option for much of the flight regime, thus flying the aircraft was required. In addition, the Top Secret clearance of the program meant excruciatingly tight provisions for all phases of manufacturing, assembly and production. Flying the aircraft out of the public eye was another challenge all together.

By the summer of 1964, Gilliland had been selected by Kelly Johnson as the Chief Project Pilot for the SR-71 program. He ensured he was involved in all aspects of design and engineering efforts, to include an increase in cockpit size from the cramped A-11/A-12. Gilliland remarked, "I'm six feet three inches tall, and the cockpit of the A-12 was too small for me. I ensured I went to every technical meeting we had when it came to the cockpit dimensions of the SR-71 to ensure I influenced the design efforts."[11] His influence was already intact, however, having already amassed test and flight time in the A-11, A-12 and YF-12A Blackbird variants between 1962 and 1964, including a speed record of Mach 3.15 the week before the assassination of President John F. Kennedy.[12] By early December 1964, the SR-71 was still in pieces at Site 2 of Air Force Plant 42, located in Palmdale, California. The aircraft had recently been shipped from Burbank, California in pieces to its final assembly place, but had not yet been reassembled. Gilliland was painstakingly aware that senior Air Force officials would be on hand for the maiden flight scheduled for late December, and offered a delay until after Christmas to ensure adequate time for completion of the aircraft. Kelly Johnson denied the request and stated matter-of-factly that he did not change deadlines every time a situation developed.[13]

The first flight of the SR-71 was destined to be a hallmark event because the SR-71 debut came just four months after President Lyndon Johnson shocked the aviation world with public notification of the A-12 (which he incorrectly called the A-11). He also made the situation more delicate by allowing pictures of the then-unveiled YF-12A interceptor prototype. Resultantly, the SR-71 was publicly acknowledged to ensure President Johnson maintained his credibility over secret aircraft production and future weapons systems. This was critical in that the original prototype SR-71 was actually a Reconnaissance-Strike (RS-71) variant of the A-12, with a 2-man crew consisting of a pilot, weapons/reconnaissance system operator and a nuclear weapon.

Public acknowledgement of the aircraft as the Surveillance-Reconnaissance (SR-71) ensured President Johnson did not mince his words while describing the aircraft.[14]

The prototype SR-71, Article 2001, serial number 64-17950, performed its final engine runs and performance checks on 18 December 1964 and conducted a full "non-flight" with Gilliland at the controls three days later. This included full systems checks, taxi to takeoff position, takeoff roll with minimum burner, and braking with chute extraction; essentially all the actions required for actual flight. The aircraft was then taxied back, debrief items exchanged and a decision made for launch the following day. Gilliland and Johnson jointly agreed that in an emergency, no deadstick approach to landing would be attempted, nor would the aircraft be landed with the gear up; in this scenario, an ejection profile was preferred. Based on Gilliland's assessment and Johnson's concurrence, the aircraft would be fully exercised and the landing gear retracted on its first flight. With that, the SR-71 was ready for its maiden voyage.[15]

The first flight lasted approximately one hour and reached a speed of Mach 1.5 at an altitude of 50,000 feet. Gilliland (callsign Dutch 51) performed his test profile with fellow A-12 test pilot James Eastham and two USAF test pilots giving chase in F-104 Starfighters, deliberately watching the aircraft to voice any problems. Based on previous A-11/12 test flights, Gilliland was accustomed to the general configuration and performance of the aircraft, and proceeded to conduct aggressive flight test parameters during the short sortie. In fact, Gilliland performed a short supersonic dash but a "Canopy Unsafe" light illuminated restricting him to Mach 1.5. Under normal circumstances, this may have ended the flight prematurely, but Gilliland's vast knowledge with the cockpit provided him confidence to press on. He quickly assessed the cause of the problem, confirmed his canopy was locked, and proceeded with the remainder of the flight profile.[16]

Special Considerations

Considering the myriad details requiring scrutinization during the initial test flight, two in particular are notable. First, the SR-71 was equipped with a stability augmentation system (SAS) that used on-board systems to assist in aircraft handling. Flight test conditions called for the systems to be checked and verified in all axes during static and dynamic flight conditions while performing maneuverability and handling checks. Gilliland was expected to check each performance value with the system in the "on" and "off" positions, both individually and collectively. The SAS was unique in that it was ahead of its time and was not originally trusted by the Blackbird pilots; resultantly, its functions were evaluated heavily and the myth quashed.[17]

Secondly, the high-performance J-58 powerplants demanded close attention both before and during flight. The specialized engines required huge amounts of air at varying velocities and pressures to maximize performance and ensure proper operation. The front of the engines contained inlet spikes that moved fore and aft assisting and supplementing thrust, while the other two portions of the engine drew air in, provided combustion, and exhausted the air. Simplistically, the engines were a three-component air inlet system consisting of inlets, the engine itself, and a convergent/divergent blow-in door ejector nozzle. The air inlet control process was fiercely monitored to ensure efficient operation. Incorrect settings had the potential of causing the dreaded "unstart" condition where the shockwave of inlet air momentarily "belching" out causing tons of thrust to instantly become tons of drag.[18] According to Gilliland, this condition was originally corrected by the 2-switch inlet automatic restart system (IARS) and later automatically controlled with a digital automatic flight inlet control system (DAFICS). Surprisingly, at altitude and Mach 3.2, only 17 percent of total thrust came from the actual

engine, the balance coming from inlet and exhaust configurations.[19]

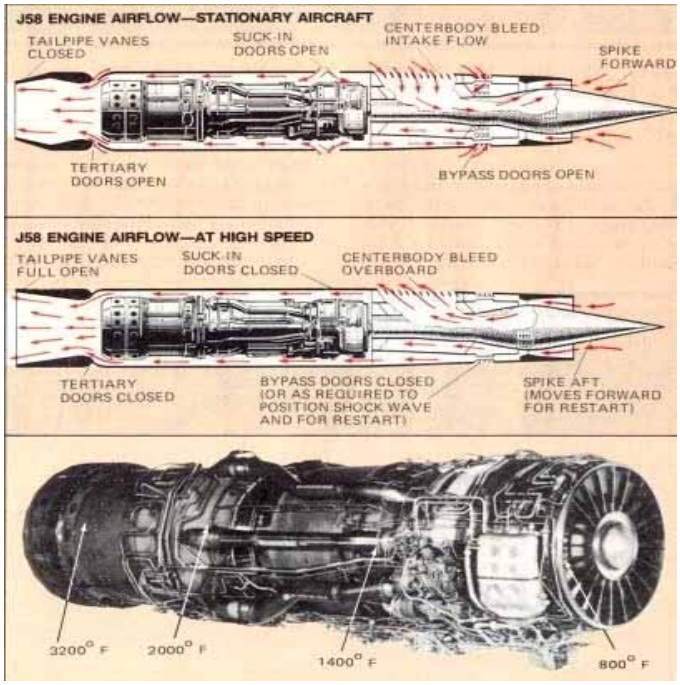

Figure 4. Pratt and Whitney J-58 Turbo (Ram) Jet Engine
Source: www.airwar.ru/enc/engines/j58.html.

With the flight test complete, Gilliland returned to the Palmdale area for final approach and landing. He was directed by Test Operations to perform a low-altitude fly-by at the behest of Kelly Johnson to showcase the aircraft for the crowd on-hand. With the Starfighters in tow, Gilliland smoothly performed a gear up fly-by, then climbed and banked to pattern altitude for landing. The Blackbird's gear dropped and three green indicators illuminated notifying a safe landing gear configuration. The aircraft turned to a wide base leg and speed was set to 185 knots. The remaining "before landing" checklist items then complete, Gilliland positioned the aircraft on a long final to runway 25 and smoothly landed followed by chute deployment. He jettisoned the chute at 50 knots and taxied off the runway to assigned parking amid a throng of delighted USAF officials, Lockheed engineers and maintenance technicians.[20] The first flight of the SR-71 was history, but its legacy was just beginning.

Figure 5. Robert "Bob" Gilliland; First Flight of the SR-71, 22 Dec 1964.
Source: http://www.wvi.com/~sr71webmaster/Gilliland.jpg.

Notes

[1] Crickmore, 150.
[2] Gilliland interview.
[3] Gilliland interview.
[4] Gilliland interview.
[5] Peebles, 58.
[6] Peebles, 56.
[7] Peebles, 59-60.
[8] Pace, 142-143.
[9] Peebles, 80-81, 99-100.
[10] Gilliland interview.
[11] Gilliland interview.
[12] Gilliland interview.
[13] Crickmore, 150.
[14] Anthony M. Thornborough and Peter E. Davies, *Lockheed Blackbirds* (Shepperton, Surrey, England: Motorbooks International, 1988), 18-19.
[15] Crickmore, 151.
[16] Crickmore, 153.
[17] Gilliland interview.
[18] Crickmore, 129.
[19] Gilliland interview.
[20] Crickmore, 153.

Chapter 4

Life After the Blackbird

"The work is exciting. You may get killed. So what!"[1]

-Robert J. "Bob" Gilliland

The After Years

Bob Gilliland continued his service to the Blackbird program testing and flying each aircraft as it became operationally ready. Ensuing SR-71 flights consisted of aircraft development and operational testing efforts, as well as joint efforts with the USAF conducting development of systems and sensors. Aerial refueling tests followed in 1965 with a determination that the aircraft was stable enough for aerial refueling with skilled pilots, and in late 1965, Gilliland helped deliver the first SR-71B pilot trainer model. Gilliland then took the Blackbird to full envelope expansion to confirm its capabilities, a USAF requirement.[2] He notes, "The A-12 could only be flown to 80 percent of design limits, while the SR-71 could be flown to 100 percent, a notable difference."[3]

Following the Blackbird test program, Gilliland continued service with Lockheed performing concept and development efforts on the CL-1200 Lancer, otherwise known as the X-27. Lockheed at the time was struggling in securing government contracts for fighter aircraft, largely due to Kelly Johnson's insistence on specific design requirements. Nonetheless,

Lockheed continued to submit proposals for consideration and the Lancer was just one example. The aircraft was essentially an F-104 fuselage with a heavily modified wing structure intended for export sales in competition of the F-5E Tiger II.[4] The program did not survive and Lockheed continued struggling with its efforts in the fighter-aircraft business. Coincidentally, the USAF ultimately purchased the General Dynamics F-16 Fighting Falcon as its then-newest all-purpose fighter, much to the chagrin of Kelly Johnson. Johnson adamantly stated the original specifications of the aircraft limited its range and utility, something he would not do in a design no matter what the return. Ben Rich, Kelly Johnson's successor at the Skunk Works notes that ultimately, all of Johnson's design mandates were found correct, and the final product F-16 closely resembled Johnson's original design specifications.[5]

Gilliland lastly piloted the Lockheed JetStar corporate aircraft before his retirement in 1975. Upon departure from Lockheed, he stayed involved with various real estate activities as well as other business opportunities. He was, and is, active in the speaking circuit, and divides much of his current time at conferences and presentation worldwide, where he continues to be in high demand. Additionally, he is quick to point out the accomplishments of his son and daughter, professionals in the field of law and medicine, respectively. The Gilliland legacy of academic and civic achievement is intact and continues today.

Awards and Distinctions

Mr. Gilliland's distinctions and honors are numerous, spanning his entire career and the influential contributions he made to the fields of flight test, aeronautics and advanced concept demonstrations. He holds the distinction of being awarded the Ivan C. Kincheloe Award in 1964 by the Society of Experimental Test Pilots for his significant contributions during the Blackbird flight test programs, which recognizes outstanding professional accomplishment in the

conduct of flight-testing by a member test pilot. Additionally, in 1978 Gilliland was involved with fellow test pilot Darryl Greenamyer in setting a world restricted altitude speed record of 982.26 mph flying a highly modified F-104RB aircraft. Overall, Gilliland logged more than 6,500 flight hours and has more experimental supersonic flight test time above Mach 2 and Mach 3 than any other pilot.

Lastly, Mr. Gilliland is also a trustee of the Association of Naval Aviators and a 2002 Godfrey L. Cabot Award recipient, which recognizes unique, significant, and unparalleled contributions to advance and foster aviation or space flight. Today, he continues involvement in various capacities as an advocate on the subjects of aviation and advanced flight test.[6]

Conclusion

Robert J. "Bob" Gilliland distinguished himself as a true pioneer of American aviation in addition to that of heroic and courageous pilot. The dangerous and challenging environment(s) in which he worked, the secrecy of the programs he was involved in, and the intense pressure of testing technology critical to US national security forged him into a true American hero. Mr. Gilliland's story is symbolic in his simple beginnings and volunteer attitude along with his recognized intelligence. His appointment to the US Naval Academy and subsequent assignments and challenges tested his toughness, again proving he had the right stuff. Further, his willingness to apply his talents to the aviation field he loved enabled him to provide invaluable service to his country. Mr. Robert J. Gilliland is a true national treasure and it is truly an honor to have him amongst the ranks of this country's finest.

Notes

[1] Gilliland interview.
[2] Crickmore, 153-154.
[3] Gilliland interview.
[4] GlobalSecurity.org Web Site, Military, "Lockheed X-27 CL-1200 Lancer," http://www.globalsecurity.org/military/systems/aircraft/x-27.htm, (c) 2000-2007 GlobalSecurity.org.
[5] Rich and Janos, 291-292.
[6] Gilliland interview.

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