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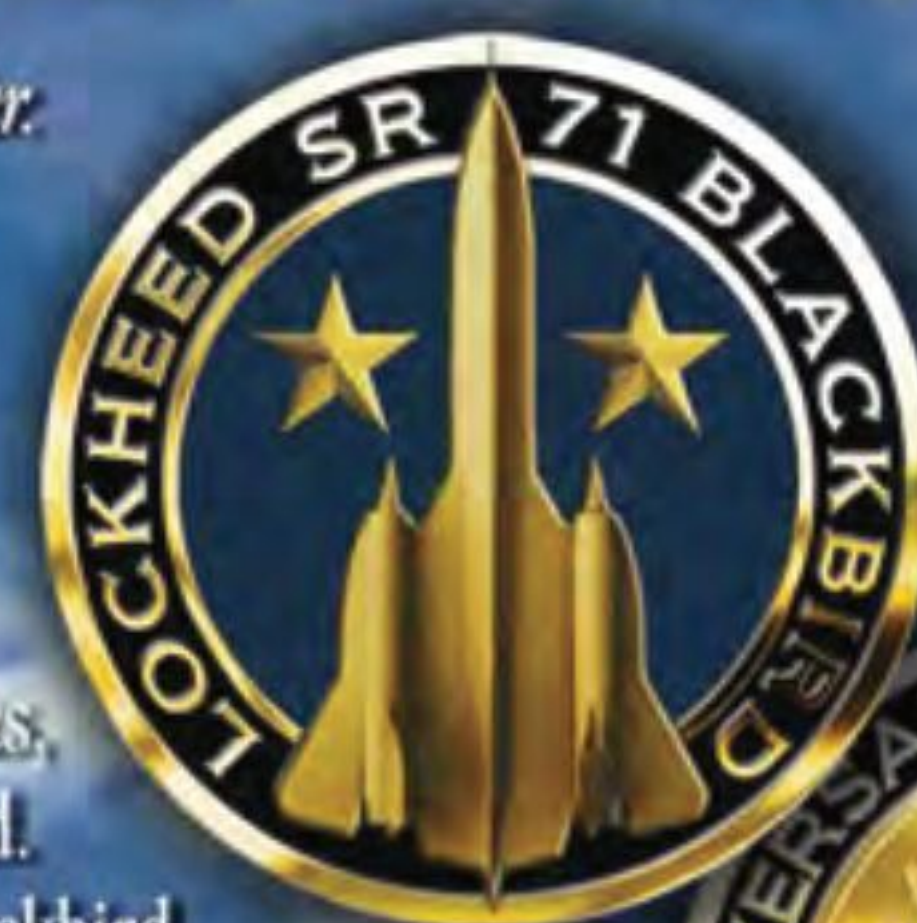
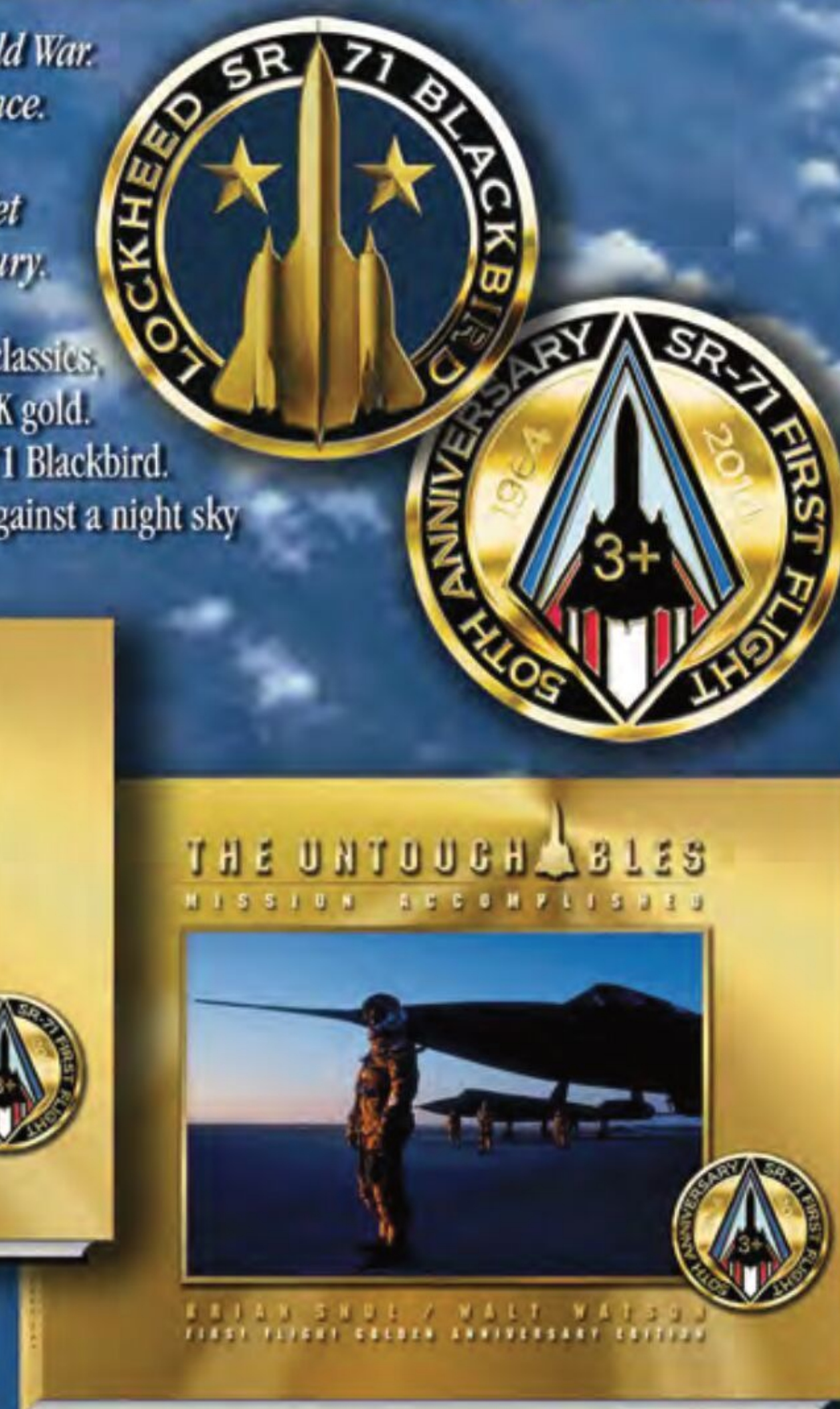
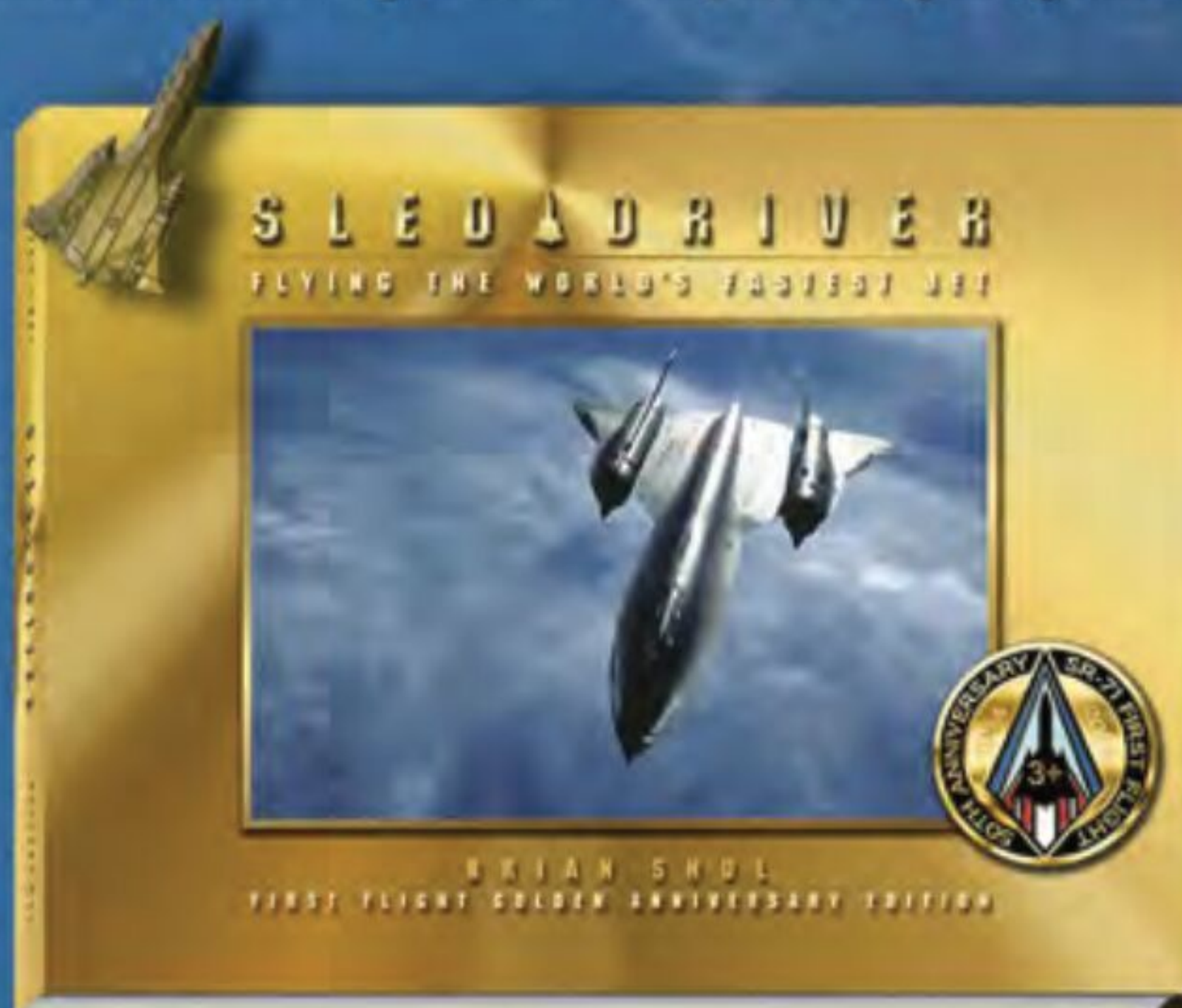
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# Covert and Stand-Off Reconnaissance

The term spy plane tends to conjure up impressions of unusual looking, darkly-painted aircraft, perhaps epitomised by the magnificent and high-performance Lockheed SR-71 Blackbird. Even today, 22 years after the type's second retirement from US Air Force service, the SR-71 is still top of the bill of aircraft designed and built for the business of spying. However, nations that operate any type of 'spy plane' never refer to them as such. Reconnaissance is the much preferred and politically-correct term used by nations to describe their reconnaissance-configured aircraft regularly used to snoop on other nations! Those nations include China, France, Russia, Sweden, the United Kingdom, and the United States. All regularly fly reconnaissance missions, snooping on neighbours and foes alike.

One surprising fact about the collection of spy planes used since World War Two is the range of types used for the mission. At one end is the menacing looking SR-71 Blackbird capable of Mach 3+ flight,

through specialised versions of strategic bombers such as the RB-47 Stratojet, to small twin-engine turboprop RC-12-series aircraft operated by the US Army.

With such facts in mind, the content of this much-anticipated edition provides details of some really cool aircraft and their respective operations from the post-war years to the current day. You can find coverage of a variety of classic types including the Caravelle, Comet, DC-8, EC-47, Nimrod, RB-45 Tornado, RB-47 Stratojet, SR-71 Blackbird and the U-2 in this special publication. Whether you're an avid aviation enthusiast or somebody with an interest in nation state intelligence gathering, *Spy Planes* is an essential read.

*Mark Ayton*  
**Mark Ayton**  
 Editor  
*Spy Planes*



ABOVE: Lockheed Martin



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# 1948-1960

## The Golden Age of Anglo-American Strategic Reconnaissance

**David Isby** tells the story of American and British strategic reconnaissance from the post-war years through to 1960

**O**n April 5, 1948, the 'golden age' of airborne intelligence, surveillance, and reconnaissance (ISR) began: a US Air Force Boeing RB-29 assigned to the 46th Reconnaissance Squadron made the first overflight of Soviet territory authorised by the National Command Authority. That golden age ended on May 1, 1960, at 70,000ft over the Soviet city of Sverdlovsk (currently Yekaterinburg). A Lockheed U-2 flown by US civilian pilot Francis Gary Powers was shot down by an S-75 Dvina (SA-2 Guideline) surface-to-air missile (SAM).

In the Cold War years between the two missions, airborne ISR was critical to enabling the United States and its allies to evolve policies that handled the Soviet threat while

avoiding escalation into nuclear war. While Air Force General Curtis LeMay, then commander of Strategic Air Command (SAC), thought projections of the Soviet nuclear build-up so compelling as to advocate a pre-emptive war, ISR missions produced contradictory evidence for President Dwight Eisenhower – whose wartime command had taught him the value of intelligence – that the perceived bomber and missile gaps amounting to Soviet nuclear superiority were, in fact, illusory.

Aside from a very few individuals at the highest level of government, the military, and the aerospace industries, only those carrying out strategic ISR missions knew about their importance. The value of overflights of Soviet

territory was such that the US flew hundreds between 1948 and 1960, in addition to many more standoff collection flights. The Royal Air Force was an active participant in the campaigns from the beginning, using its own aircraft and rules of engagement.

### An Urgent Need

In 1945, the deterioration of relations with the Soviet Union made the possibility of a conflict something that had to be considered, first by the British and then by American decision makers. It was apparent that Anglo-American strategic airpower would be the only way to strike directly at the Soviet Union.

But there was almost no information available to plan air operations against

BELOW: A Boeing WB-29 of the 55th Weather Reconnaissance Squadron based at McClellan Air Force Base California seen in April 1952. In 1949, a WB-29 provided the first evidence that the Soviets had exploded a nuclear device. The 'bug catcher' air scoop atop the fuselage gathered airborne debris from Soviet nuclear tests. Such missions required the aircraft to be decontaminated, as seen. National Museum of the US Air Force







ABOVE: *The US Air Force was initially opposed to the U-2. Sending a single-engine one-man aircraft alone over hostile territory did not seem like a good idea. But the high-altitude performance demonstrated by CIA U-2s led to a change in policy. This U-2, marked 001, was the first delivered to the Air Force in 1955; 65 years later versions of the type are still in operation.*  
National Museum of the US Air Force

the Soviets except for captured German intelligence. Some of the initial air reconnaissance efforts, the US Peaceful Air Reconnaissance Program, and the Anglo-American Project Bourbon, starting in 1945-1946, authorised, at the theatre level, overflight of Soviet-occupied territory (but not yet the Soviet Union itself). Most missions were flown in friendly or international airspace including the air corridors to Berlin from stand-off positions, using oblique cameras for photographic intelligence, as well as the signals intelligence (SIGINT) technologies developed during World War Two. Communications intelligence (COMINT) was found to be valuable, as the vast size of the Soviet Union – and its newly-occupied territory – required extensive use of radio communications rather than landlines.

Strategic Air Command was established as part of the US Army Air Force on March 21, 1946 and started its own reconnaissance collection campaign over the high Arctic using Boeing RB-17 Flying Fortress and RB-29 Superfortress aircraft in September 1946. An Anglo-American aerial photo-mapping campaign, Project

Casey Jones, provided accurate maps of Europe and North Africa. Project Leopard provided oblique photographic coverage of the Soviet Union's Chukotskiy Peninsula, the easternmost tip of Eurasia.

SAC became part of the US Air Force on September 26, 1947, just eight days after the service was founded.

By 1948, experience had showed that overflights could often bring back valuable images and caused Soviet air defences and communications to light up, so that waiting SIGINT and COMINT platforms could collect against them. Some overflights required high performance aircraft. On May 10, 1949, the first reconnaissance overflight mission was conducted by modified Lockheed RF-80 Shooting Stars over the Soviet-occupied Kuril Islands in the northern Pacific. These missions continued for two years.

On September 3, 1949, a Project Fitzwilliam WB-29 weather reconnaissance aircraft collected radioactive particles from the

high-altitude jet stream, hard evidence of the first Soviet atomic bomb test. The need to gather intelligence about this new threat and its delivery systems became terribly urgent. Anglo-American cooperation was regularised through a series of agreements.

## Shooting Starts

In April 1950, the Soviets shot down a US Navy Consolidated PB4Y Privateer over the Baltic, the first deliberate shootdown of a standoff ISR aircraft. This represented a change in Soviet policy such that attacks on allied ISR aircraft operating at stand-off range from Soviet airspace and territory continued until November 1970.

The Navy replaced its SIGINT-configured PB4Ys with higher-performance Martin P4M Mercator and Lockheed P2V Neptune aircraft.

Communist victory in the Chinese Civil War and the outbreak of the Korean War (1950-1953) shifted the strategic focus to east Asia. In addition to standoff collection missions, overflights of Chinese territory started; the RAF used Spitfires PR19s based in Hong Kong. The US Central Intelligence Agency (CIA) expanded its involvement in overflights, setting up joint operations with the Chinese Nationalists in Taiwan and a wide variety of aircraft operated over mainland China and neighbouring countries until the 1970s. North American RB-45 Tornado aircraft flew over North Korea and China, but their 45,000ft service ceiling made them vulnerable to attack by Mikoyan MiG-15 interceptors.

In 1952, the United States needed to know whether the Soviets were preparing to escalate the Korean War, then at stalemate on the battlefield, or create further conflict in Europe. On September

RIGHT: *RB-47H Stratojet 53-4288 was configured for the SIGINT mission and survived an operational flying career with the 55th Strategic Reconnaissance Wing; all versions of the B-47 had a high accident rate.*  
National Museum of the US Air Force





## "In 1952, four US Air Force RB-45Cs were selected for a highly secretive RAF project called Ju-Jitsu, the name given to planned overflight missions deep inside the Soviet Union."

17, 1952, Major Roy Kayden flew a piston four-engine Boeing RB-50 over the Arctic islands of Franz Josef Land where the Soviets were thought to be building bomber airfields. Kayden's mission found no evidence of this based on the intelligence gathered by the RB-50's cameras and SIGINT systems. Years later, Kayden said: "Flying 180 miles-per-hour at less than 3,000 feet, under a scattered to broken cloud cover, while searching visually for evidence of a Soviet presence on one island after another, so impressed me that I never forgot it."

Over a number of months in 1952, RB-45s successfully checked out Khabarovsk Air Base in Siberia. In October, the first Boeing RB-47E Stratojets, versions of the new six-engine medium bomber configured for reconnaissance, flew missions to photograph five bomber bases located deep inside eastern Siberia.

On October 17, 1952, Colonel Donald Hillman cruised over them

at 40,000ft in daylight. He said: "We had finished covering two of our five targets, taking radar and visual images, when warning receivers on board announced that we were being tracked by Soviet radar. Sitting in the rear seat behind me, Ed Gunter [the co-pilot] was alerted to be ready for a possible encounter with MiG-15s, which we knew to be stationed in the area. Ed swivelled his seat 180° to the rear to control the bomber's only defensive armament, the [20mm] tail-guns. A few minutes later he advised over the intercom that he had Soviet fighters in sight, below and to the rear, climbing desperately to intercept". The MiG-15s could not get within range.

The worldwide overflight effort continued. North American RF-86As flew over Vladivostok in 1954, returning at intervals over the next year. In Europe, West Germany-based North American RF-100A Slick Chicks flew similar missions. Information gathered during those airborne

ISR missions, revealed the Soviets were not massing bombers for war.

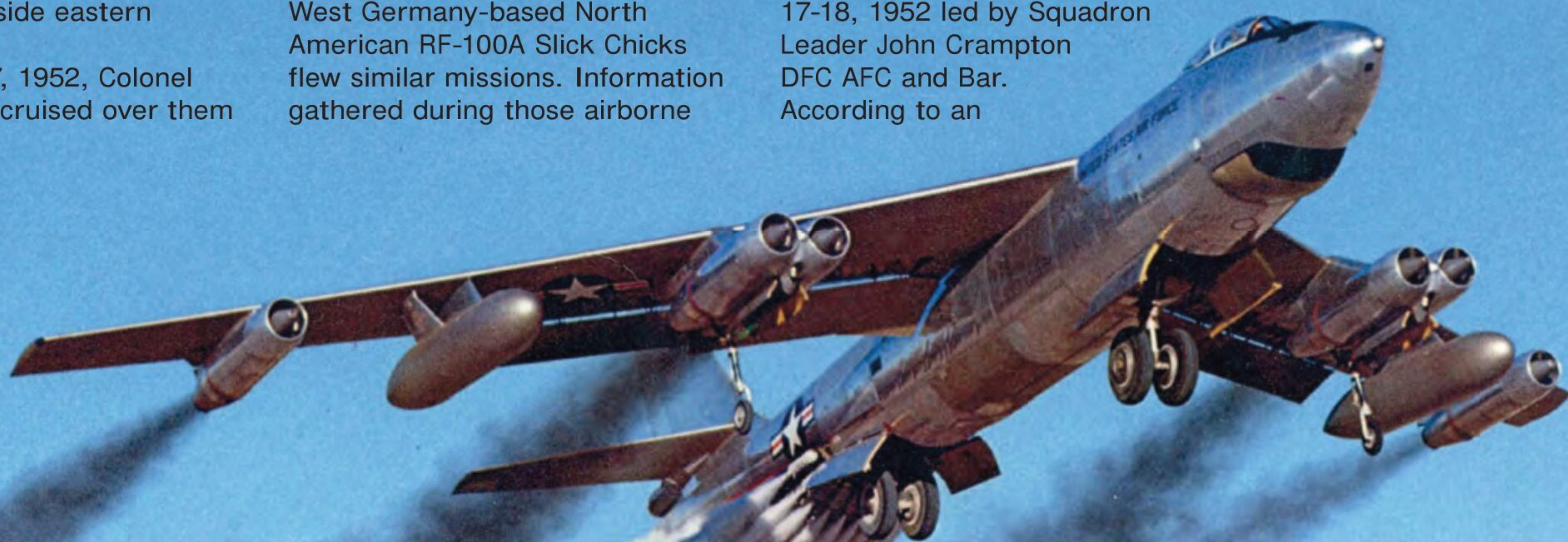
That evidence did not allay concerns of a looming bomber gap created by the mass-production of Soviet jet bombers.

In August 1951, the Royal Air Force commenced initial training on RB-45C Tornado aircraft at Barksdale Air Force Base, Louisiana, and further training at Lockbourne Air Force Base, Ohio.

In 1952, four US Air Force RB-45Cs were selected for a highly secretive RAF project called Ju-Jitsu, the name given to planned overflight missions deep inside the Soviet Union.

Those aircraft belonged to the 322nd Strategic Reconnaissance Squadron deployed to Sculthorpe on TDY from Lockbourne at the time.

Three of the aircraft flew the first RAF mission overnight April 17-18, 1952 led by Squadron Leader John Crampton DFC AFC and Bar. According to an



LEFT: An RB-47H SIGINT aircraft as used during Operation Homerun takes off with JATO (jet assisted take-off) assistance. Despite having six engines, B-47s were underpowered and often had to use JATO to get airborne with a full fuel payload. National Museum of the US Air Force



RIGHT: *This image shows the Soviet Tyuratam missile launch complex first discovered and photographed by a U-2 in 1957. It was one of the high-value locations Francis Gary Powers was supposed to photograph on his last U-2 mission.*  
National Museum of the US Air Force

BELOW: *RB-47Es conducted many overflights of Soviet territory but required both forward basing (including in England) and aerial refuelling from KC-97 Stratofreighter tankers.*  
US Air Force

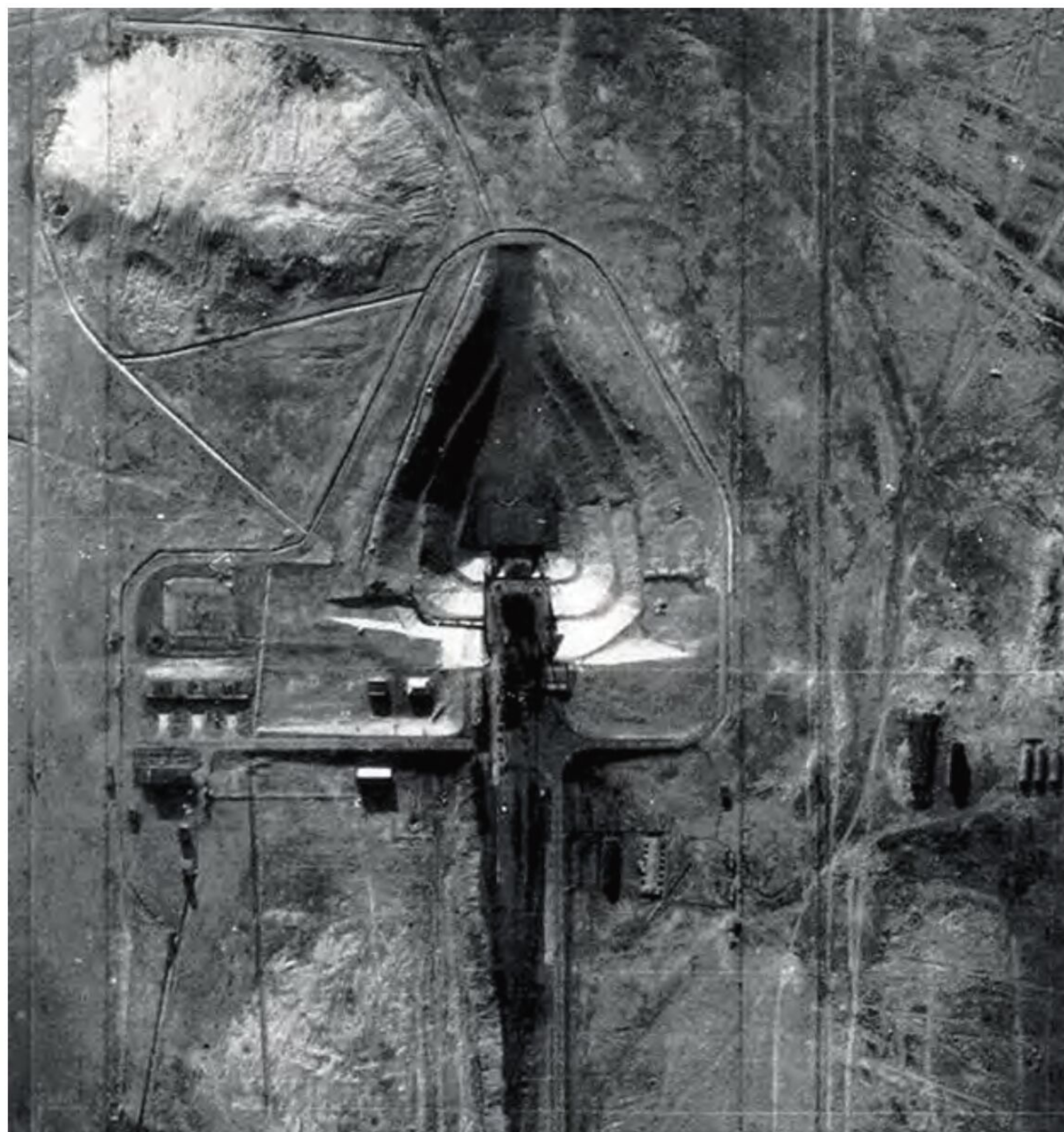
account by the then commander of the SAC detachment at Sculthorpe, Lieutenant Colonel Marion Mixson, the three aircraft entered the Soviet Union simultaneously at three different locations in the northern, central, and southern areas of the Western USSR. Flying at about 35,000 feet, the aircraft proceeded on separate tracks one to the Baltic states, Poland, and the GDR, one to Belorussia and the third to the Ukraine and the Black Sea coast.

The 322nd Strategic Reconnaissance Squadron returned to Lockbourne in late 1952.

A second, and final RAF mission was flown overnight on April 28-29, 1954 once again using aircraft deployed from Lockbourne and led again by Crampton. Discussing the final mission, he said: "Having taken nearly all our photos we were heading south towards Kiev at 36,000 feet and Mach 0.7... My reverie was rudely interrupted by the sudden heart-stopping appearance of a veritable flare path of exploding golden anti-aircraft fire. There was no doubt about it; it was very well predicted flak – dead ahead and at the same height as we were. My reaction was instinctive – throttles wide open and haul the aeroplane round on its starboard wing tip until the gyro compass pointed west."

On both missions, all three RB-45s returned undamaged with the radar images. The intelligence gathered on the Ju Jitsu missions was used to plan and guide attacking bombers in the event of a conflict.

After an RAF Avro Lincoln configured for the SIGINT role was shot down in March 1953 during a MiG attack in a



Berlin air corridor, four modified Boeing Washington bombers (former US Air Force B-29 Superfortress aircraft) flew SIGINT operations with 192 Squadron (later renumbered 51 Squadron), until they were replaced by jet-powered De Havilland Comet R2s by 1958.

Additionally, the RAF used twin-engine English Electric Canberras as jet bomber and reconnaissance aircraft, flew standoff ISR missions. The US Air Force had been so impressed by the Canberra's capability that it ordered its own versions, produced by Martin under license, including the extended-wing RB-57D that could carry out ISR missions at altitudes of 65,000ft, higher than an RB-47 could operate.

Operation Robin, a joint SAC-RAF programme, integrated three RAF Canberras with US-made long focal-length cameras for standoff missions. Unconfirmed reports claim the aircraft were used by 540 Squadron to fly deep penetration missions, including to the Kapustin Yar missile test site in the southwestern region of the USSR where the Soviets were developing ballistic missiles. One Canberra, in August 1953, was reportedly damaged by a MiG and diverted to a recovery base in Iran.

On May 8, 1954 Major Harold 'Hal' Austin took his British-based RB-47E to overfly and photograph nine Soviet airfields. Austin later wrote: "Our first Soviet targets were two large airfields near Murmansk. We coasted in at 12 noon at nearly 40,000 feet over Murmansk." He was trailed by MiG-15s. "A total of six MiGs arrived behind us, with obvious intent to try to shoot us down. By this time, we had covered two more major airfield targets near Arkhangelsk and were turning to the southwest toward our last two targets." A flight of afterburner-equipped MiG-17s which intelligence had told Austin not to expect – turned into Austin's six o'clock position. "We saw cannon tracer shells going both above and below our aircraft ... this guy had almost come up our tailpipes." The RB-47E's 20mm cannon opened fire but soon jammed. It still deterred the Soviets from closing in. The RB-47E escaped, surviving a single 23mm cannon hit. But, to succeed, overflights of the Soviet Union needed to fly higher than military aircraft had





## STRATEGIC RECONNAISSANCE: THE GOLDEN AGE



ever operated.

### The Goal of Undetected Flight

In 1954, the CIA asked President Dwight Eisenhower for an aircraft designed from the outset for overflights, able to fly at altitudes above Soviet radar and interceptor coverage rendering them undetectable. Eisenhower gave the go-ahead for Project Aquatone, which became the Lockheed U-2. Designed by Kelly Johnson and the Lockheed Skunkworks design staff, it would be ready for operations by 1956. The Air Force, uninterested in the programme at first, soon placed its own order. The U-2 demonstrated exceptional performance. The RAF was invited to send pilots to

train on them.

Until the U-2 would be operational, there was a need for survivable overflight platforms to bring back imagery from deep inside the Soviet Union. Projects Grandson and Genetrix launched some 516 unmanned high-altitude free balloons with automatic cameras to drift, with the prevailing winds, from Europe, across the Soviet Union, to the Sea of Japan, where their film would be retrieved in-flight. Only 44 arrived successfully - not a reliable source of intelligence.

In 1955 and 1956, US Air Force Captain Gerald Cooke was flying overflights of eastern Europe in a Martin RB-57A Canberra, its ISR

capabilities enhanced by Project Heart Throb. Cooke recalled: "My first mission included targets near Brno and Bratislava in Czechoslovakia. I recall getting only one of my targets on one overflight (probably the third flight) because of cloud cover. I also remember seeing MiG-17s on one mission in the vicinity of Budapest, Hungary, probably on my second or third mission. My fourth mission was aborted because I was forming contrails at the point of penetration over communist territory. ... The RB-57A Heart Throb Canberra was a great aircraft and a joy to fly."

Between March and May 1956, General LeMay, with permission, staged Operation Homerun, a sustained overflight campaign conducted by SAC RB-47Es assigned to the Lockbourne-based 10th Strategic Reconnaissance Squadron operating from Thule Air Base, Greenland. Missions were flown with RB-47Hs assigned from the 343rd Strategic Reconnaissance Squadron based at Forbes Air Force Base, Kansas, and support with multiple aerial-refuelling brackets from SAC's Boeing KC-97 tankers made the operation possible. One of the deepest penetrations was on April 14 when three RB-47Es overflew the industrial city of Norilsk, 200 miles north of the Arctic Circle.

On the final Homerun mission, six RB-47Es flying at 40,000ft crossed the

LEFT: **US Navy Martin P4M Mercators** were used for **SIGINT** and **standoff ISR** missions during which they were repeatedly attacked by Soviet and Chinese fighters ending in shootdowns or narrow escapes.

Naval Historical & Heritage Center/Cdr Richard Timm

RIGHT: **The Boeing RB-50F Superfortress** was the main US Air Force strategic aircraft configured for **SIGINT** in the early 1950s. Many had the original gun turrets removed to increase performance, which is partly why several RB-50s were shot down by Soviet and Chinese fighters.

National Museum of the US Air Force

BELOW: **Early-production CIA U-2s** being prepared for operations at 'The Ranch' in Nevada, now universally known as **Area 51**. **NACA** (National Advisory Committee for Aeronautics) tail markings were part of the CIA's cover story that U-2 aircraft were civilian high altitude research aircraft. **NACA** was superseded by the National Aeronautics and Space Administration, aka **NASA**.

US Air Force







East Siberian Sea coast at Ambarchik and headed for the bomber base at Anadyr near the Bering Sea. There, they turned west and landed at Eielson Air Force Base, Alaska. Colonel George Brown was a planner and describing the process, he said: "This was the one mission that had the entire staff and commanders excited, as well as a bit apprehensive because of its audacity, especially when it was executed without a hitch and without a reaction from the Soviets."

Operation Homerun's 156 overflight sorties, without losses or hostile action, provided a clear electronic and photographic picture of the northern Soviet Union. Its unstated purpose may have been to demonstrate Soviet vulnerability to its leadership.

On July 4, 1956, the U-2 made its first overflight, a successful mission, bringing back what had been the highest collection priority for years: photos of Kapustin Yar. They showed Soviet ballistic missile development was less advanced than US analysts had projected. The perceived missile gap that had led LeMay to fear a nuclear Pearl Harbor a few months earlier did not exist. Yet Soviet diplomatic protests demonstrated that the U-2 had not achieved its objective of flying undetected above radar cover.

US military aircraft ended most overflights of Soviet territory after December 1956, when a three-sortie

RB-57D effort found little and triggered diplomatic protests, but U-2s continued overflights of the Soviet Union.

Initially operated by the CIA with civilian pilots using a thin weather research cover story, U-2 overflights proved controversial – the British ordered them to leave bases in England – but close intelligence cooperation between the United States and the UK continued.

British access to U-2 imagery was interrupted when the 1956 Suez crisis diverted their overflight missions to the Middle East. But Suez also demonstrated how aerial photography could enable crisis resolution when shared imagery helped the negotiations for ceasefire and disengagement agreements.

Overflights of non-Soviet territory and standoff missions in international and friendly airspace were continued. In 1958, a US Air Force Lockheed C-130A Sun Valley communication intelligence aircraft was somehow lured across the Soviet southern border and shot down by MiG-17s over Sanaschen, Armenia. All 17 crewmembers were killed.

U-2s continued overflights; CIA efforts being supplemented by U-2s based in Turkey, some flown by RAF pilots over the Middle East and, starting in 1959, the Soviet Union. U-2s, RB-57Ds and RAF Canberras also continued to fly standoff SIGINT missions, some to collect telemetry data from Soviet missile tests at Kapustin Yar.

## After the Fall

After Gary Powers was shot down in a Lockheed U-2 spy plane over Sverdlovsk on May 1, 1960, overflight missions of the Soviet Union, constrained since 1956, came to a halt. While 24 U-2 overflights of the Soviet Union had gathered valuable intelligence and demonstrated the value of the aircraft's design, by August 1960, Eisenhower received the first photographic imagery from a US reconnaissance satellite.

But even after Soviet overflights ended, ISR missions still shaped the course of the Cold War, most significantly in the 1962 Cuban missile crisis, when imagery guided US decision-making and provided the world with evidence of Soviet ballistic missiles in Cuba. Other ISR operations monitored Soviet merchant ships carrying more missiles to Cuba.

Today, Anglo and American ISR aircraft continue to fly strategic missions. In the event of a crisis, they operate in international airspace, monitoring events from a standoff range. Both the Royal Air Force and the US Air Force fly SIGINT-specialised Boeing RC-135V and RC-135W Rivet Joint aircraft, and their missions remain as vital today as they were during the Cold War. Despite the August 1960 advent of reconnaissance satellites, the U-2 spy plane continues to conduct high-value ISR missions worldwide.



# Reconnaissance Comets and Nimrods

**Jon Lake** reviews two of the RAF's SIGINT aircraft, the Comet R2 and the Nimrod R1

**H**aving pioneered airborne signals intelligence (SIGINT) gathering during the World War Two, the UK maintained autonomous sovereign national capabilities throughout the Cold War. The RAF's primary SIGINT unit (successively designated as the Central Signals Establishment Development Squadron, then as 192

Squadron, and finally as 51 Squadron) made a disproportionate contribution to the wider NATO/allied SIGINT effort throughout the Cold War and since, with what has often been a trio of primary mission aircraft. In the early days, three Lincolns were augmented by a Mosquito, while the unit's three Washington aircraft were supplemented by a pair of SIGINT-configured Canberra B2s. Due to the Washington's vulnerability, the Canberras soon became 192 Squadron's primary mission platforms, even though they carried only a single specialist

operator where the Washington carried six, and the Lincoln two.

Everything changed with the introduction of the Comet in December 1957. The Comet enjoyed much better speed and altitude performance than the Washington, and carried 12 (later 13, and eventually 12 again) specialist operators, making it significantly less vulnerable and more operationally useful. Despite this, the Canberras continued in use, the Canberra flight eventually growing to four long-nosed Canberra B6RCs. The Canberras often flew 'feints', deliberately stirring up Soviet defences, which the Comets





BELOW: *Comet R2 XK655 at its final resting place, the Strathallan Collection at Auchterarder, Perthshire in September 1976.*  
*AirTeamImages/Carl Ford*

would then monitor and record. Sometimes the Comets would fly towards Soviet or Warsaw Pact territory, flying a profile similar to a bomber, and the Canberras would fly in close formation, until they dropped away and accelerated as though they were air-to-surface missiles. This would often prompt Russian air defence radar operators to react! Alternatively, the Canberras could operate singly or in pairs, without an accompanying Comet, though they carried only a single specialist operator, tasked with ELINT or COMINT, but not both.

### Comet R2

The Comet SIGINT story began in 1953, when ACAS (Signals) recommended the procurement of three Comet 2s powered by Avon engines to replace the Washington aircraft, pending the availability of the preferred solution, which was the Vickers V1000. The Comets were to be augmented by the two Canberras, and by four converted Shackleton MR1s for low level operations – the endurance of the Comet being viewed as being inadequate below 35,000ft. It was even suggested that two Comet 1s powered by Ghost engines might be obtained as interim equipment.

In the event, three Comet 2s were ordered for Signals Command under a 1955 contract. The aircraft cost £350,000 each, and a further £185,000 was allocated for conversion. Basic structural and systems work for the conversion was carried out by Marshall of Cambridge, who fitted a new two-man navigation station in place of the forward luggage compartment, aft of the flight deck on the port side. Twin

Blue Shadow side looking airborne radar antennas were installed, together with Green Satin Doppler, Gee Mk3, and a host of other nav aids. Marshall also stripped out all passenger equipment, including the galley and one of the two toilets. Instead, equipment racks with forward-facing twin seats were installed on each side of the aisle, seating a maximum of 26 personnel. These racks were then fitted with their SIGINT equipment by the Central Signals Establishment at RAF Watton, Norfolk.

The operational fit was complicated by the fact that the planned Breton centimetric ELINT system was not expected to be ready in time. This meant that the aircraft was originally delivered with a Phase 1 fit based on equipment taken from the Washington, with Breton following on as a Phase 2 fit.

The three aircraft were delivered with the square windows that had caused such problems in the BOAC Comet 1s, and this required them to be operated at a reduced pressure differential, requiring the crew to wear oxygen masks at operational altitudes.

Originally the crew consisted of eight ELINT operators, two COMINT operators and two supervisors, with an additional operator when Breton finally came on stream. To train the new operators required (between six and seven extra per crew compared to the Washington) 192 Squadron gained an additional Varsity training aircraft.

The first Comet 2R, XK663, officially designated as the Comet R2, was delivered to Watton on April 18, 1957, and became available for operations in February 1958, and the first sortie was made on February 3. A second

aircraft, XK659, joined the squadron in April 1958, and the third, XK655, with a partial Breton installation, in early 1959. By this time, 192 Squadron had been renumbered as 51 Squadron, with the official stand up of the new unit taking place at RAF Watton on August 21, 1958.

### Sorties

The Comets and Canberras flew border sorties, and flew into the Baltic, the Black Sea, the Caspian, and the Barents Sea (the latter using Bodo in Norway as a stepping off point), and mounted sorties against Syria, Israel, and Egypt from Nicosia in Cyprus. Most operations were initially flown on moonless nights, though daylight sorties were flown over West Germany and in the Mediterranean. The squadron also flew the first of many claret missions against Soviet warships.

The squadron suffered a blow when XK663 burned out in a hangar at Watton in the early hours of June 3, 1959, but an even bigger shock came when a US Air Force RB-47H was shot down by a Soviet Air Force MiG-19 while operating in international airspace above the Barents Sea on July 1, 1960. The RB-47Hs usually carried just three ELINT operators, with no COMINT capability to provide early warning, and their navigation was much less precise. Despite this, 51 Squadron found itself limited to flying no closer than 30 nautical miles from enemy coasts or borders, and sudden deviations in track towards enemy territory were briefly banned!

Use of Sharjah in the UAE as a base for 51 Squadron's operations started in 1962, and in 1963, operations began in





the Far East.

An air transport-configured Comet C2 XK695, with oval cabin windows, was converted to R2 standards to replace XK663, and was handed over to 51 Squadron on September 30, 1963. By now, the squadron was based at RAF Wyton, Cambridgeshire, having made the move from Watton in April 1963. The new aircraft was delivered to a much-improved standard, even though the others had undergone frequent upgrades during their squadron careers, with a mixture of US and British equipment.

No.51 Squadron's seemingly modest fleet of four Canberras and three Comets was actually NATO's second-largest airborne SIGINT force, and included NATO's only low-level ELINT capability. Squadron activities were carefully co-ordinated with SIGINT missions flown by the US Air Force and US Navy, and joint operations were flown on occasion. The squadron earned the respect of the wider SIGINT community for the quality of the intelligence it produced, which was based on the long-serving specialist operators, many of whom had spent decades on the squadron, and whose skill at manipulating their manually-tuned receivers was unmatched. The squadron's aircraft were frequently intercepted by hostile fighters, and occasionally fired upon, but superb navigation and early warnings from the COMINT operators meant that no aircraft were lost.

This was the reason for the unprecedented sharing agreement between the United States and the UK.

Other nations received end-product intelligence analyses derived from SIGINT, whereas the UK received raw ELINT data.

### Replacement Plan

A replacement plan for the Comet and Canberra was agreed in 1968, not least because the Comets were rapidly approaching the end of their fatigue lives. Comet operations wound down in 1973, as one crew was removed from operations in order to convert to the Nimrod R1 (see below).

The first of the three aircraft to retire was XK659 on May 13, 1974. It was subsequently flown to Manchester airport from where it was moved to Pomona Dock where it became a restaurant annexe to the *North Westward Ho* – Manchester's first pub-on-a-ship. The ship was a former Isle of Wight passenger ferry decommissioned after an explosion in the engine room in 1971. The Comet didn't last long, being scrapped in 1981.

XK655 made its final operational flight on July 1, 1974, subsequently being flown to the Strathallan Collection at Auchterarder, Perthshire on August 28, 1974, where its undercarriage collapsed on arrival! The museum finally closed in September 1988, but XK655 lingered on until she was scrapped in 1993. The nose was saved, and Tim Moore of Skysport Engineering Ltd in Bedfordshire eventually restored it and displayed it on a roof at Gatwick Airport in 1995, repainted in BOAC colours. In March 2008, the remnant was moved to the Al Mahatah museum in the UAE.

The last Comet R2, XK695

was withdrawn in January 1975, subsequently flown to the Imperial War Museum at Duxford on January 10. Despite being in the care of a national museum, the aircraft had to be broken up in October 1992 because of excessive corrosion. The fuselage went to RAF Newton, Nottinghamshire where it was used as a training aid for police dogs, until it was scrapped. The nose and front fuselage were donated to the Mosquito Aircraft Museum in 1995, by Hanningfield Metals in Essex.

### Nimrod R1

The then Hawker Siddeley Nimrod R1 became 51 Squadron's longest-serving aircraft type, clocking up 37 years in frontline service. Though the external configuration and internal layout changed relatively little in that time, there were major changes in equipment, doctrine, and tactics, and the Nimrod R1 aircraft retired in 2011 were configured very differently to the aircraft that entered service in 1974. One constant was that 51 Squadron was always at the forefront in terms of operational delivery and was always the most in demand UK asset by allied force commanders.

When the aircraft finally retired, Group Captain Chris Jones, the then





BELOW: *Nimrod R1 XW665 marked with a 51 Squadron tail badge, moments from touchdown at RAF Waddington.*  
*AirTeamImages/Ian Tate*

RAF Waddington station commander observed that: "From the Falklands to Afghanistan – and at many discrete locations in between – the R1 has been there, mostly in the background but always providing the timely, accurate, and directed intelligence and information that answered questions, shaped operations, and kept others safe."

Cancellation of the Vickers V1000 in 1955 led to a shake up in the RAF's Comet replacement plans, such that the Vickers VC10, Boeing 707 and Comet 4 were all considered, with the VC10 emerging as the clear favourite, though it was subsequently eliminated on cost grounds. After dallying with a proposal to convert three RAF Comet C4s to SIGINT configured aircraft, attention switched to a variant of the new Nimrod maritime patrol and anti-submarine aircraft, the prototypes of which were designated HS801Rs.

Three Nimrod R1s were ordered in 1969, with an estimated development cost of £2.38 million, production costs of £11.34 million and special equipment costing another £1.75 million.

The HS801R featured a new ventral panner which eventually accommodated seven 'spinner' direction finding antennas. The panner followed the contours of the original bomb bay but was covered by dielectric

hatches which could be opened on the ground for access but could not be opened in flight. Not intended for the maritime patrol role, Nimrod R1s did not feature a magnetic anomaly detector tail boom, but another spinner, and provision for further antennas to be housed in the nose of wing-mounted pods.

Internally, the aircraft was configured with two navigator positions on the port side, five consoles or 'racks' facing to port, and eight facing to starboard in the aft of the cabin. Three additional forward-facing AUX racks were also provided.

Though the first Nimrod R1, XW664, was delivered to RAF Wyton on July 8, 1971, it was virtually an empty shell, and it underwent two years of fitting out with mission systems under SRIM 3623, flying for the first-time post-conversion on October 31, 1973. The jet was finally handed over to 51 Squadron in February 1974 and flew its first operational mission on May 3. Two further aircraft, XW665 and XW666, were delivered in relatively short order.

## Operations

Early Nimrod R1 operations followed much the same pattern as those previously conducted by the Comets. Interestingly, Tehran, Iran had been a regular operating base for 51 Squadron

but was lost as a result of the Iranian revolution – the final sortie was flown from Tehran in September 1978.

Until 1991, the bulk of the squadron's tasking was directed against the Soviet Union, its Warsaw Pact allies, and a number of client states, as part of the persistent aerial reconnaissance effort that played such a large part in keeping the peace.

In 1982, there was a short distraction from the usual missions, when Wing Commander Brian Speed, the then commanding officer, led a detachment to San Felix island, off the coast of Chile, for Operation Acme. The single Nimrod R1 deployed provided SIGINT support for British Forces engaged in reclaiming the Falkland Islands following the Argentinian invasion. Three operational missions were flown.

In August 1990, Iraq's invasion of Kuwait led to the squadron participating in another war. All three of the squadron's Nimrod R1s were eventually deployed to RAF Akrotiri, Cyprus, from where they flew many sorties before combat started on January 17, 1991.

The UK's commitment to the American-led Operation Desert Storm, dubbed Operation Granby was a major turning point for 51 Squadron and the Nimrod R1. It marked the start of the squadron's transformation from its strategic Cold War role to one of direct





support - 51 Squadron's better-known role over the last 30 years. To enable the more tactical direct support role, the Tactical Information Broadcast System was temporarily installed in the starboard escape hatch during the first Gulf War.

After the Cold War ended, the world became, if anything, a more unstable place, and conflicts arose in the Balkans, and across the Middle East, leading to more operations in which the Nimrod R1 could show its mettle. Throughout the 1990s, 51 Squadron developed its tactical reporting based upon established US procedures, and operations became more focused on COMINT, though ELINT remained important. ELINT was especially important when allied aircraft were tasked to go into harm's way against nations with modern integrated air defence systems. Iraq was the first such nation and an essential tasking for the Nimrod R1s.

During the 1990s, 51 Squadron Nimrod R1 aircraft operated in support of the Iraqi southern no-fly zone, and from February 2000 supported the northern no-fly zone, operating from Incirlik Air Base, Turkey. Mission emphasis was on force protection, where data was perishable and rapid reporting was key.

From June 1992, Nimrod R1s made regular deployments to Italy to support UN and NATO operations in and over the former Yugoslavia, initially as part of Operation Deny Flight, and later Operation Allied Force (the Bosnian and

Kosovo Wars, respectively).

In the meantime, Nimrod R1 XW666 was lost on May 16, 1995, during a post maintenance test flight from RAF Kinloss. A starter motor failed explosively, punctured the wing fuel tanks, and caused a catastrophic fire. Fortunately, the pilot, Flt Lt Art Stacey, was able to carry out a successful ditching in the Moray Firth, which saved the lives of the seven skeleton crew members onboard.

A replacement for XW666 involved the conversion of redundant Nimrod MR2 XV249 to Nimrod R1 standards by BAE Systems at Woodford, Lancashire, under Project Anneka. The sensitive mission systems were installed by the Electronic Warfare and Avionics Detachment at RAF Waddington, Lincolnshire where 51 Squadron had moved in April 1995. Configured as a fully-operational Nimrod R1, XV249 made its first flight from Waddington on April 11, 1997.

### Upgrades

Nimrod R1 aircraft received a number of major equipment and capability upgrades during the 1980s and 1990s. Examples include the Astral Box COMINT upgrade in the early 1980s, and the Starwindow distributed architecture in the early 1990s.

In the early part of the new millennium, Project Extract pooled various spinners,

pulse analysers and tuner/receivers so that individual racks were no longer hard-wired to specific assets.

The Tigershark upgrade enhanced the aircraft's COMINT capabilities that proved pivotal in Afghanistan and Iraq, including the role played by the squadron in the capture of Iraqi dictator Saddam Hussein on December 13, 2003. Hussein was pinpointed at a remote farm compound south of Tikrit in part as a result of SIGINT gathered by a Nimrod R1. A final upgrade, dubbed Project Interpret, was planned, later renamed as Project Helix, but morphed into the Nimrod R1 replacement programme.

The premature retirement of the Nimrod MR2 fleet on March 31, 2010, following the loss of XV230 over Afghanistan, and the cancellation and scrapping of the Nimrod MRA4 project on October 19, 2010, sounded the death knell for the Nimrod in the SIGINT role. There had been proposals to produce an MRA4-based Nimrod R5, but proposals to replace the type with the US Rivet Joint had gained favour with an air staff obsessed with harmonisation with the US Air Force, and with an increasingly influential group of senior officers who favoured COMINT capability. Some saw the latter proposal as a retrograde step, as the Nimrod R1 had a superior ELINT capability, and a larger number of operators than the American RC-135V

BELOW: *This head-on image shows the number of antennas fitted atop and beneath the fuselage, and other arrays fitted to the lower surface of the wings.*  
AirTeamImages/Derek Pedley





and RC-135W Rivet Joint. But the die was cast, helped by the multi-aspect disastrous Nimrod MRA4 programme, and the earlier attempt to build a fully-functioning fleet of airborne early warning-configured Nimrod AEW3 jets.

Following the 2010 Strategic Defence & Security Review, the Nimrod R1 retirement date was brought forward from 2012 to 2011.

XW665 was grounded from October 27, 2010, leaving XV249 and XW664 as the last flying Nimrod aircraft, with an out of service date (OSD) set for March 31, 2011. In the event, the OSD had to be delayed by 90 days to allow the aircraft to participate in operations over Libya in support of the UK's Operation Ellamy and the UN Operation Unified Protector. The brief service life extension was supported by a Nimrod R1 life extension team and cost some £4 million.

RAF offensive operations over Libya began on March 19, 2011, enforcing a no-fly zone and monitoring government forces as they fought to suppress the revolution in Libya.

XV249 departed Waddington for RAF Akrotiri on March 4, 2011 joining 907 Expeditionary Air Wing in support of Operation Ellamy. Tasking involved flying off the Libyan coast to intercept

communications and radar signals from pro-Gaddafi forces. XV249 returned to Waddington on May 23, 2011 and was replaced by XW664 for the final month of operations. XV249 was withdrawn from normal service on June 9, 2011 but was kept airworthy for the official retirement ceremony and to facilitate subsequent disposal.

XW664 returned to Waddington on June 24, 2011, two days after its last mission over Libya, marking the end of the type's operational career.

### Retirement

On June 28, 2011, the Nimrod R1 was formally retired from RAF service, marked by a ceremony at RAF Waddington. XV249 made a farewell flypast over the airfield at 1100am, piloted by Flt Lt Mike Chatterton and a flight crew of six, with a special set of retirement markings on both sides of the aircraft. For the record, the type's official OSD was June 30, 2011.

Major sections of all Nimrod R1s survive today. The salvaged cockpit section of XW666 is privately preserved at Aero Venture, Doncaster while the forward fuselage of XW665 went to the Speyer Air Museum, Germany in 2011, after being broken up at Waddington.

XW664 was sold to the East Midlands

Aeropark, flying into the adjacent East Midlands airport on July 12, 2011. The aircraft remains on display, and visitors can walk through the well-restored and virtually fully-equipped interior. Sometimes you can even sneak a peek at the spinner antennas in the forward part of the ventral panner. When current RAF Rivet Joint aircrew visited recently, they were said to be astonished at how advanced the aircraft was. Especially by the fact that touchscreen functionality had been provided – a capability then missing from the RC-135W.

On July 29, 2011, XV249 was flown to Cotswold Airport, Kemble for dismantling by Air Salvage International. After which the fuselage was transported by road to the RAF Museum Cosford in Shropshire on March 11, 2012. It was reassembled and put on display. Occasional opportunities to tour the aircraft are provided.

Today, 51 Squadron operates three RC-135W Rivet Joint aircraft, and to some extent now represents a closely integrated adjunct to the 55th Wing - the US Air Force Rivet Joint wing based at Offutt Air Force Base, Nebraska. While this almost certainly gives the UK privileged access to the wider US SIGINT take, the extent to which national priorities, requirements and needs can be accommodated in the squadron's taskings remains unknown.





# Electric Goons to EMARSS

**David Isby** reviews America's twin-engine aircraft used for the SIGINT role

**I**n 1946, during the opening months of the Cold War, both US and British forces had to improvise twin-engine signals intelligence (SIGINT) aircraft.

Flying up the air corridors to Berlin, Project Bourbon pioneered coalition airborne intelligence, surveillance and (ISR) effort. This continued for decades, integrating both country's SIGINT and communications intelligent (COMINT) efforts with visual and photographic intelligence. Eventually the project included the use of enhanced electro-optical and infrared (EO/IR) technologies, to provide confirmation as to the type and location of the source of electronic emissions.

Today, a new generation of US and British SIGINT-capable twin-engine medium-altitude ISR aircraft carry out similar missions. They provide

invaluable information for a reasonable operating cost. Many other air arms with limited force structure and resources, that do not need (and cannot afford) the few high-end four-engine ISR platforms such as those operated by the US and Britain, make effective use of twin-engine aircraft with integrated sensor suites allowing a single aircraft to be equipped with SIGINT, COMINT and multi-spectral sensor capabilities. Today's aircraft are a far cry from their improvised predecessors, but still stand benefit from the lessons of how they were deployed and used in the past.

## **1963-1973: The Electric Goon in Southeast Asia**

As conflict escalated in southeast Asia during the early 1960s, the familiar

Douglas C-47 twin-engine transport was a readily available platform for the many US Air Force ISR missions. Ones that did not expose them to hostile aircraft. Modified C-47s were among the aircraft that had carried out SIGINT missions in Europe, starting in 1946, and during the 1950-1953 Korean War.

The US military had many C-47 Gooney Birds available for modification, aircraft that would appear little different from the more common C-47 transport versions. That was an important deception tactic. By using discretion and not advertising that an aircraft was on a SIGINT mission, operators of enemy threat systems were





BELOW: *An airman gives starting orders to the pilot of EC-47 'Blood, Sweat and Tears' in a revetment at Phu Cat Air Base, South Vietnam on November 22, 1969.*  
US Air Force/Airman 1st Class Kenneth LeCompte

less likely to switch off their radars and radios.

The C-47 was nicknamed the Gooney Bird because of its podgy appearance and lumbering flight characteristics which servicemen stationed on Midway Island likened to the resident albatross birds on the Pacific atoll.

The aircraft's main cabin provided the kind of volume required to fit electronic SIGINT systems, which were bulky yet delicate in the pre-transistor era. A large, often 12+, headset-wearing mission crew rode in the back, including trained linguists to collect enemy voice communications.

EC-47s (informally known as the Electric Goon) arrived in South Vietnam in 1963. Enemy forces were making increasingly sophisticated use of radios, which was a source of valuable intelligence that had eluded other ISR platforms such as high-performance photo-reconnaissance aircraft.

After EC-47 aircraft confirmed the presence of regular North Vietnamese troops in divisional strength inside South Vietnam, the Air Force, which had been wary of using low-and-slow ISR aircraft vulnerable to enemy fighters, realised their value.

Consequently, the Air Force ordered the conversion of additional EC-47s and quickly formed new squadrons to operate them. No one trained on an EC-47 in the United States, it was all done in-theatre. Pilots were originally selected from the ranks of the old and bold, some with combat experience. Subsequent to that initial selection criteria, lieutenants fresh from undergraduate pilot training on jet aircraft were selected for the EC-47.

Soon, EC-47s were able to provide expanded SIGINT coverage of the war inside South Vietnam, allowing faster or larger ISR aircraft to concentrate on supporting the bombing offensive against North Vietnam. Rich Krejsa was part of an EC-47's mission crew, intercepting tactical communications and carrying out airborne radio direction finding (ARDF). He said: "Using radio direction finder equipment, we would fly over enemy territory, pick up radio transmissions, triangulate and create a geographic fix within 500 metres."

The US military build-up in South Vietnam brought the number of EC-47s in country to three squadrons worth, all in different configurations reflecting multiple engines and sensor capabilities. EC-47s were able to use ARDF to provide tactical warning and identification of ambush sites, troop movements and targets for airstrikes

and artillery. The most lethal threat to EC-47s, however, proved to be mountains shrouded in cloud and a lack of navigation aids. The advantage of SIGINT by its nature allowed aircraft to stand-off and look across sensitive borders while it reduced – but never removed – vulnerability to anti-aircraft artillery (AAA).

In 1966, Air Force Major General Grover Brown said that without this source of intelligence: "we would be completely in the dark about what was happening in the DMZ [the Vietnam Demilitarized Zone]."

An escalating number of interdiction missions against the Ho Chi Minh trail in Laos required additional EC-47s to deploy to bases in Thailand. These aircraft also supported Laotian ground force operations and made use of their multiple communications channels to function as Airborne Battlefield Command and Control Centers (ABCCC), directing airstrikes.

Operating over Laos, EC-47s encountered intense AAA and in 1966, one of the few offensive North Vietnamese fighter missions reportedly intercepted and shot down an EC-47 over the country. Also, in March 1968, an EC-47, badly damaged by anti-aircraft fire, flew 60 miles on one engine to belly land on a forward airstrip.

In 1970, the Air Force started to transfer some EC-47s to the South Vietnamese Air Force and other air arms in the region; some were reconverted to transports. However, the US Air Force retained a force of EC-47s for combat duties. In 1972-1973, the North Vietnamese authorities reinforced their air defences in Laos.

Captain Paul McGuire was a pilot on a Thailand-based EC-47. He said: "We shared one common goal: to be safe. Boring and routine was good. Uneventful missions, smooth take-offs and landings were good. In the air or on the ground, drama was bad. No shots fired at us





## TWIN-ENGINE SIGINT

during the mission – good; 37[mm] and 57[mm] ground fire – bad. Rockets launched at us in the air or on the ground – all bad.” In February 1973, a Thailand-based EC-47 flew into what McGuire – who had originally scheduled to be aboard – called a North Vietnamese flak trap. It became the last US Air Force aircraft shot down during the conflict.

### Twin Engine Multi-Spectral ISR

Decades later, the need for improvisation to enable SIGINT as part of an effective airborne ISR capability became apparent during the conflicts in Afghanistan and Iraq.

Insurgents made effective use of tactical radios and cell phones to both communicate and trigger improvised explosive devices (IEDs). The US Air Force, the US Army, the Royal Air Force, and other coalition partners with deployed troops, found these threats a challenge to counter. The limited number of specialised aircraft capable of ISR missions – especially SIGINT – were already committed to combat and were flying to high operational tempos. Sensors on those aircraft – whether a suite integrated on large multi-engine jets or a pod-mounted system on tactical aircraft – were not intended for the counterinsurgency role. Suitable ISR aircraft optimised for the role were urgently needed.

The US Army had used multiple versions of twin-engine Beechcraft types configured for the SIGINT mission, the earliest RU-8 Seminoles date back to the 1950s.

US Army RC-12 Guard Rail aircraft were used from the opening stages of the conflicts in Afghanistan and Iraq. But their sensor suites were not designed to deal with cell phones (see later). Additionally, the RC-12s still had other worldwide commitments, so the army supplemented them



with Beechcraft King Air 350ER twin turboprops. The 350ERs were fitted with an integrated sensor suite developed by the Sierra Nevada Corporation. Named the Enhanced Medium Altitude Reconnaissance and Surveillance System, or EMARRS, it provided the US Army with a specialised sensor platform that effectively supplemented high-end ISR aircraft.

The multi-spectral system featured radar, EO/IR, SIGINT, Ku-band SATCOM, and the tactical common data link. As one of many sensor suites in use across the battlespace, MARSS was vital for distinguishing local people from potential insurgent targets.

Cued by communications intelligence, the EO/IR sensor allowed the MARSS crew to track high-value individual targets on the move. Those individuals were then placed under surveillance using unmanned air vehicles (UAVs). Strikes could be called in and executed by fighters, strike fighters or even bomber aircraft.

Starting in 2006, MARSS went into combat with Task Force ODIN, an acronym for Observe, Detect, Identify and Neutralize. The task force was dedicated to defeating IED, first in Iraq

and then in Afghanistan.

In 2011, Afghanistan-based US Army SIGINT aircraft started to use a system called CAESAR, an acronym for Communications Attack, Electronic Surveillance and Reconnaissance. CAESAR could either monitor, jam or disrupt cell phones and radios, and incorporated electronic attack and electronic countermeasures capabilities.

### MC-12 Liberty

Though the US Air Force eventually resolved its 1960s opposition to the EC-47 SIGINT force, it was reluctant to do the same for the conflicts in Iraq and Afghanistan, even though the Department of Defense wanted more round-the-clock ISR coverage. The reluctance shown by senior Air Force leaders escalated until it culminated with the sacking of the US Air Force secretary Michael Wynne and its chief of staff, General Michael Moseley on June 5, 2008.

Their successors went ahead to introduce a new multi-spectral ISR aircraft with a good SIGINT capability. Orders were placed in July 2008, to commence procurement of what would become the MC-12W Liberty.

ABOVE: *This image of a Beechcraft King Air 350ER EMARRS aircraft shows how distinguishable the type is thanks to the dorsal Ku-band SATCOM radome atop the fuselage, and an extensive array of antennas.*  
*US Army PEO Intelligence, Electronic warfare, and Sensors/John Higgins*

BELOW: *RC-12D 81-23542 at RAF Mildenhall, England on September 30, 1984 during a refuelling stop on its delivery flight to the 1st Military Intelligence Battalion at Wiesbaden, West Germany.*  
*Bob Archer*





BELOW: **EC-47P 43-49013/AJ** assigned to the 360th Tactical Electronic Warfare Squadron 'Antique Airlines' on take-off from Nakhon Phanom, Thailand. This EC-47P was configured as a 'straight bird' with X and Y system consoles, components of the Sanders ALR-34 Airborne Radio Direction Finding system. X system (direction finding) antennas can be seen above and below the forward and mid-fuselage and the wing. Two long wire Y system (intercept and communications) antennas are mounted from atop the forward fuselage to the tail fin. This aircraft was originally delivered to the US Army Air Force as a C-47B on October 10, 1944.  
US Air Force

Experience of improvising and operating EC-47s had been largely forgotten by the Air Force when the Department of Defense forced the service to repeat the process with the MC-12W. Getting the type into action quickly became the responsibility of the Air Force's Big Safari programme office, one experienced in the modification and sustainment of special mission aircraft based at Wright-Patterson Air Force Base, Ohio.

Beechcraft King Air 350ERs were ordered and fitted with L3 Communications SIGINT and SATCOM systems, EO/IR sensors, and a laser illuminator and designator. A datalink was used to downlink sensor feeds directly to combat aircraft equipped with the Link 16 system or to troops using a laptop terminal hosting a remotely operated video enhanced receiver system dubbed ROVER.

Following a hasty training programme using scratch crews drawn from throughout the Air Force, MC-12Ws first went into action over Iraq in June 2009 operated by the 362nd Expeditionary Reconnaissance Squadron based at Balad Air Base. MC-12 deliveries were supplemented by four civil-registered and contractor-operated Blue Devil twin-turboprop Beechcraft 90s in 2010.

### Liberty in Combat

US Air Force MC-12Ws, like their EC-47 predecessors, were operated by a two-person flight deck crew and an aft cabin mission crew.

On the flight deck, the mission commander and pilot would normally follow a pre-planned route, following

country-wide operational priorities for ISR of which there was an insatiable demand to support ground operations.

Once the aircraft had spiralled up to its operational altitude (often over 18,000ft to reduce vulnerability to missile threats) and was trimmed out, the mission commander would often leave the flying to the pilot and manage the sensors using a screen, keyboard, and a mouse.

Racetrack patterns were flown on station to minimise the likelihood of sensors and antennas being blanked out by the wings during turns. During an aircraft-to-aircraft handover, the crew of the MC-12 aircraft arriving on station had to fly the pattern with the aircraft already there, because there was no way to transfer the monitoring already underway.

In a dynamic tactical situation, MC-12Ws could be re-tasked to work with other manned aircraft or UAVs, using the on-board laser target designator.

An MC-12 mission crew usually comprised a linguist responsible for intercepting and monitoring enemy voice transmissions, and a sensor operator.

Data could be transferred via datalink and SATCOM to a ground station, which had the capability to analyse and fuse information, and if required, to take control of the aircraft's onboard sensors.

The hastily improvised MC-12W squadrons were able to successfully execute their missions, recording a 99.96% mission accomplishment rate in Afghanistan. This achievement can be attributed to the ability and professionalism of individual personnel, very few of whom had ISR experience, and training for ab initio personnel

was limited. Short tours of duty meant that some 20% of personnel assigned to each deployed MC-12W squadron turned over every month. Air Force personnel were supplemented by operatives from other services and civilian contractors.

Effects of its hasty development and deployment were also apparent during flight operations. It was only after an MC-12W, trying to climb over a storm cloud in Afghanistan, stalled and went into an unrecoverable spin, killing all aboard, that it became apparent that neither the pilots nor indeed anyone in the Air Force knew what the MC-12's stall speed was.

When fully loaded at altitude, the MC-12 had a more limited flight envelope than a King Air 350ER in standard configuration. For MC-12 pilots, the aircraft's handling was affected by the dorsal SATCOM radome and the ventral sensor pannier configuration.

Following the wind down of operational commitments in the US Central Command's area of responsibility after 2014, the Air Force hustled the MC-12W out of service. Aircraft were transferred to other services, with just one squadron retained by Air Force Special Operations Command for ISR training and operational commitments held by US Southern Command.

### Guardrail

Often overlooked within its own service (the world's largest operator of helicopters), US Army ISR aircraft, in war and peace, have often been over-shadowed by larger four-engine





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## TWIN-ENGINE SIGINT

Air Force and Navy SIGINT aircraft. But these aircraft have been involved everywhere American soldiers have engaged in combat. They provided half of the in-country SIGINT capability in South Vietnam during the Vietnam War. More recently, army aircraft have been heavily committed to Afghanistan, Iraq, and Syria.

Army SIGINT aircraft are intended to provide corps-level and other commanders with timely intelligence used to direct the fight and win the ground battle. During the advance on Baghdad in 2003, monitoring Iraqi tactical communications helped identify which roads were open or where ambushes were being prepared. In peacetime, army SIGINT aircraft help provide indications and warning (I&W) of potential threat activities.

The Guardrail system first entered Army service in 1971. It linked three modified Beechcraft King Air Model 200s designated as RU-21s to an integrated signal processing facility at a decommissioned Nike surface to air missile (SAM) site in Grünstadt, West Germany. Up to 18 operators in 40-foot trailers monitored what the aircraft were picking up in real time. Since then, successive versions of the RC-12 Guardrail operated along the border with the German Democratic Republic during the Cold War and parallel to the Korean demilitarised zone. In the 1990s, Guardrail aircraft were part of the NATO coalition of SIGINT aircraft conducting ISR missions over the former Yugoslavia.

A fleet of RC-12 aircraft replaced much older RU-21s, various models of which hosted the first generation of Guardrail systems.

The Improved Guardrail V (integrated on RC-12D aircraft) and the Guardrail Common Sensor (GRCS) systems are remotely controlled, airborne SIGINT collection and location systems.

The first RC-12D (of 13) configured with the ASD-9 Guardrail V remote-controlled communications intercept and direction-finding system was delivered in 1983.

The first RC-12G (of three) configured with the Crazy Horse system used to gather unique ELINT in Central America for counter insurgency and counter drug operations, and an a 15,000lb MTOW was delivered in 1985.

The first RC-12H (of six) configured with THE GRCS System 3 (Minus) and 15,000lb increased MTOW was delivered in 1988.

The first RC-12K (of nine) configured with the GRCS System 4, a large cargo door, more powerful PT6A-67 turboprops each rated at 1,100shp, oversized landing gear, and an increased 16,000lb MTOW was delivered in 1990.

The first RC-12N (of 15) configured with the GRCS System 1 was delivered in 1994.



The first RC-12P (of nine) configured with the GRCS System 2, a new different datalink, fibre optic cabling, smaller and lighter wing pods and an increased 16,500lb MTOW was delivered in 1999.

The first RC-12Q (of three) was also delivered in 1999. Dubbed the Direct Air Satellite Relay aircraft, the variant was configured with a dorsal radome housing a satellite communications antenna to expand the aircraft's operational area outside satellite footprints compared to the RC-12P.

The first RC-12X (of 19) was delivered in 2011. The RC-12X is configured with an upgraded GRCS system that features SIGINT technology developed for the Block 30 RQ-4 Global Hawk, featuring expanded frequency ranges, a capability to locate signals in both stand-off and stand-in modes, and an adaptive beam-forming antenna array used to locate emitters in dense signal environments.

The RC-12X is the army's current integrated SIGINT platform that provides near real-time targeting information to tactical commanders and supports full-spectrum operations. The Guardrail system has been modernised since inception to maintain relevancy and to enable continued prosecution of emerging threats within changing battlespaces.

GRCS sensor capability produces COMINT and ELINT for battlefield mapping of common and modern signals of interest for detection, identification, and geolocation of known threats.

The standard concept of operations supports both single-ship, multi-ship and cooperative operations utilising Tactical Common Data Links (TCDL) and network-based infrastructure back through an OGS and a Distributed Common Ground System Army, located in the United States for correlation, exploitation, and dissemination.

RC-12X aircraft are former RC-12N and RC-12P models, upgraded by the Guardrail programme's prime contractor, Northrop Grumman. The upgrade included structural modifications, a digital cockpit, and integration of a Northrop Grumman sensor and communications suite, with datalinks and remote operating capability. An RC-12X Guardrail aircraft is the air component of the GRCS system.

The US Army has 14 RC-12X aircraft in operation, assigned to the two aerial exploitation units, the 3rd and 204th Military Intelligence Battalions. The 3rd MI BN(AE) is based at Camp Humphreys-Desiderion Army Airfield, Pyongtaek, Republic of Korea, and the 204th MI BN(AE) at Fort Bliss-Biggs Army Airfield, El Paso, Texas.

Like their 1971 predecessors, multiple RC-12X aircraft normally operate together between 20,000 and 24,000ft to gather near-real time SIGINT and geolocation information. Data gathered is downlinked via a Tactical Common Data Link to a GRCS operational ground station (OGS).

In combat, the RC-12X can also conduct targeting, and is currently certified to undertake precision long-range fire support, netted into digital networks through the OGS and the US Army's variant of the distributed common ground system.

### Current Army ISR Fleet

In 2020, the US Army operated a fleet of 61 turboprop ISR aircraft, comprising RC-12Xs, King Air 350ERs fitted with the EMARRS system, De Havilland Canada DHC-7-based EO-5s and De Havilland Canada DHC-8-based EO-6s.

The RC-12X fleet comprises 14 operational and five trainer aircraft used by the 305th Military Intelligence Battalion based at Fort Huachuca, Arizona. The trainers are not equipped with a full suite of sensors.

Of the 24 EMARRS aircraft currently in service, the EMARSS-S is the specialised SIGINT version, while the EMARSS-M is capable of multi-spectral ISR operations. In June 2020, the US Army took delivery of the first upgraded EMARSS-V version, and the EMARSS-E, with enhanced ELINT capability, is currently under development.

A small fleet of seven EO-5Cs are configured with the multi-sensor, day and night, all-weather Aerial Intelligence, Surveillance, Reconnaissance (AISR) system, awkwardly named Airborne Reconnaissance Low-Multifunction or ARL-M. An EO-5C aircraft has both communications intelligence and imagery intelligence (COMINT/IMINT) with real-time analysis and dissemination capability.

ABOVE: *The Wiesbaden-based 1st Military Intelligence Battalion operated RC-12K Guardrails during the mid-1990s. This image of 85-0152 seen landing at RAF Mildenhall, England on October 16, 1993 shows the PT6A-67 turboprop engines, the oversized landing gear, and an extensive antenna array.*  
Bob Archer



Another small fleet of eight new RO-6As (plus one trainer) are configured with the AISR system, more awkwardly named Airborne Reconnaissance Low-Enhanced or ARL-E. Its reconfigurable sensor payload includes enhanced COMINT and IMINT sensors with real-time analysis and dissemination capability. The more capable ARL-E were expected to start replacing the ARL-M systems in FY2020.

By 2025, the army plans to cut its current fleet of 61 turboprop fixed-wing ISR aircraft to 52. The smaller fleet will include all RC-12Xs (14 operational and five trainers), and 24 King Air 350ERs configured with the EMARSS system.

Five of the RO-6A ARL-E aircraft will operate with a configuration of mission-specific sensors, including the Leidos Saturn Arch surveillance system or another sensor suite intended for missions in US Southern Command's area of responsibility.

Currently, the army is looking to withdraw all funding for the Guardrail Common Sensor system starting in FY2023. If implemented, the planned 52 aircraft fleet of 2025 would be out of reach, meaning the RC-12X Guardrail aircraft might have to serve for a further decade. In FY2018, the RC-12X's service life was extended until 2034.

While the Department of Defense and the Congress will have the final say, the Guardrail Common Sensor system funding has to compete with high-priority Army Aviation programmes. In the competition for funding, a decision to retire the system might be made based on the inescapable fact that the aircraft might not be survivable in a conflict with a hostile great power.

## Next Steps

Rather than funding the GRCS, the US Army appears more interested in a new multi-spectral sensor system

integrated on a twin-jet business jet airframe. That system is called ARTEMIS, the abbreviation of Airborne Reconnaissance and Targeting Multi-mission Intelligence System, which has been flown in experimental configuration.

The army has been interested in twin-jet ISR aircraft for years: its Aerial Common Sensor (ACS), cancelled in 2006, was a collaborative programme with the Navy to integrate an Embraer 145 regional jet airframe with a Lockheed Martin sensor suite and mission systems. Its projected procurement and operating costs seemed unaffordable.

The army and its industry partners launched ARTEMIS in 2019. If the army were to use the Boeing 737 or Gulfstream 550 as the baseline airframe, ARTEMIS could operate at up to 40,000ft, while connected into multi-domain operations that are a current priority of the US military.

Leidos is the prime contractor for the ARTEMIS sensor suite featuring its High-Accuracy Detection and Exploitation System (HADES). This is an airborne component of the Multi-Domain Sensing System (MDSS), intended to enable multi-domain operations, with COMINT, ELINT and geolocations capabilities.

Currently the programme uses two contractor owned/contractor operated Bombardier CL-600 Challenger 650 business jets to demonstrate operational utility while minimising the army's up-front investment. In July 2020, the Challenger 650s flew to Kadena Air Base, Okinawa to fly missions. In August, ARTEMIS was revealed to the public and in September one of the Challengers deployed to Georgia to participate, with other US forces, in Exercise Noble Partner.

Procurement of the system possibly integrated on ten aircraft could start as early as FY2023, with first deliveries by

2028.

In the meantime, current deployments of US Army ISR aircraft to NATO countries in the Baltic region continue the decades-long coalition I&W efforts. In 2021, ADS-B tracking has shown two army SIGINT aircraft flying near the border with the Russian enclave of Kaliningrad at standoff ranges.

## Applicable Lessons?

In the future, it is likely that sensors will be improvised to counter the challenges presented by emerging threats rather using fleets of ever more advanced ISR aircraft. Sensors are being developed as modular systems, often pod mounted, with software designed to enable a plug and play capability, in theory removing lengthy and expensive development cycles.

Although pod-mounted systems have given tactical aircraft a SIGINT collection capability since their introduction in the 1960s, today the miniaturisation of SIGINT systems dictates the systems of the future. Miniaturisation means that UAVs can be used for such missions, while the use of smaller specialised manned aircraft including the EMARSS and Shadow R2 will provide operational flexibility.

Allied and coalition air arms have discovered that twin-engine turboprop and business jet airframes fitted with integrated sensor suites and datalinks give them many of the capabilities provided by larger and more expensive systems such as Rivet Joint for a fraction of their procurement and operating costs.

The time to invest in such platforms is before any conflict forces urgent improvisations. Comparing the rise and fall of the EC-47 and MC-12W in US Air Force service, with the steady tailored refinement of US Army twin-engine SIGINT aircraft supports that assertion.

BELOW: RC-12P 92-13125 assigned to the Wiesbaden-based 1st Military Intelligence Battalion seen in July 2002. The RC-12P variant featured smaller and lighter wing tip pods. Bob Archer collection





# Shrouded in Secrecy

**Lindsay Peacock** reviews a notable American reconnaissance aircraft, the secretive North American RB-45 Tornado

**A**ssured of a place in history by virtue of being the first jet bomber to enter service with the United States Air Force, the North American B-45 Tornado remains relatively little known. And this despite achieving a number of notable firsts during an operational career that spanned barely a decade. This included making the first non-stop crossing of the Pacific Ocean by a jet bomber in July 1952. Compatibility with the aerial refuelling boom method of in-flight replenishment allowed the RB-45C 48-0042 to twice receive fuel from KB-29P tankers during the nine-hour 50-minute journey from Elmendorf Air Force Base, Alaska to Yokota, Japan. The flight resulted in the award of the

prestigious Mackay Trophy for the most meritorious flight of the year. Shrouded in great secrecy at the time, the RB-45C was also the aircraft of choice to undertake the first ventures by a jet bomber type into the denied territory of the Soviet Union, having previously accomplished a number of equally hazardous reconnaissance missions that included penetrations of China and North Korea during the Korean War of 1950-1953.

Originally intended to see service with Strategic Air Command (SAC) and meant to be armed with early nuclear weapons, it soon emerged that the Tornado was actually unable to carry the 'bomb' and would require extensive modification in order to do so. As a direct consequence of

this shortcoming, the pure bomber B-45A version was instead assigned to Tactical Air Command (TAC), with which it began to enter service in November 1948, joining the 47th Bomb Wing at Barksdale Air Force Base, Louisiana. Such was the pace of development in the immediate post-war era that this event occurred barely 18 months after the maiden flight of the first XB-45 prototype at Muroc Army Airfield, California. It is, however, worth mentioning that suitably modified B-45As did eventually gain atomic capability in 1951 and 1952 and were immediately transferred to the European theatre of operations, where they represented a potent capability until replaced by the B-66 Destroyer in the late 1950s.

BELOW: RB-45C 48-0017 was redesignated as a JRB-45C following modifications in support of various flight test programmes. From September 1950, the aircraft was assigned to the 2750th Air Base Wing with Air Materiel Command at Wright-Patterson Air Force Base (WPAFB), Ohio. It was modified to ERB-45C standard in April 1951 and initially served with Headquarters Air Research and Development Command and then the Air Research Development Center both at WPAFB. In June 1954, the aircraft was used by the Air Force and Pratt & Whitney to test new types of jet engine while mounted in a retractable pylon underneath the bomb bay as a JRB-45C. US National Archives







### RB-45C

Other than being powered by four General Electric J47 turbojet engines installed in pairs on a straight, shoulder-mounted, wing, the Tornado possessed few radical features and less than 150 examples of three basic variants were eventually completed. Many of them were ultimately destined to see service with the United States Air Forces in Europe (USAFE), either as B-45A medium bombers or in the RB-45C reconnaissance configuration. An impressive array of camera kit could be carried by the RB-45C, with the most obvious sign of the reconnaissance mission being replacement of the glazed bombardier/navigator compartment in the nose by a bulbous fairing that housed a forward oblique camera. Elsewhere, the aft fuselage section contained five stations that were able to accommodate an assortment of cameras. These included primary vertical, left and right oblique and multiple split vertical arrays, as well as trimetrogon for photo mapping tasks. Unfortunately, the camera compartment was inaccessible in

flight. Photoflash bombs to illuminate targets at night could be carried in and released from the forward weapons bay but operational testing soon revealed a major flaw - buffeting encountered when the bay was opened rendered night photography impractical.

Production of the RB-45C numbered just 33 aircraft (serial numbers 48-0011 to 48-0043), all of which were accepted by the US Air Force between July 1950 and February 1951 (see Table 1). In many respects, the RB-45C could be perceived as something of an unwanted child, leading a nomadic existence in the first few years of its service that included assignment to three major US Air Force commands in quick succession between 1950 and 1954 – SAC, TAC and USAFE in that order.

At the start of its reconnaissance career, the RB-45C was briefly employed by SAC, which took delivery of its first example on August 26, 1950. This was immediately assigned to the 91st Strategic Reconnaissance Wing, which operated the type until 1953, initially at Barksdale and then, from September 1951, at Lockbourne Air Force Base,

US Air Force RB-45C Acceptance Dates

Date	Quantity
July 1950	4
August 1950	3
September 1950	8
October 1950	6
November 1950	1
December 1950	3
January 1951	2
February 1951	6
<b>Total</b>	<b>33</b>

Ohio. While with the 91st Strategic Reconnaissance Wing, numerous overseas detachments saw examples of the RB-45C deployed in support of other commands, most notably in the United Kingdom and Japan.

The RB-45C was also used in the Korean War, where it saw some action, albeit not without cost. One aircraft (48-0015) was shot down by a MiG-15 on December 4, 1950 while engaged on a reconnaissance sortie near the Yalu River, thus securing the dubious accolade of being the first jet bomber to be shot down by a jet fighter.

Initially operating by day, the RB-45C subsequently managed to avoid direct confrontation with Chinese MiG-15s for the next several months but immunity from this threat ended in April 1951 when an RB-45C came close to being shot down. Thereafter, daytime missions to northwest Korea were only undertaken with fighter escort, but even that brief interlude ended in another close encounter with hostile aircraft in November 1951. The small force then switched to night operations in January 1952, but with little success because of the buffeting problem mentioned earlier.

Despite these and other shortcomings, the RB-45C was much less vulnerable than the RB-29 Superfortress and undertook its fair share of hazardous missions before being withdrawn

ABOVE: **North American JRB-45C** in flight with test apparatus mounted on the aft fuselage.  
US Air Force

RIGHT: **RB-45C 48-0031** was transferred from Korea to RAF Sculthorpe, England where it was withdrawn from use in August 1957. The aircraft was subsequently transferred to Rhein-Main Air Base, West Germany for use as a fire trainer.  
US Air Force via Robert S Hopkins





from the Korean theatre, where a second RB-45C (48-0016) became an operational loss when it crashed near Yokota, Japan in June 1952. In addition to reconnaissance missions over Korea, examples of the RB-45C also undertook peripheral and overflight sorties in the vicinity of China and Russia in 1951-1953, with target areas including but not limited to Shenyang and Beijing (Peking) in China, plus Sakhalin Island and Vladivostok, Russia.

While active with the 91st Strategic Reconnaissance Wing, the RB-45C equipped the 323rd and 324th Strategic Reconnaissance Squadrons, with this wing's third squadron, the 322nd Strategic Reconnaissance Squadron operating a few B-45As, presumably mainly for crew training purposes. As it transpired, the Tornado's career with SAC was destined to be brief, ending in early 1953 when the 91st Strategic Reconnaissance Wing converted to the Boeing RB-47 Stratojet, a much more radical machine in almost every way and one that possessed far superior performance. It was at this point that aircraft were reassigned to TAC.

### British Ju Jitsu

In the meantime, however, the RB-45C hadn't been idle and had been exposed to combat over Korea. Of greater importance was the fact that it had also donned British insignia when the 91st Strategic Reconnaissance Wing 'loaned' a few aircraft to the Royal Air Force for a special mission that involved penetration of Soviet airspace to obtain priceless reconnaissance material.

Without doubt the most intriguing of

all those missions were the ones that were undertaken by RAF personnel of the so-called Special Duty Flight in 1952 and 1954. Code-named 'Ju Jitsu', they involved a concerted penetration of Warsaw Pact and Soviet airspace by groups of three aircraft, each of which had been given British insignia specifically for the mission. Training of RAF aircrew was undertaken on the RB-45 at Barksdale, Langley, and Lockbourne from mid-1951, and was apparently not without problems, with one aircraft said to have been written off by an RAF pilot as a result of a heavy landing at Lockbourne – this may have been 48-0025 which was reportedly destroyed somewhere in Ohio in March 1952.

Classified beyond top secret at the time, many files relating to these activities have yet to be released. Despite still being subject to secrecy, easily the best-known reconnaissance and intelligence-gathering operations involving the RB-45C were those accomplished by the RAF using aircraft borrowed from the US Air Force and displaying British roundels and fin flashes. The main objective of these operations was to obtain imagery depicting the radar picture that would be seen by crew members of bombers sent to attack targets in the Western Soviet Union. This could only be done by physically overflying potential targets, something that SAC's Commander, General Curtis LeMay, was prepared, even eager, to do. However, there was ambivalence about overflights of denied territory by US aircraft and personnel, which is where

the RAF came in.

A softly-softly approach was employed at the outset, with just a single RB-45C and one British crew completing a peripheral mission along the Berlin corridor on March 21, 1952. There was no specific 'take' in terms of intelligence, although this sortie was critical in helping to determine how the Russians reacted to such a provocation. Evidently, there was little response, smoothing the way for the first operation, which took place during the night of April 17-18, 1952. Each of the trio of RB-45Cs involved flew a separate track from and to RAF Sculthorpe – one covered the Northern Baltic states, including Kaliningrad and Tallinn; the second covered Poland and the central portion of the USSR, but didn't extend quite as far as Moscow; the third covered part of the German Democratic Republic, Czechoslovakia, Poland, and the southern Soviet Union, including Kiev and Kharkov. In-flight refuelling was accomplished on both the outbound and return sectors, with the intelligence take consisting of radar imagery of a multitude of targets that permitted SAC and RAF Bomber Command planners to prepare target materials that might be used in the event of conflict.

The degree of success or otherwise of the first incursion is hard to determine, but planning was soon initiated for a second mission. This was given the code-name 'Pepsin' and would have been a joint US-UK effort including four RB-45C routes (Red, Yellow, Blue, and Black) to be undertaken in mid-December 1952, with RAF personnel again receiving instruction and

**BELOW:** Four RB-45C aircraft, serial numbers 48-0012, 48-0025, 48-0027 and 48-0034, assigned to the 91st Strategic Reconnaissance Squadron seen on a flight line during the Korean War. The squadron was based at Yokota Air Base, Japan between November 1950 and 1954. US Air Force

**"Despite still being subject to secrecy, the best-known reconnaissance and intelligence-gathering operations involving the RB-45C were those accomplished by the RAF using aircraft borrowed from the US Air Force and displaying British roundels and fin flashes."**







ABOVE: **RB-45C 48-0021** wearing the distinctive tail markings of the 91st Strategic Reconnaissance Wing, US Air Force

training on the RB-45. In the event, the United States balked, prompting cancellation by Prime Minister Churchill on December 9, with the aircraft returning to home base at Lockbourne. Shortly afterwards, the 91st Strategic Reconnaissance Wing re-equipped with the RB-47E, with the surplus RB-45Cs being reassigned to the 19th Tactical Reconnaissance Squadron (TRS) at Shaw Air Force Base, South Carolina. By then, Sculthorpe was much busier, with the B-45As of the 47th Bomb Wing having taken up permanent residence in June 1952, arriving in England just a few weeks after the first overflight mission.

As a consequence, when the time came to stage a second overflight (Ju Jitsu II) in April 1954, Sculthorpe was again the launch point, this time using RB-45Cs 'borrowed' from the 19th TRS. Four aircraft were again made ready and decorated with British insignia, three of which set off on the second mission on the night of April 28, essentially flying the Red, Yellow and Blue routes from the abortive 'Pepsin' planning. Again, relying on in-flight refuelling to extend range,

all three safely returned after some 10 hours in the air. The routings used on this occasion were similar to those of the 1952 incursion but were more extensive and involved many more changes of course. On this occasion, in addition to gathering imagery, monitoring of Soviet communications networks was undertaken by the British Government Communications Headquarters (GCHQ) Y Service, which revealed a vigorous but largely ineffectual response on the part of the Soviet air defence network. This failed to prevent the RB-45Cs from completing their missions, but at least one was targeted by anti-aircraft fire in the vicinity of Kiev, happily without damage, while it later emerged that some of the Russian MiG pilots had been ordered to ram the intruders, again unsuccessfully.

Barely two weeks later, the RB-45Cs of the 19th TRS were permanently reassigned to USAFE and attached to the 47th BW, moving from Shaw Air Force Base, South Carolina to Sculthorpe on May 11, 1954. This proved to be the final assignment for the RB-45C, which

completed at least one more potentially hazardous mission over denied territory on March 29, 1955. On this occasion, American personnel and three RB-45C aircraft of the 19th TRS undertook a peripheral mission to obtain data and imagery of Warsaw Pact facilities in Eastern Europe, stopping short of the Soviet border. There is no evidence that any further adventures of this kind took place and, despite attrition having claimed at least 10 aircraft by the mid-1950s, the RB-45C continued to provide valuable service to USAFE until the summer of 1957, when the dwindling number of survivors were replaced by the Douglas RB-66B Destroyer. Apart from one test-dedicated example that flew on for a while in the United States, which survives in the SAC Museum collection at Ashland, Nebraska, the remaining few aircraft were then dispersed to various air bases in Europe for use in fire practice. Most eventually succumbed to the flames, an ignominious end for a little-known aircraft that played a significant but at the time largely unsung role in the Cold War.

RIGHT: **Four US Air Force RB-45Cs assigned to Strategic Air Command's 91st Strategic Reconnaissance Wing at RAF Sculthorpe, England in 1952. All four aircraft are marked with Royal Air Force insignia as part of the highly secretive Ju Jitsu missions. RAF crews assigned to the British Special Duty Flight flew missions over Eastern Europe and Western areas of the Soviet Union to obtain priceless reconnaissance material.** US Air Force





# Boeing's Swept-Wing Snooper

**Lindsay Peacock** details Strategic Air Command's RB-47 Stratojet, a reconnaissance version of the jet bomber

Boeing's path to pre-eminence as a manufacturer of commercial jet airliners in the second half of the 20th Century began more than a decade earlier, with the B-47 Stratojet, which married a sharply swept wing to underslung podded engines. It proved to be a winning concept, as well as a template that was subsequently employed by a succession of types that include, but are not limited to, the 707 and 747 airliners, as well as the B-52 Stratofortress and KC-135 Stratotanker. Where Boeing led, others very quickly followed, notably Convair and Douglas in the United States and Airbus in Europe, but all owe a debt to the B-47. Perhaps best remembered as a bomber, the B-47 was never called

upon to deliver any weapons in anger but did repeatedly venture into harm's way in the reconnaissance role with Strategic Air Command (SAC) as the RB-47.

More than 1,300 examples of the B-47E, the pure bomber variant, were eventually completed for service with no fewer than 28 Medium Bomb Wings. Many originated from Boeing's factory at Wichita, Kansas, but such was the demand for the B-47E that manufacture was also undertaken by Douglas at Tulsa and Lockheed at Marietta. In the case of the dedicated reconnaissance versions, however, production of close to 300 examples was entirely entrusted to Boeing at Wichita. The lion's share of these consisted of the RB-47E model which was primarily configured

for photographic reconnaissance. Compared with today, production was accomplished at an almost unbelievable rate, with some 255 aircraft being completed and delivered to SAC in little more than two years, although the final 15 never saw service as RB-47Es, being further modified to the RB-47K configuration for weather reconnaissance. They were followed by 32 examples of the RB-47H and a trio of ERB-47Hs, which closed out production of all Stratojets at the end of 1956. Both of these considerably more sophisticated versions were employed to gather electronic intelligence and they ultimately proved to be the last models of the Stratojet family to see service with SAC, with a few remaining active until the end of 1967.

*BELOW: RB-47H 53-4299 was delivered to Forbes Air Force Base, Kansas in October 1955 and assigned to the resident 55th Strategic Reconnaissance Wing. During its 11-year service career the aircraft flew missions over the Soviet Union. After restoration by the US Air Force Museum at the turn of the last Century the aircraft was placed on display in the spring of 2003.*  
US Air Force Museum







ABOVE: **RB-47H 53-4288** flying in formation with a second aircraft looking reasonably immaculate with the Strategic Air Command band across the nose. This variant was configured for electronic reconnaissance equipped with a nose-mounted APS-54 tail-warning radar system and an APD-4 multi-band radar direction finding system. Note the two barrels of the M24A1 20mm cannon in the remote-controlled tail turret.  
US Air Force

BELOW RIGHT: **RB-47H 53-4302** landing at Yokota Air Base, Japan. Toshio Tagaya via Robert Hopkins III

## RB-47s

The RB-47E was essentially similar to the B-47E bomber, albeit with a number of changes associated with the reconnaissance task. The most obvious difference concerned the nose section which was extended by some 2ft 10in in order to accommodate a battery of up to 11 cameras. These included a 600mm or 900mm focal length forward oblique K-38, split vertical and vertical 600mm or 900mm K-38s, and a trimetrogon arrangement allowing horizon-to-horizon imagery to be obtained. Other equipment comprised flash bombs and cartridges for night photography and these aircraft also featured tail gun armament to provide a measure of defensive capability. Instead of cameras, the RB-47H and ERB-47H relied on antennas and recorders to gather information, with the RB-47H normally having a crew of six – three flight crew and three system operators known as Ravens – while the ERB-47H had only a pair of Ravens. These worked in a special pressurised pod situated in the aircraft's belly, occupying the space originally taken by the bomb bay. Nevertheless, both were tasked with locating and recording signals of interest across a very broad spectrum of frequencies, including those generated by search and fire control radars.

Assigned only to the 55th Strategic Reconnaissance Wing based at Forbes Air Force Base, Kansas, the RB-47Hs and ERB-47Hs equipped two the 38th and 343rd Strategic Reconnaissance Squadrons, with the wing's other unit, the 338th Strategic Reconnaissance Squadron, being unique in operating the weather reconnaissance RB-47K model. This was given a somewhat rudimentary system consisting of cameras and measurement equipment such as dropsondes, eight of which could be carried and ejected throughout the mission to accomplish a parachute-retarded descent during which data pertaining to pressures, temperature and humidity were recorded and relayed to the parent aircraft for onward transmission to ground stations. Missions were flown daily by the RB-47K and typically involved a northbound route over Canada to study weather patterns in likely areas that would be used to aerial refuel bombers heading towards Russia in the event of war.

Development and production delays suffered by early B-47 models proved an obstacle to SAC plans to acquire dedicated reconnaissance versions of the Stratojet and culminated in the appearance of the interim day-only capable YRB-47B and 91 examples of these were eventually converted from B-47B bombers. They were

assigned to the 26th and 91st Strategic Reconnaissance Wings at Lockbourne from April 1953. As it transpired, the first purpose-built RB-47Es arrived shortly afterwards, in November 1953, whereupon the YRB-47Bs reverted to B-47Bs and were re-assigned to the 320th and 340th Bomb Wings. While configured for reconnaissance, the YRB-47B utilised a removable camera pod in place of the weapons bay door, with transformation typically taking 12 hours to accomplish.

## Overflight Missions

Intelligence-gathering operations undertaken by aircraft of SAC and other major commands involved what was euphemistically described as 'denied territory' broadly speaking fell into one of two categories – overhead or peripheral. As it implies, overhead required aircraft to physically cross a national border in order to obtain photographic and radar imagery and might reasonably be expected to be the more hazardous approach. Peripheral involved standing-off at a distance in international airspace so as to gather intelligence. This was usually achieved in a passive manner by listening and taking notes, although it could also include photography, using cameras with powerful lenses that could look into a country from a considerable distance outside its boundaries. In fact, both types of activity proved equally risky to the RB-47, with single aircraft being shot down over denied territory and while in the supposed safety of international airspace. However, that safety was often illusory, with several RB-47Hs coming under attack between 1958 and 1965. One was shot down and another was so badly damaged that it was subsequently scrapped.

The intent to use versions of the Stratojet to undertake potentially hazardous and undeniably provocative overflights of Soviet territory was apparent at a very early stage in the type's service life. Superior performance in terms of speed and altitude made it





BOEING RB-47 STRATOJET

an obvious candidate, with a suitably modified B-47 being made ready in mid-1950 for a sortie over the Chukotskii Peninsula. This mission was programmed to be performed in September or October 1951, but with no dedicated reconnaissance version of the Stratojet available, it was decided to use the fourth production B-47B (serial number 49-2645), with preparations including fitment of an operative tail gun turret and a camera pallet in the weapons bay. With modification work completed, the B-47B deployed to Eielson Air Force Base, Alaska, from where the overflight mission would be staged, only to be destroyed by fire during refuelling on September 20. With few aircraft available, it would be another year before SAC tried again.

A second attempt was made in October 1952, this time with considerable success. Two suitably modified B-47Bs (serial numbers 50-0028 and 50-0073) from the 306th Bomb Wing based at MacDill Air Force Base, Florida deployed to Eielson, from where both aircraft took off on October 15.

In the event, only one (50-0073, piloted by 306th Bomb Wings deputy



ABOVE: A top-down shot of an RB-47E showing the configuration of the swept wing and the six podded engines. US Air Force collection

commander, Colonel Donald Hillman) performed the overflight, entering Soviet airspace near Ambarchik and then heading towards the Chukotskii Peninsula before coasting back out into international airspace at Providenya, after covering more than 900 miles of denied territory and obtaining camera and radar imagery of five airfields.

Interception attempts were made by MiG-15s but were ineffectual.

The next overflight by a Stratojet targeted a very different part of the world and was undertaken from RAF Fairford, England, in May 1954. The area of interest appears to have been that of the Black Route which was planned to be flown by an RB-45C in December 1952 as part of Operation Pepsin, only to be cancelled. The flight path extended from Murmansk to Arkhangelsk and this mission was noteworthy in being the first occasion on which an RB-47E was employed to perform an overflight. In fact, eight newly-delivered RB-47Es from the 91st Strategic Reconnaissance Wing had deployed to Fairford, six of which took-off in the early morning of May 8 and headed north, with three of the jets continuing to a point about 100 nautical miles from Murmansk. Two of them then reversed track and set course for Fairford, while the third – piloted by Major Harold Austin – headed into Soviet territory, with the objective of gathering imagery of nine separate airfields. This, however, was far from uneventful, with the lone RB-47E meeting with a heated reception involving several groups of MiG fighters, some of which eventually proved able to accomplish firing passes. One such pass scored a hit on the port wing flap, with shrapnel damage extending to the fuselage but not affecting handling qualities. Efforts to return fire using the twin 20mm tail guns lasted just a few seconds before they jammed, leaving the Stratojet defenceless, but the aircrew was able to make good their escape. Unaware that they had been hit, the more pressing concern for Austin and his crew was the fuel state and it soon became evident that they would be unable to make it back to Fairford, without a top-up of fuel. Fortunately, their radio request for a stand-by tanker was heard, with a

Strategic Reconnaissance Wings

Wing	Squadrons	Base	Period of Operation and Remarks
26th Strategic Reconnaissance Wing	3rd, 4th, and 10th Strategic Reconnaissance Squadrons	Lockbourne Air Force Base, Ohio	1953-1958 (Inactivated July 1, 1958)
55th Strategic Reconnaissance Wing	38th, 338th and 343rd Strategic Reconnaissance Squadrons	Forbes Air Force Base, Kansas	1954-1966 (Moved to Offutt Air Force Base, Nebraska in August 1966, see below)
		Offutt Air Force Base, Nebraska	1966-1967 (re-equipped with RC-135C)
70th Strategic Reconnaissance Wing	6th, 26th and 61st Strategic Reconnaissance Squadrons	Little Rock Air Force Base, Arkansas	1955-1962 (adopted the crew training role from June 1958 onward)
90th Strategic Reconnaissance Wing	319th, 320th and 321st Strategic Reconnaissance Squadrons	Forbes Air Force Base, Kansas	1954-1960 (adopted the crew training role from May 1958 onward)
91st Strategic Reconnaissance Wing	322nd, 323rd and 324th Strategic Reconnaissance Squadrons	Lockbourne Air Force Base, Ohio	1953-1957 (Inactivated November 8, 1957)



LEFT: RB-47H 53-4296 seen at an icy airfield, possibly Thule Air Base, Greenland or Eielson Air Force Base, Alaska, during deployment from Forbes Air Force Base, Kansas. All 32 RB-47H aircraft were assigned to the 55th Strategic Reconnaissance Wing. US Air Force





RIGHT: **A Soviet Air Force MiG-19 flying close to the wing-tip of a US Air Force RB-47.**

*Johnny Frost via Robert Hopkins III*

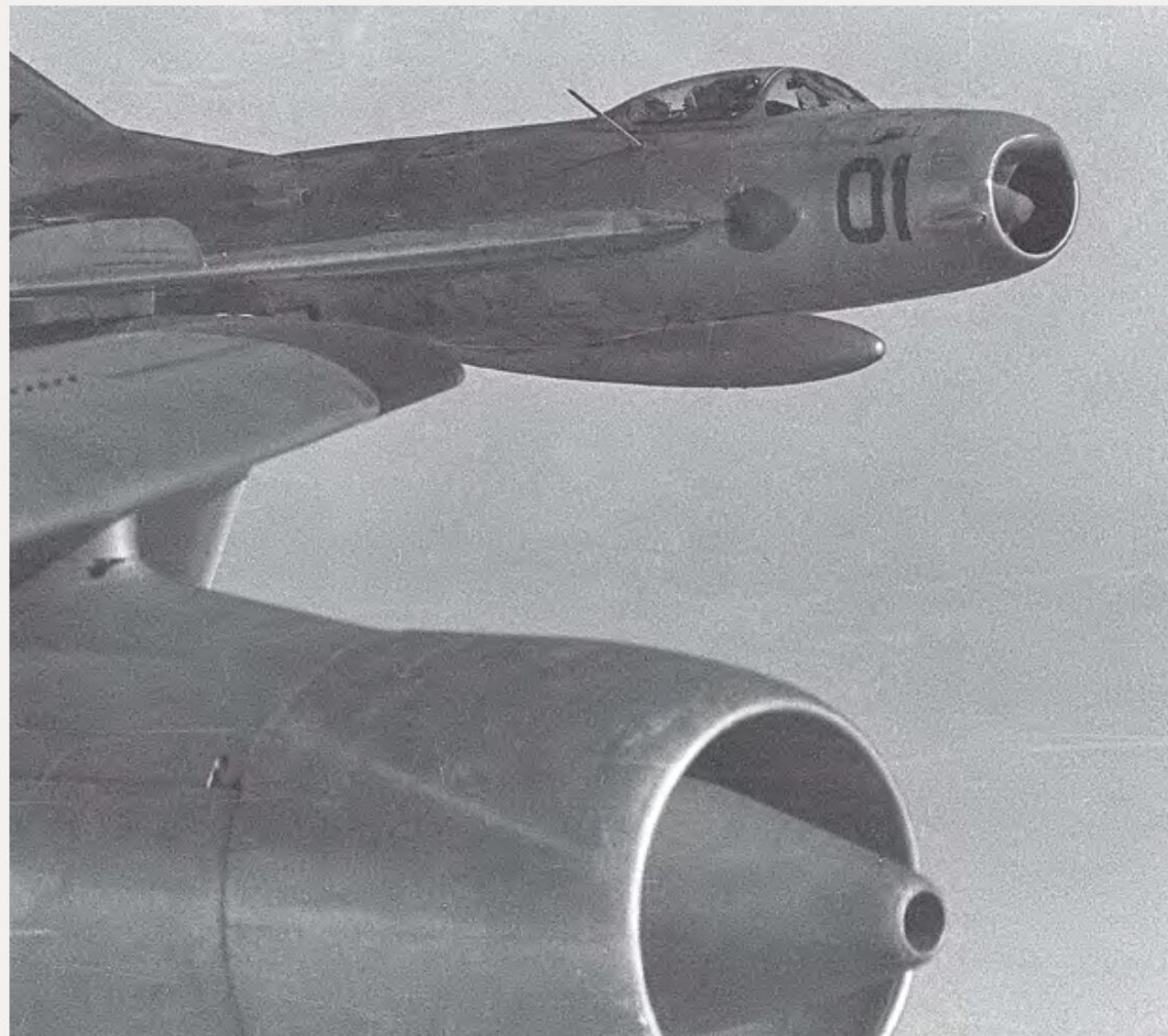
BELOW: **RB-47H 53-4290 was substantially damaged from rounds fired by North Korean MiG-17s on April 28, 1965 over the Sea of Japan. The aircraft successfully recovered to Yokota Air Base, Japan but was irreparable and scrapped. During that encounter, co-pilot Hank Dubuy shot down one of the communist MiGs using the M24A1 20mm cannons in the tail turret.**

KC-97F getting airborne from Mildenhall and effecting a rendezvous that gave the RB-47 sufficient fuel to recover safely at Fairford with its precious intelligence take.

The next mission involved a return to the Soviet Far East, specifically the Kamchatka Peninsula, and was undertaken by one of two RB-47B-I Roman I aircraft from the 26th Strategic Reconnaissance Wing. Both aircraft (serial numbers 51-2054 and 51-2142) were previously YRB-47Bs and both received modifications to the bomb bay in 1954-1955 to enable them to carry a very powerful side-looking camera with a 2,500mm lens in order to gather imagery during a peripheral mission. The aircraft entrusted to undertake Operation Seashore was 51-2054, which left Eielson on April 17, 1955 and was never heard from again. Several days of searching revealed no signs of any wreckage and the circumstances surrounding the loss of this aircraft remained a mystery until 1992 when Russian President Boris Yeltsin handed over documents to US investigators that confirmed it had been shot down by two MiG-15s, with fatal consequences for the three crew.

### Operation Home Run

With no indication of anything particularly untoward having occurred in 1955 and with approval from President Eisenhower, planning progressed for a vastly more ambitious programme of overflights in Operation Home Run. This took place during April and May 1956, when RB-47s from the 26th and 55th Strategic Reconnaissance Wings were used in large numbers, crossing the Polar regions from Greenland to photograph and electronically map Russia's northern border, with special attention paid to bomber and fighter bases in the region, such as Belushya, Dikson and Tiksi. This covered a vast and, until that time, largely unknown area, extending all the way from the Kola Peninsula near Murmansk to the Bering Strait territorial boundary between Russia and the United States. The area of special interest was sufficiently large as to



merit being divided into three sectors, specifically the Kola Peninsula to Dikson on the Kara Sea coast; Dikson to Tiksi on the Laptev Sea coast; and Tiksi to Provideniya on the Bering Sea coast.

It was a formidable undertaking, as well as one that was potentially fraught with danger for the personnel involved. By the time it was completed, no fewer than 156 sorties had been flown, many of which were direct overflights, on occasion requiring RB-47s to penetrate more than 300 miles into denied territory.

Assembling the force to perform Home Run began on March 21, 1956, when the first of 15 RB-47Es from the 26th Strategic Reconnaissance Wing and four RB-47Hs from the 55th Strategic Reconnaissance Wing arrived at Thule Air Base, Greenland. In addition to those configured for photography, eight of the RB-47Es were specially modified under project Peter Pan. The aircraft were configured with a Westinghouse APQ-56 Side-Looking Airborne Radar (SLAR), with the antenna housed in prominent

fairings attached to both sides of the aft fuselage. Reliability of the SLAR system was evidently less than spectacular, but it was the only system available, and in conjunction with imagery acquired by project Plain Jane RB-47Es, helped flesh out the picture of just what military capability the Soviet Union had in the Arctic regions. While the RB-47Es went about their business, the smaller contingent of RB-47Hs prowled offshore, passively detecting and recording a multitude of emissions and signals that help to assemble an electronic order of battle. Tanker support was provided by a 28-strong force of KC-97s drawn from three squadrons, with a typical





RB-47 New-Build Production and Acceptance

Model	Serial Numbers	Construction Numbers	US Air Force Acceptance
RB-47E-1-BW	51-5258 to 51-5264	4500543-4500549	July-October 1953
RB-47E-5-BW	51-5265 to 51-5270	4500550-4500555	October-December 1953
RB-47E-10-BW	51-5271 to 51-5276	4500556-4500561	December 1953-January 1954
	51-15821 to 51-15827	4500627-4500633	January-February 1954
RB-47E-15-BW	51-15828 to 51-15853	4500634-4500659	February-April 1954
RB-47E-20-BW	52-0685 to 52-0719	4500906-4500940	March-June 1954
RB-47E-25-BW	52-0720 to 52-0754	4500941-4500975	June-August 1954
RB-47E-30-BW	52-0755 to 52-0789	4500976-4501010	August-October 1954
RB-47E-35-BW	52-0790 to 52-0825	4501011-4501046	November 1954-February 1955
RB-47E-40-BW	52-3374 to 52-3400	4501047-4501073	February-May 1955
RB-47E-45-BW	53-4245 to 53-4279	4501269-4501303	May-August 1955
RB-47H-1-BW	53-4280 to 53-4309	4501304-4501333	July-October 1955
ERB-47H-1-BW	53-6245 to 53-6246	4501386-4501387	September 1956
RB-47H-1-BW	53-6247 to 53-6248	4501388-4501389	January 1957
ERB-47H-1-BW	53-6249	4501390	October 1956

Note: Final 15 RB-47E aircraft (53-4265 to 53-4279) were produced as RB-47Es but were then modified to RB-47K-1-BW (Bomb Wing) standard before joining the 55th Strategic Reconnaissance Wing between December 1955 and March 1956.

package of four RB-47Es and a single RB-47H needing nine KC-97s in order to accomplish the mission.

After an inauspicious start on April 5 when the mission had to be scrubbed because of insufficient tankers, things improved, with subsequent missions looking at Novaya Zemlya (April 6); the Laptev Sea area including the base at Dikson and a second look at Novaya Zemlya (April 11); and Tiksi Air Base and Wrangel

Island, followed by landing at Eielson (April 25). Particularly noteworthy missions included a more than 300-mile penetration to the city of Norilsk on April 14; a second visit to Tiksi by a Peter Pan RB-47E and two RB-47Hs on April 27 when MiG fighters made an unsuccessful attempt at interception; and the grand finale on May 6-7, when a gaggle of six RB-47Es in formation overflew the whole of the Chukotskii Peninsula from Ambarchik to Providenya, before landing at Eielson.

With Home Run satisfactorily completed, the contingent began redeploying to home bases on



LEFT: An RB-47H uploads fuel from a tanker. Aerial refuelling was critical for all of the RB-47's long-range snoop missions. US Air Force

May 10, but there are reports that the Soviet Union submitted complaints to the United States about the incursions, allegedly to be told that they were the result of navigational difficulties!

More Capable Threats

The long period of relative immunity from interception was drawing to a close, with Soviet defences becoming ever more capable and formidable, beginning with the MiG-19 Farmer fighter which posed a genuine threat, especially to the RB-47. By mid-1958, the era of the RB-47E was virtually at an end, with most either withdrawn or relegated to training duties. However, the RB-47H still had almost a decade of service in front of it and close encounters continued between MiG-19s and RB-47Hs at fairly regular intervals, although they were generally benign. Work on developing surface-to-air missiles (SAMs) was also progressing and both systems were employed to good effect in separate incidents in the first half of 1960. The first involved the shooting down of Gary Powers' Lockheed U-2 by an SA-2 Guideline SAM over Sverdlovsk on May 1. The

BELOW: RB-47E 52-725 was one of eight aircraft specially modified under project Peter Pan and configured with a Westinghouse APQ-56 Side-Looking Airborne Radar. Fairings located on both sides of the aft fuselage housed the radar's antenna, seen just forward of the national insignia. Augustine Letto via Mike Habermehl







ABOVE: **RB-47H 53-4296** seen at an icy airfield, possibly Thule Air Base, Greenland or Eielson Air Force Base, Alaska, during deployment from Forbes Air Force Base, Kansas. Note the forward landing gear bay doors in orange with the last three digits of the serial number displayed in white. US Air Force

RIGHT: **The RB-47H** carried a crew of six, with the pilot, co-pilot, and navigator in a pressurised section in the nose. Three electronic warfare officers or Ravens were stationed in a confined windowless compartment, completely surrounded by electronic equipment occupying the space of the bomb bay. US Air Force

second was the destruction of an RB-47H which was shot down by a MiG-19 while operating in international airspace above the Barents Sea.

Aircraft flying close to the Soviet borders were by no means safe from interception. For the most part, such encounters passed off uneventfully, but just occasionally things turned nasty. That was certainly the case on July 1, 1960, when an RB-47H (serial number 53-4281) from the 55th Strategic Reconnaissance Wing was conducting an electronic intelligence mission as part of the Castle Gate operations order, probing the Soviet radar networks. Despite being outside Soviet airspace, it was struck by cannon fire from a MiG-19, which resulted in a loss of control such that the aircraft commander (Captain Willard Palm) ordered the crew to eject. Palm did not survive the freezing waters, nor did any of the three Ravens, but co-pilot 1st Lt Freeman Bruce Olmstead, and navigator 1st Lt John McKone were picked up by a trawler, flown to Moscow and subsequently incarcerated in the Lubyanka Prison for several months before being repatriated in early 1961.

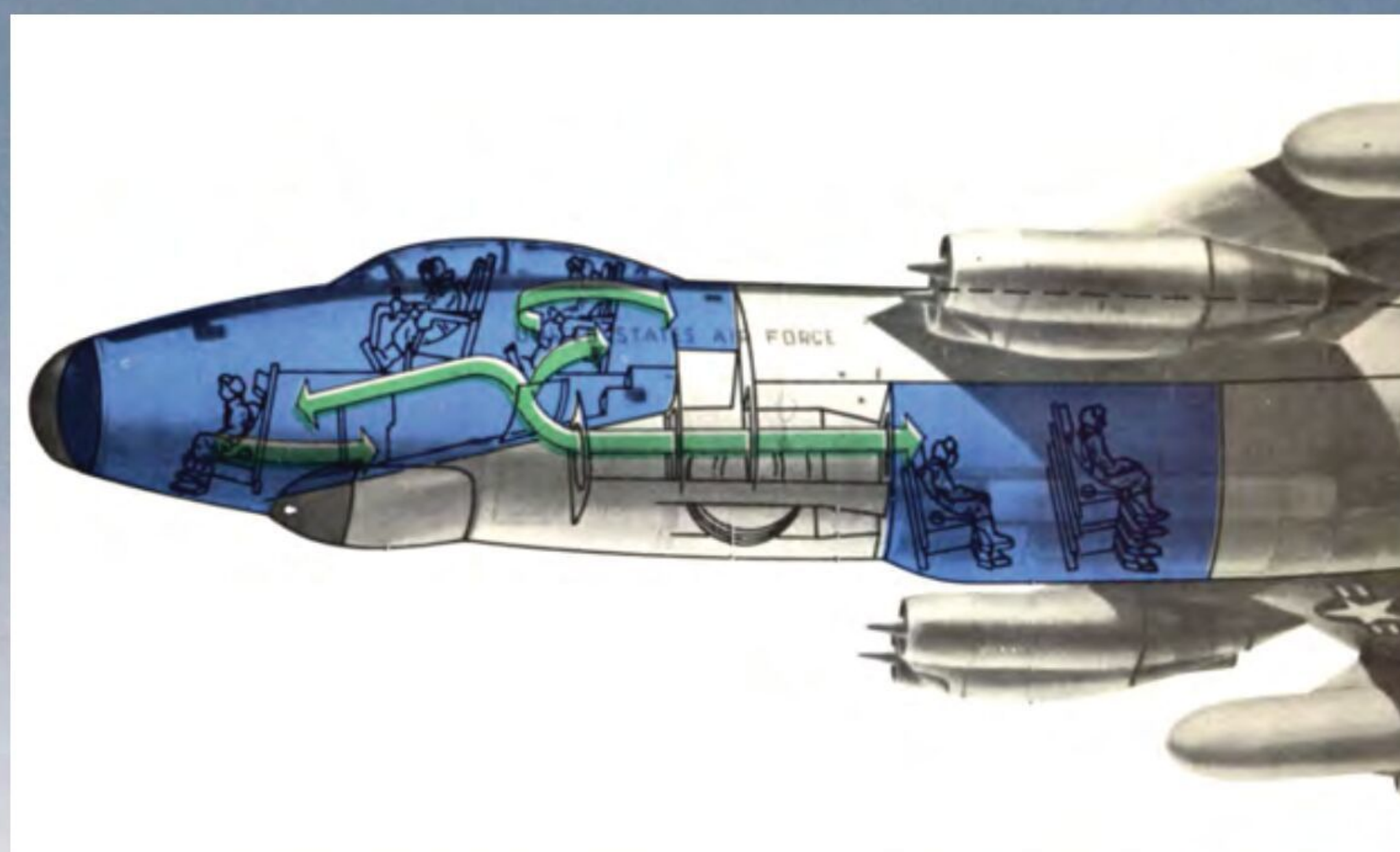
Further encounters followed but did not involve direct confrontation until April 28, 1965 when North Korean MiG-

17s attacked RB-47H 53-4290 over the Sea of Japan. Happily, for the six-man crew, they were able to make good an escape and get back to Yokota Air Base, Japan. The aircraft sustained enough damage to be considered irreparable and fit only to be scrapped. However, this was one occasion where the battle was far from one-sided, with co-pilot Hank Dubuy being credited with shooting down one of the attackers. That was almost certainly the final occasion when an RB-47 went in harm's way. The final examples serving in the

reconnaissance role with SAC retired on December 29, 1967, having been superseded by Big Team RC-135Cs.

One other version performed what could be called an intelligence-gathering mission. This was the Tell Two EB-47E(TT), three examples of which were converted from standard B-47E bombers in 1958. The aircraft were used specifically to capture telemetry data from rockets launched from sites at Kapustin Yar, Astrakhan and Tyuratam, Kazakhstan, a task later entrusted to the RC-135S Rivet Ball and Cobra Ball. All three aircraft were usually deployed to the 55th Strategic Reconnaissance Wing's Operating Location-4 at Incirlik, Turkey, which was a convenient location to launch missions to fly data collection orbits over the Black Sea and above eastern Iran. The five-man crew included two Ravens seated in a capsule in the weapons bay.

Two of the three aircraft (serial numbers 53-2315 and 53-2316) remained in service almost to the end, being retired in late November 1967 – the third (serial number 53-2320) was written off in a landing accident at Incirlik in April 1965.





# Mixed Powered Reconnaissance

**Rick Burgess** charts the career of the  
Martin P4M-1Q Mercator in US Navy service

BELOW: **P4M-1Q**  
**BuNo 124365/JQ6**  
**assigned to Electronic**  
**Countermeasures**  
**Squadron 2 over Italy**  
**in 1959.**  
*Adron Joyner/Angelo*  
*Romano collection*







ABOVE: **Marked with fake BuNo 194873, this P4M-1Q is seen taxiing at Marine Corps Air Facility Iwakuni, Japan on August 3, 1956 devoid of any markings.** US Naval Archives. Robert F Dorr via Glenn Martin Air Museum/Angelo Romano collection

BELOW: **P4M-10s assigned to Airborne Early Warning Squadron 2 Detachment Able at Port Lyautey, Morocco circa 1952. Note the pronounced dihedral of the wings.** Gaynor Abbot/Angelo Romano collection

The electronic reconnaissance version of the Martin P4M Mercator, the P4M-1Q, was the US Navy's primary dedicated land-based electronic reconnaissance aircraft of the 1950s. Converted from the small Mercator production run, the P4M-1Qs spanned the time during the type's relatively short career when electronic reconnaissance became institutionalised in a dedicated force structure in the Navy and set the pattern used today by the US Navy's EP-3E ARIES II fleet air reconnaissance squadron.

The P4M was designed beginning in 1944 to be a successor to the long-range Consolidated PB4Y-2 Privateer assigned to the Navy's patrol bombing squadrons. The heavily armed Privateers, which wreaked havoc on Japanese shipping and shore installations during World War Two, deserved a worthy successor, with some new technology to make

them faster and more survivable. The Navy had in mind a mining platform for the planned invasion of Japan, a role performed splendidly by the US Army Air Force B-29 crews.

Contemporaneously, Lockheed was developing the P2V Neptune, intended as a successor to the Lockheed PV-1 Ventura and PV-2 Harpoon medium patrol bombers. Larger and more heavily armed than its predecessors, it was designed to survive in a high-threat environment.

The end of World War Two caused extensive budget reductions in the US armed forces which had a major impact on aircraft procurement. Whereas two or more aircraft types with similar missions might have been procured during the war, the economic climate forced reductions in some classes of combat aircraft. While two or more types of jets were usually in development through the late 1940s and 1950s, aircraft such as patrol planes and attack aircraft were

whittled down to one type. The AD Skyraider superseded the AM Mauler, and the medium patrol bomber class embodied in the PV was discarded, with the P2V competing with the P4M to be the Navy's prime land-based patrol bomber.

## P4M-1 Mercator

Though similar in concept and general appearance, the P4M and P2V were quite different aircraft. The P4M was much larger and heavier. It was equipped with two 3,250hp Pratt & Whitney R-4360-20 radial engines plus — an innovation of the time — a Allison J33-A-10 jet engine installed in the aft section of each engine nacelle, generating 4,360lbf. The jet engines boosted the Mercator's dash speed to 400mph. The P2V had twin R-3350 radial engines only — although wing-pylon-mounted J34 auxiliary jets would be fitted in later versions. The Neptune had a longer range and the P4M was more expensive than the P2V, a factor which may have been primary in the decision to terminate production of the Mercator at only 21 aircraft.

XP4M-1 (BuNo 02789) made its first flight on September 20, 1946, more than a year after the first flight of the XP2V-1. A second prototype (BuNo 02790) was built with some changes but was retired early. The first prototype was modified with a longer forward fuselage, but the production version featured a longer aft fuselage as well.

Blessed by its higher performance compared with the P2V, the P4M-1 entered production, with the first (BuNo 121451) flying on July 18, 1949, but the Navy chose to make the P2V the mainstay of its land-based patrol plane force.





## MARTIN P4M MERCATOR



Production standard Mercator aircraft were armed with Emerson turrets in the nose and tail featuring 20mm cannons, twin 0.50-caliber machine guns in a Martin dorsal turret, with single 0.50-calibre waist positions as well. The bomb bay could carry 12 depth charges or mines or six 2,000lb mines or two 2,000lb Mk13 torpedoes. The waist guns were never installed for operational use. Extra fuel tanks also could be carried in the bomb bay in place of ordnance.

A Mercator crew consisted of two pilots, a navigator, an APS-33 radar operator, a radio operator, an electronic countermeasures operator,

a photographer, a nose gunner, and a tail gunner.

The production run of 19 P4M-1s (BuNo 121451-121454, 122207-122209, and 124362-124373) was completed in September 1950, by which time the rival P2V had equipped more than a dozen patrol squadrons (VPs). The P4M-1 equipped only one patrol squadron, VP-21, beginning in June 1950, at Naval Air Station Patuxent River, Maryland, replacing the squadron's PB4Ys. The entire squadron deployed nine aircraft to Naval Air Facility Port Lyautey, French Morocco, with the contingency mission of mining in support of the US Sixth Fleet in the Mediterranean area.

### P4M-1Q Mercator

Having a single Mercator squadron among two dozen Neptune squadrons made little economic and logistical sense, but the Navy found that it needed a replacement for the PB4Y-2s it used covertly in the electronic reconnaissance role. The Privateer's role came to light when one PB4Y-2s assigned to VP-26 was shot down over the Baltic Sea by Soviet LA-11 fighters on April 8, 1950, with the loss of the entire crew.

While VP-21 was allocated 10 P4M-1s, the Navy began converting the remaining eight aircraft for the electronic reconnaissance role, and later modified the 10 Mercators withdrawn from VP-21 to an upgraded P4M-1Q configuration. As an aside, a test P4M-1 (BuNo 121452) was lost in a crash in the Chesapeake Bay on March 8, 1951. The conversion work, completed by the Overhaul and Repair facility at Naval Air Station Norfolk, Virginia, resulted in the P4M-1Q, which first flew in February 1951.

A major change to the P4M-1Q was the size of its crew, which had to include specialists for ELINT collection. The pilots, navigator, radar operator, radio operator, and two gunners were retained, supplemented by a plane captain and a third gunner. The electronic countermeasures operator and photographer positions were replaced by six stations, one for a signal evaluation officer (SigEval) and five enlisted electronic evaluators. Initially the evaluators were not part of the flying unit or squadron but were drawn from a Naval Security Group unit, Communications Unit 32G. Two

LEFT: *The last P4M-1Q built, BuNo 124373/XD3, with the tail markings of Airborne Early Warning Squadron 2 Detachment Able based at Port Lyautey, Morocco seen in 1954.*

*Tailhook Association collection*

RIGHT: *A rare photo of a 1951 formation flight of P4M-1Q Mercator aircraft assigned to Naval Air Facility Port Lyautey each marked with the bogus 'YN' tail code.*

*US Navy via Don East/Tailhook collection*





more evaluators were later added, bringing the crew size to 16 personnel.

The P4M-1Q featured an impressive mission system comprising four APR-4 and four APR-9 receivers. As with all signal intelligence aircraft, the aircraft featured numerous blade and whip antennas as well as four antennas housed in blister radomes below the fuselage for APA-69 direction-finding receivers. The aircraft also had an SLA-1 pulse analyser which could display the intercepts from all ELINT stations to the SigEval and for a camera to record the pulses for later analysis. All told, the P4M-1Q could intercept emissions in a range from 50 to 10,750MHz. Unlike later Navy electronic reconnaissance aircraft, the P4M-1Q did not have a communications intelligence (COMINT) capability. A galley and a toilet for crew comfort also were added.

With all of the extra crewmen and electronic equipment, the P4M-1Q was much heavier than the patrol version, grossing out at 92,500lb. Speed and range were reduced accordingly, to 340 knots and from 2,840 to 2,000 miles, respectively.

The first unit to receive the P4M-1Q was Naval Air Facility Patrol Unit (NPU) Port Lyautey, where the PB4Y-2s formerly of VP-26 were replaced as the Mercators were delivered beginning on April 2, 1951. The configuration of the first aircraft needed some improvements in interior cabin layout, and the subsequent deliveries of three more aircraft incorporated the upgrades.



### P4M-1Q Squadrons

In the Pacific Fleet, four P4M-1Qs were delivered during April 1951 to Composite Squadron 11 (VC-11) Detachment Miramar, California, which flew PB-1W Flying Fortress early warning aircraft. In September, the Mercators and crews were transferred to Naval Air Station Sangley Point, Philippines. On October 1, 1951, the Special Electronic Search Project Division, usually known as the Special Project Division (SPD), of the air station's Air Operations Department was established to operate the P4M-1Qs.

The two P4M-1Q units changed designations numerous times

over their histories, always with the intent of concealing their true ELINT mission. The SPD at Sangley Point was re-designated Airborne Early Warning Squadron 1 (VW-1) Detachment Able on May 1, 1953. On the same date, Naval Air Facility Patrol Unit Port Lyautey was re-designated VW-2 Detachment Able (tail code XD). When VW-1 was replaced on deployment by VW-3, Detachment Able was transferred to VW-3 on June 1, 1954. On September 1, 1955, the two detachments were established as full squadrons, being designated Electronic Countermeasures Squadron 1 (VQ-1) and 2 (VQ-2) respectively. These units were dubbed

*BELOW: Assigned to Electronic Countermeasures Squadron 1 based at Marine Corps Air Facility Iwakuni, P4M-1Q BuNo 124365/PR5 at Tachikawa Air Base, Japan in 1958. ELINT-configured Mercator aircraft frequently took off from one base and recovered at another to be re-positioned for a subsequent mission. Mel Lawrence/Angelo Romano collection*





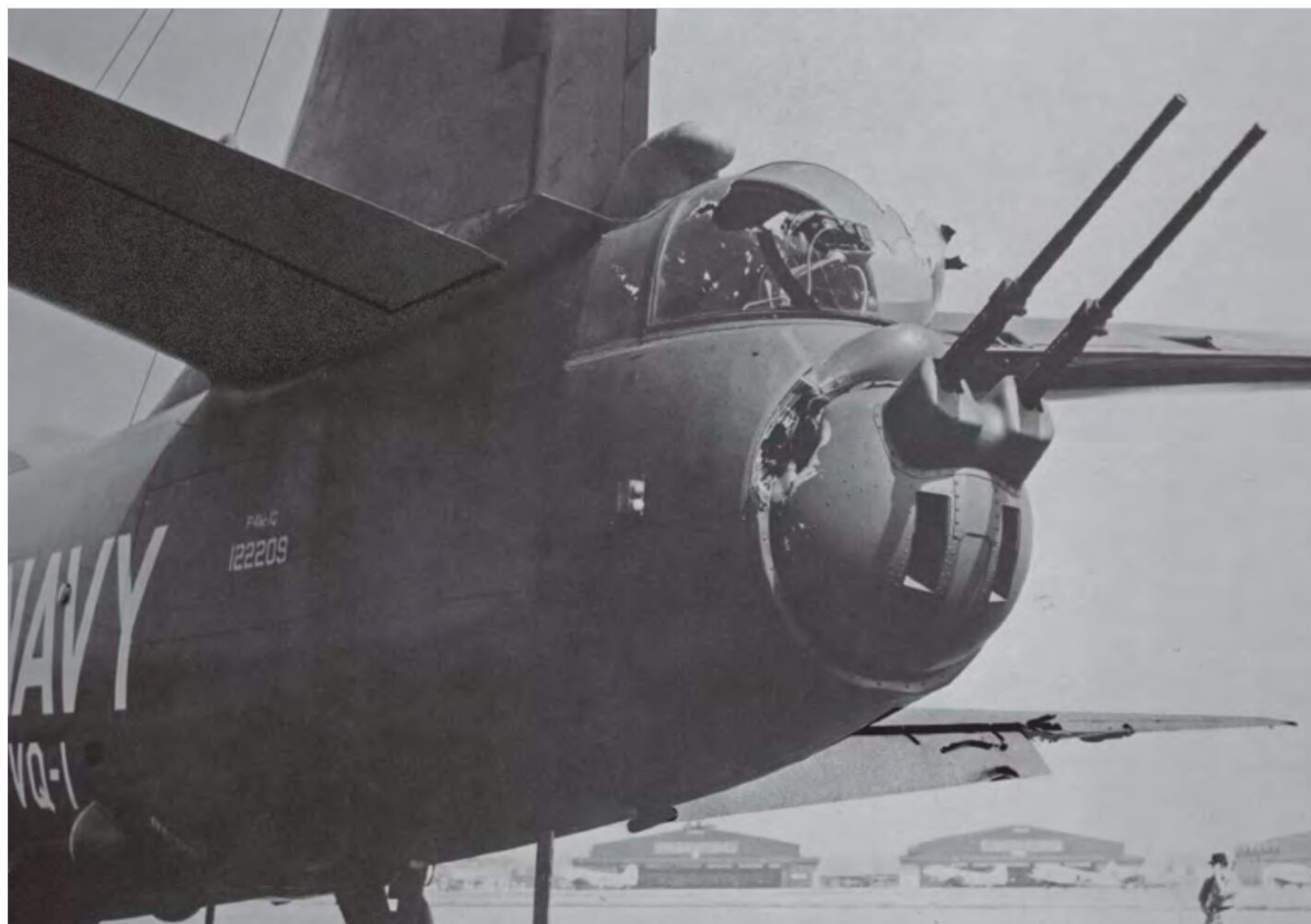
## MARTIN P4M MERCATOR

ECMRONs, with tail codes PR and PS, respectively. On August 9, 1957, VQ-2 changed its tail code to JQ, and on the date of its designation, VQ-1 moved to Marine Corps Air Facility Iwakuni, Japan.

On January 1, 1960, the ECMRONs were redesignated Fleet Air Reconnaissance Squadrons 1 and 2 (retaining the same VQ-1 and VQ-2 identifications and tail codes). VQ-1 moved to Naval Air Facility Atsugi on July 1, 1960, and VQ-2 re-located to Naval Station Rota, Spain, in January 1959.

Former VP-21 Mercator aircraft converted to P4M-1Qs — and featuring some mission equipment upgrades, including replacement of the dorsal gun turret with a blister covering an antenna for an APA-69 — replaced the survivors of the original eight P4M-1Q conversions from the mid-1950s. When VW-3 took over Detachment Able from VW-1, it received four newly modified P4M-1Qs, plus two more after the unit became VQ-1. VQ-2's allocation was increased up to six aircraft. The surviving three of the earlier four were sent to Litchfield Park, Arizona for storage and were then stricken on November 15, 1956.

P4M-1Qs often operated with fake and changing tail codes — or codes allocated to P2V squadrons — and fake bureau numbers in attempts to confuse the Soviets and other adversary nations into believing they were assigned to regular patrol squadrons, much the same as P-3 Orion aircraft of the special project units did from 1969 onward. Over time,



the aircraft also gave up their midnight blue colour scheme for a dark bluish grey.

The ELINT missions, mostly along the maritime periphery of the Soviet Union, China, North Korea, and Vietnam, were mainly involved in the detection, location, and classification of coastal air-defence radars. On occasion, they overflew target emitters to photograph them. Most missions were flown at night, with running lights turned off. Some missions lasted as long as 14 hours, but most lasted eight to nine hours.

Numerous airfields were used, ranging from Shemya Air Force Station in the Aleutian Islands to Sangley Point in the Western Pacific, and from Wiesbaden, Germany, to Nicosia, Cyprus, in Europe. The missions were particularly critical to planning potential routes into the Soviet Union for air force and Navy strike aircraft in the event of war. The passive ELINT mission was related but distinct from ECM, a fact lost on many observers. It should also be noted that these units also operated some P2Vs modified for ELINT missions.

ABOVE: *The tail turret of P4M-1Q BuNo 122209 was hit by fire from North Korean MiG-17 fighters, severely wounding the tail gunner. The Mercator was attacked and damaged during a mission over the Sea of Japan and made an emergency landing at Miho, Japan. This aircraft was written off at Iwakuni, Japan, on November 10, 1959.*  
Angelo Romano collection



LEFT: *An excellent view of P4M-1Q BuNo 124363/PR3 assigned to Electronic Countermeasures Squadron 1, landing in Japan on May 15, 1960. This image gives a good view of the landing gear wells, and the configuration of radomes and antennas fitted to the fuselage underside.*  
Angelo Romano collection



### Risky Missions and Mishaps

By definition, Cold War missions were risky, and intercepts from fighters occurred, although the total number of firing attacks is not known, two resulted in the loss of one P4M-1Q and the write-off of another. Known attacks occurred on:

January 23, 1952 - An NPU P4M-1Q was fired on by rockets from a Soviet fighter over the Baltic Sea.

July 1952 - An SPD P4M-1Q was fired on by Soviet or North Korean MiG-15s over the Sea of Japan.

April 23, 1953 - SPD P4M-1Q BuNo 124369 was attacked by Chinese MiG-15s off Shanghai.

April 1955 - VW-3 Det A P4M-1Q BuNo 124362 was attacked by Chinese MiG-15s.

August 22, 1956 - VQ-1 P4M-1Q BuNo 124362 was shot down by Chinese MiG-15 fighters during an ELINT mission 32 miles east of Wenchow, China, and 180 miles north of Formosa. The crew sent a radio message that read "attacked by aircraft" before contact was lost. US Navy ships and AD Skyraiders from USS *Lexington* searched the East China Sea and spotted wreckage. Two bodies from the crew of 16 were recovered. Others were recovered by Chinese vessels and later returned to the United States. The Chinese government stated that the Mercator was thought to have been a Nationalist Chinese aircraft.

June 16, 1959 - VQ-1 P4M-1Q BuNo 122209 was attacked over the Sea of Japan 78 miles east of Wonson Harbour by North Korean MiG-17s, which made at least three firing runs on the Mercator. The tail gunner was wounded when his gun turret was neutralised. With the two starboard engines shot out and control surfaces damaged, the crew, led by Lt Cdr Mayer, managed to fly the Mercator safely to Miho, Japan. The aircraft was

**"By definition, Cold War missions were risky, and intercepts from fighters occurred, although the total number of firing attacks is not known, two resulted in the loss of one P4M-1Q and the write-off of another."**

scrapped after reclamation of parts at Iwakuni after being stricken on November 10, 1959.

Four P4M-1Qs were lost in mishaps on:

February 7, 1952 - NPU P4M-1Q BuNo 124731 which had launched on an ELINT mission over the Black Sea from Cyprus with a crew of 15. South of the Crimean Peninsula, the starboard radial engine developed a severe oil leak and had to be shut down. Precluded from landing in Turkey by the nature of its mission, the crew pressed on to the Mediterranean, but fuel exhaustion forced a ditching at night. All crewmen survived and were rescued except the plane commander, Lt Bob Hager, who re-entered the aircraft to make sure the crew had escaped. One source attributes the fuel exhaustion to out-running Soviet fighters.

November 19, 1957 - VQ-2 P4M-1Q BuNo 124372 was involved in an unspecified mishap and was stricken on July 27, 1958.

January 4, 1958 - A VQ-2 P4M-1Q suffered engine failure on approach to Naval Air Station Norfolk, Virginia, during an emergency and crashed, killing four of the 13-member crew.

January 19, 1960 - VQ-2 P4M-1Q BuNo 124365 in transit from Rota to Incirlik, Turkey, crashed into a mountain on approach, killing all 16 crewmen on board. One source attributes this incident as related to a

Soviet intercept.

Other mishaps occurred which nearly caused aircraft to be lost, including one in which one of the radial engines fell off and the pilots were able to recover from a flat spin.

### California: The Final Stop

During the late 1950s, the Mercator aircraft were supplemented by new carrier-capable Douglas A3D-1Q (EA-3A) and later A3D-2Q (EA-3B) Skywarriors and unarmed four-engine Lockheed WV-2Q (EC-121M) Warning Star land-based aircraft. All three types were true SIGINT aircraft configured for the gathering of both ELINT and COMINT data.

Support of a small Mercator fleet became increasingly difficult to justify and with able replacements on hand, the Navy decided to withdraw the P4M-1Q from service in 1960. VQ-2 made its last Mercator flight on February 29, 1960. The squadron's aircraft were scrapped at Rota. VQ-1 ceremoniously retired its last two P4M-1Qs at Atsugi on July 23, 1960, just after the squadron's move there from Iwakuni. Three P4M-1Qs were scrapped at Atsugi and one (BuNo 124364) was flown to Naval Air Station Alameda, California, and stricken in October 1960. None remain as memorials to an aircraft that gave yeoman reconnaissance service to the nation.

BELOW: **P4M-1Q BuNo 124362/PR4** assigned to Electronic Countermeasures Squadron 1, at Naval Air Station Alameda, California in August 1960. This aircraft was ferried to Alameda from Atsugi and was the last Mercator to fly. It was scrapped in October 1960. Tailhook Association collection





# Gary Powers' Plane

**Bob Archer** details one of America's most notable and famous spy planes, the high-flying Lockheed U-2

**O**n June 20, 1956, a Central Intelligence Agency Lockheed U-2 undertook the first overflight of Eastern Europe. The pioneering sortie was the first of many which initially photographed important areas of Eastern Bloc nations, comprising the satellite states of the Soviet Union. These included Bulgaria, Czechoslovakia, the German

Democratic Republic, Hungary, Poland, and Romania, all of which were equipped with the latest Soviet hardware, and therefore key targets for western intelligence gathering.

Sixty-five years later, on February 10, 2021, a descendant of the first U-2 flew a sortie from RAF Akrotiri, Cyprus, to RAF Fairford, England on the first stage of its flight back to the United States for maintenance.

Whereas the 1956 flight was shrouded in secrecy, known about by just a handful of personnel with a need-to-know clearance, the February 2021 sortie was tracked by many enthusiasts on their mobile telephones, thanks to the wonders of flight data produced by Automatic Dependent Surveillance-Broadcast

technology. Provided the aircraft concerned is using its transponder to transmit data, the system automatically shares information about flight characteristics. For transit flights, and sometimes operational missions, the U-2 community uses ADS-B. Whilst this may seem foolhardy to let a potential adversary know of a U-2's presence, the days of cloak and dagger spy flights are well and truly in the past. Quite often a U-2 will be flown to ensure that the potential adversary knows that they are being watched. However, not all such flights are carried out in such an overt manner.

While the lengthy U-2 programme has evolved, today missions are similar to those conducted in the mid-1950s.

*BELOW: U-2S 80-1070/BB flies above the Sierra Nevada Mountain Range, California. The aircraft is configured with a raft of antennas, an interchangeable nose and under wing slipper tanks housing advanced sensors, and an elliptical radome atop the centre fuselage housing Senior Span and Senior Spur satellite datalink systems.*  
US Air Force/SSgt Robert Trujillo





RIGHT: *Air Force Flight Test Center U-2D 56-6721 at Naval Weapons Center China Lake, California in October 1975.*  
Bob Archer



On August 1, 1955, while conducting its second taxi trial, the first U-2, known simply as Article 341, got airborne unintentionally. Lockheed test pilot Tony LeVier was at the controls. He had intended to accelerate the aircraft, in a normal manner, to gauge low speed handling. However, the huge wings, and the lightweight structure, combined with the natural ground effect produced lift, resulting in Article 341 making a very short first flight.

Soon afterwards, on August 8, the official first flight was staged in front of selected officials from Lockheed, the government, and military. All activities were carried out at Area 51,

deep within a remote and restricted part of the Nevada desert. The Articles were constructed at Burbank Airport, California, and the dismantled aircraft were transported the short distance by Douglas C-124 Globemaster transport aircraft. Once each dismantled aircraft was unloaded at Area 51, re-assembly was undertaken in a hangar. Though security was tight, satellite imagery had yet to become reality, so there was no chance of potential adversaries gaining any knowledge of the programme through overhead sources. The CIA was in overall control of the programme, known as Project Aquatone, although the military and

other agencies were involved.

The aircraft was little more than a glider, equipped with an engine, and a bay to house photographic equipment. As such, it was easy for Lockheed to build in a secure area at Burbank, which soon became known as the Skunk Works.

During loading on board a C-124 and its transit flight, each dismantled U-2 was wrapped in a protective cover to conceal it. Several U-2s were flown to Area 51 by the beginning of 1956, when the programme achieved the desired operational capability, reaching the required 72,000ft altitude ceiling and 2,950-mile range.





## LOCKHEED U-2

With sufficient pilots and aircraft available to conduct missions, and the necessary infrastructure in place to process the precious film footage, the US government began to establish bases in Western Europe to start flights that would breach the Iron Curtain. Initially, RAF Lakenheath in England was selected, with four aircraft and the essential support arriving by May 4, 1956. While plans were being formulated for operations, several incidents occurred which could have been embarrassing to the UK government. The situation resulted in the entire deployment relocating to Wiesbaden, West Germany. While at Lakenheath, the aircraft were ostensibly assigned to Weather Reconnaissance Squadron (Provisional) 1, which of course, was a cover for the CIA's role. Personnel from the CIA, US Air Force and Lockheed simply knew the arrangement as Detachment A (Det A).

The move to Wiesbaden was completed on June 11, 1956 although the need to maintain the U-2s out of the public gaze meant the site wasn't felt suitable due to the base being in a populated area. Therefore, the decision was made to move the operation for a third time to Giebelstadt 100 miles to the east. However, before relocating again, the Agency flew their initial overflights.

Other Dets were formed during the following four years - Det B at Adana (renamed Incirlik) Turkey, and



other locations within the Indian sub-continent; Det C at Naval Air Facility Atsugi, Japan; Det G at Edwards Air Force Base, California; and Det H at T'ao-yuan, Taiwan.

Weather Reconnaissance Squadron (Provisional) 2, 3, and 4 were also created as cover for CIA U-2 operations at Incirlik, Atsugi, and Edwards, respectively. Aircraft and crews frequently relocated within their area of responsibility as missions dictated.

### Operation Overflight

Run by the CIA, the U-2 programme was known as Operation Overflight, though President Dwight D. Eisenhower made the final decision to launch each incursion sortie. Eisenhower worried

that overflights might be tracked, and that in the event of a technical issue and loss of a U-2 over denied territory, the fallout could have far-reaching repercussions with the unpredictable Soviets. Despite reassurances from senior aides, and various intelligence reports into Soviet defences, the President remained uneasy.

But with the American public alarmed at the prospect of a perceived advantage gained by the Soviet Union in the production of strategic bombers, the dilemma forced the president's hand. Richard Bissell, the CIA project officer for the U-2, had notified the president of an intention to begin missions, with a flight over the German Democratic Republic and Poland on

**ABOVE: A U-2 pilot drives a high-performance chase car down the runway to catch a U-2 performing a low touch and go at Al Dhafra Air Base, United Arab Emirates. The pilot driving the chase car helps the pilot flying the U-2 by communicating alignment with and height above the runway during take-offs and landings.**

*US Air Force/Senior Airman Gracie Lee*

**BELOW: Performing overshoots to train future U-2 pilots in May 1981, U-2CT 56-6953 was one of three deployed to RAF Upper Heyford in August 1962.**

*Mike Grove*







ABOVE: **U-2S 80-1067** landing at Palmdale, California during November 2004, while on test with Lockheed Martin. Tail code WR signifies assignment to Warner Robins ALC at Robins Air Force Base, Georgia.  
Gerhard Pomitzer

June 20, 1956.

Two more missions were performed on July 2, one covering Czechoslovakia, Hungary, and Bulgaria, while the second photographed East Germany, Poland, Hungary, and Romania. Films were flown to the processing laboratory in Washington DC and results were encouraging. Bissell was anxious to carry out the first mission over Soviet territory. Presidential approval, and favourable weather conditions enabled this mission to go ahead on July 4. Article 347 (serial number 56-6680) was assigned to the mission which overflew Poznan, Poland where riots had taken place days before, then above Belorussia, north to Leningrad, and home via the Baltic States.

The next day, another mission followed a similar route, but to an area to the east of Moscow, permitting limited photography of the city itself - the only such time Moscow was targeted. Various production plants and test facilities, including Ramenskoye were photographed.

President Eisenhower was anxious to know if the flights had been detected and tracked, and while it was confirmed that interceptors had launched, the CIA was bemused that tracking was inconsistent, and that the weakest radar coverage was around Moscow and Leningrad. Indeed, the Soviets were unaware that a U-2 had even overflown both cities!

Amazingly, the films showed tiny specks, which photo interpreters deduced were MiG-15 and MiG-17s attempting to intercept but failing to gain altitude.

Subsequently, operations commenced from Adana, Turkey, enabling

overflights to be more intensive, with the U-2 able to explore more remote areas of the Soviet landmass. In addition, the CIA had also established at Peshawar in northwest Pakistan. The mission flown on May 1, 1960 was one of the most daring to date, with a plan to depart Peshawar, and traverse the Soviet landmass, overflying the Kazak region, before heading to the Urals area, and eventually landing at Bodo, Norway.

However, by this time, the Soviet Union's defences had improved with batteries of S-75 Dvina (SA-2 Guideline) surface-to-air-missiles in operation. One of multiple SA-2's fired on May 1, 1960 detonated near enough to the aircraft and fatally crippled the U-2, which was brought down near Sverdlovsk (today renamed Yekaterinburg). Pilot Gary Powers ejected, was captured, put on trial, and imprisoned. The incident forced President Eisenhower to halt all overflights of the Soviet Union, though he refused to end the U-2 programme but forced the CIA to transfer all U-2 operations in the region to the US Air Force.

NASA, and its forerunner the National Advisory Committee for Aeronautics, had borrowed U-2s for weather research and had flown some 200 sorties by 1960. Following the loss of Powers' U-2 over Russia on May 1, 1960, in an act of strategic deception NASA hurriedly prepared an aircraft to show the press. On May 6, an all-black U-2 painted with a NASA tail stripe and the fictitious serial 55741 was parked outside the administration's hangar at Edwards Air Force Base, California. The ruse failed spectacularly. The following day Soviet leader Nikita Khrushchev

revealed that the U-2's pilot Gary Powers had been captured!

Subsequently, the Ames Research Laboratory was provided with two U-2Cs, the first examples directly assigned to NASA and registered N708NA (assigned until August 1990) and N709NA (last seen in June 1987).

Interestingly, both NASA aircraft had previously been assigned to the CIA, as Articles 348 and 349, and were amongst the first four to be deployed to Lakenheath, and Wiesbaden. Therefore, they were included in the initial overflight programme of Eastern Europe, and the Soviet Union. One aircraft subsequently deployed to RAF Upper Heyford, England in 1962 for HASP duties. At the conclusion of their CIA and US Air Force service, the two aircraft were transferred to NASA.

U-2s N708NA and N709NA both conducted earth survey work, until they were replaced by a pair of brand-new ER-2S aircraft; N706NA (80-1063), acquired in June 1981 (re-registered as N806NA) and N809NA (80-1097) acquired in March 1989. Both aircraft remain in service with the Armstrong Aircraft Operations Facility at Palmdale, California performing a variety of high-altitude missions dedicated to earth sciences, flying as laboratories in the Airborne Science Program.

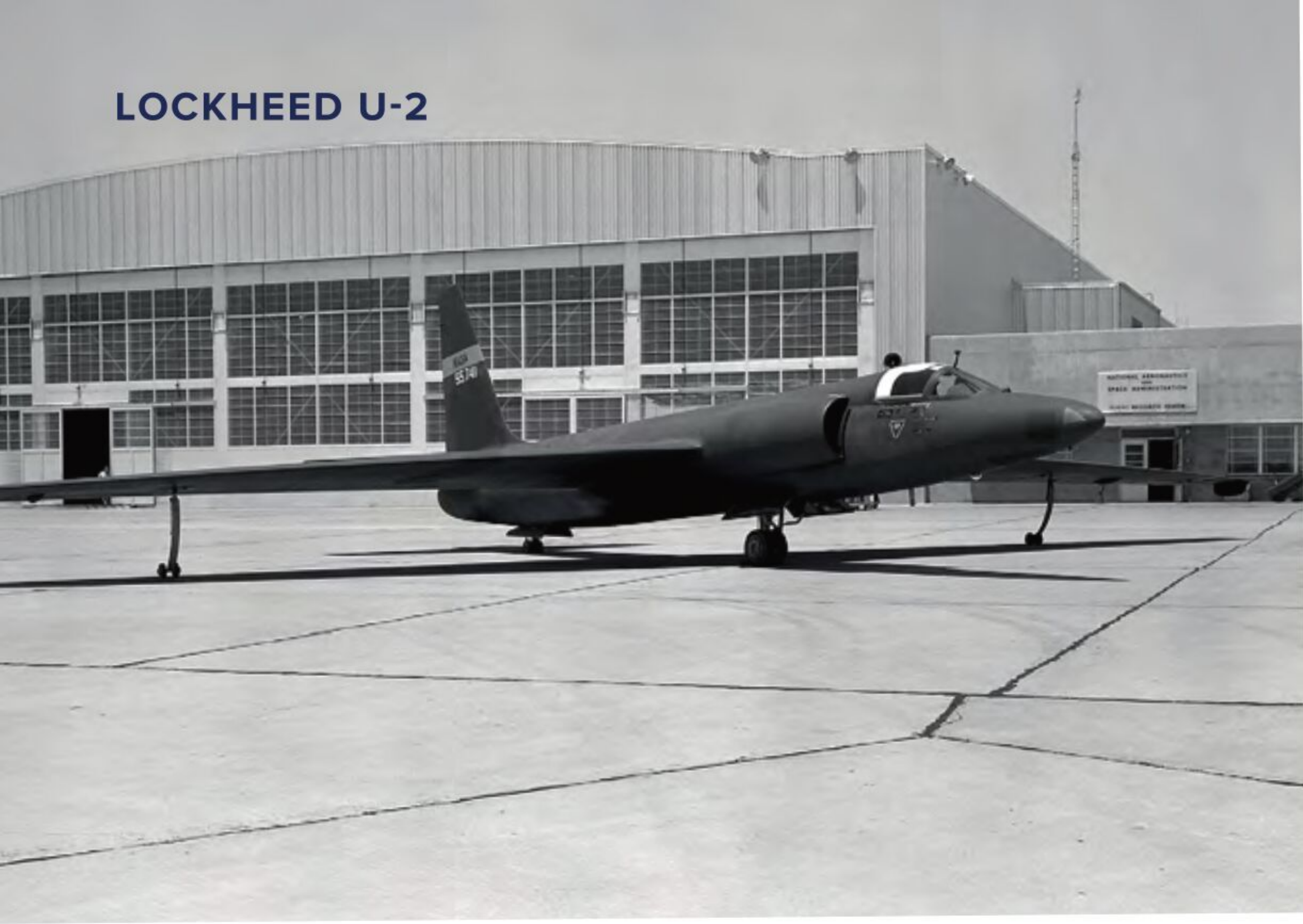
Between June 1995 and October 1996, NASA operated ER-2 80-1069 (708), but the aircraft was returned to the US Air Force to replace an aircraft lost in an accident.

## Strategic Air Command and the U-2

Shortly after the CIA had acquired its U-2s, the decision was made for



## LOCKHEED U-2



Strategic Air Command (SAC) to begin operating the type. The Air Force could provide a tailor-made cover story for Agency U-2 operations, as well as a source of pilots who could be 'sheep-dipped' while in the government employ. The first 20 aircraft were produced for the CIA, identified simply as Articles 341 to 360 (and with US Air Force serial numbers allocated to all but the first aircraft, as 56-6675 to 56-6693). The next 29 were supplied to the Air Force, with serial numbers 56-6694 to 56-6722. A further six were ordered in 1959 for CIA service, as Articles 390 to 395, with Air Force serials 56-6950 to 56-6955. The assignment of Air Force serials enabled aircraft to be exchanged between the military and the agency.

The 4080th Strategic Reconnaissance Wing at Laughlin Air Force Base, Texas was operating the high-altitude Martin RB-57D, so it was a logical option to locate the U-2 at the same facility. The 4028th Strategic Reconnaissance Squadron (later Strategic Reconnaissance Weather Squadron) was the initial flying squadron, formed on April 1, 1957. U-2A 56-6696 is thought to have been the first to be assigned. Other aircraft soon followed, enabling the Air Force to become operational with the U-2.

The High-Altitude Sampling Program (HASP) designed to sample the radioactive debris in the upper atmosphere following the detonation of Russian, Chinese, and French Nuclear weapons was the 4028th's

initial tasking. Missions were flown from Ramey Air Force Base, Puerto Rico, and Plattsburgh Air Force Base, New York, as well as overseas locations. U-2 aircraft carried sampling equipment in the nose, along with other devices installed on the port side of the fuselage. Filter membranes were placed inside these units, with particulates captured when flying through radioactive clouds. Aircraft flew in a straight line, north-to-south and then reversed course, hence the unofficial mission name Crow Flight. As a result of the 1963 Partial Nuclear Test Ban Treaty, the HASP programme was terminated, with the equipment removed, and replaced with photographic cameras, and electronic sensors.

Because Laughlin was planned to become a pilot training base, the 4080th relocated to Davis-Monthan Air Force Base, Arizona on July 1, 1963. The 100th Strategic Reconnaissance Wing replaced the 4080th on June 25, 1966, with the 4028th Strategic Reconnaissance Squadron renumbered as the 349th Strategic Reconnaissance Squadron.

The U-2 operation remained at Davis-Monthan until September 30, 1976, when SAC consolidated high altitude reconnaissance assets under a single parent wing. Following departure of the 17th Bomb Wing's B-52s from Beale Air Force Base, California, the base had the capacity to add the U-2 to the incumbent 9th Strategic Reconnaissance Wing, already operating the Lockheed SR-71A Blackbird.

LEFT: *Displayed outside the NASA hangars at Edwards Air Force Base on May 6, 1960, a U-2 with a NASA tail stripe and bogus serial 55741, possibly 56-6714, for a press visit. This was a deceptive and shallow attempt to divert attention away from the true nature of Gary Powers' U-2 shot down five days earlier.*  
NASA

RIGHT: *Pilots assigned to the 1st Reconnaissance Squadron prepare for take-off in a TU-2S aircraft at Beale Air Force Base, California on December 20, 2020.*  
US Air Force/SSgt Ramon Adelan

BELOW: *U-2R 68-10339 with Senior Span fairing and tail art, operating from Aviano Air Base in September 1992, during the Balkans crisis.*  
Sergio Gava







On September 19, 1991, the 9th Strategic Reconnaissance Wing was re-designated as a wing. Soon afterwards in June 1992, SAC passed into history, with the wing and assets joining the new Air Combat Command. The new assignment enabled the wing to adopt the BB tail code, along with a tail band comprising four red iron crosses within two red stripes.

Re-designated as a Reconnaissance Wing on October 1, 1993, the assigned squadrons changed titles during subsequent years, but U-2 operations remained largely the same.

### Weather Mission to Germany

During May 1975, six of the few remaining U-2Cs were painted in a two-tone grey camouflage scheme for a deployment to RAF Wethersfield, England to conduct high altitude reconnaissance missions over mainland Europe.

Under Operation Constant Treat, U-2Cs 56-6680, 56-6701 and 56-6707 arrived on May 8, followed by 56-6700 and 56-6714 the next day. Aircraft 56-6700 crashed near Winterberg, West Germany on May 29 and was replaced by 56-6716 on June 5, 1975.

Tasking was designed to evaluate the Advanced Location and Strike System (ALSS) over West Germany. With several U-2s airborne for each mission, potential targets were triangulated, with the details transmitted to a ground station. The evaluation was not successful, although the ALSS did eventually evolve into the TR-1A battlefield surveillance system.

Interestingly, Harold Wilson's Labour government at the time would not permit the aircraft to operate from the UK with the usual matt black

colour scheme, hence the participants received the unusual paint scheme. Operation Constant Treat ended during the second week of July when the aircraft returned home.

### Other Hunting Grounds

US Air Force U-2s, along with other dedicated intelligence, surveillance, and reconnaissance (ISR) assets, have been in constant demand for some six decades, to provide intelligence during periods of tension, intervention, and warfare. The Cuban missile crisis of October 1962, the Vietnam War during the 1960s and 1970s, and every subsequent campaign has involved the U-2 gathering timely photographic coverage, signals, and other electronic intelligence.

When Iraqi forces invaded Kuwait in early August 1990, the U-2 was one of many assets ordered to the Middle East as part of the general build-up of American forces. To provide a degree of safety for the U-2 and TR-1 aircraft, the Air Force organised Operating Location - Camel Hump (OL-CH) at Tail-King Fahd Air Base, in the south of Saudi Arabia. Initially, two U-2Rs were deployed to TKF, followed one week later by a pair of TR-1As from RAF Alconbury, England.

The four aircraft commenced operations immediately, with support flown in from Beale, California, and RAF Alconbury by KC-135 Stratotankers. During mid-October, another two U-2Rs arrived, including one from Osan Air Base, Korea. Aircraft continued to arrive and depart at regular intervals based on maintenance requirements. Alconbury was central for aircraft returning to the 17th Reconnaissance Wing, or those in transit to the United States. See later

for details about the TR-1A and 17th Reconnaissance Wing.

Strategic Air Command retained overall control of the aircraft and replaced the OL-CH with the 1704th Reconnaissance Squadron (Provisional) on September 21, to enable the operation to function effectively with personnel drawn from numerous locations.

By mid-January 1991, the aircraft complement at TKH had increased with four U-2Rs and four TR-1As assigned, and by February 22 was further increased to six of each type. Quite possibly the largest concentration of U-2s and TR-1s gathered for a military operation in the type's history.

Aircraft were assigned a number of roles that ranged from photography to real-time, high-resolution radar detection of stationary and moving ground targets using the Advanced Synthetic Aperture Radar System dubbed ASAR-2.

During the six weeks of Operation Desert Storm, the TR-1As flew 89 missions, while the U-2Rs conducted 149. The majority of missions exceeded eight-hours duration.

Following the February 28 ceasefire, the majority of U-2 and TR-1 aircraft were flown home, although some remained at TKF to monitor ongoing Iraqi activities, particularly in the country's central region where Saddam Hussein retained control.

### Attrition and Replacements

The fleet of 55 U-2s was reduced due to accidents and operational losses. Of the 55 aircraft, just 11 survived, with the remaining jets now preserved at various locations in the United States, except for former U-2CTs 56-6682 with



## LOCKHEED U-2

the Imperial War Museum at Duxford, England, and 56-6953 at the Norsk Luftfartsmuseum at Bodo Norway.

Wreckage of U-2A 56-6691 is on display at a museum in Beijing, China, while the remains of Gary Powers' ill-fated U-2A 56-6693 are on display at the Central Armed Forces Museum in Moscow, Russia.

Such was the U-2's loss rate, and the constant requirement for high-altitude reconnaissance, that Lockheed was contracted to design and build a larger version designated the U-2R. Eight were ordered in August 1966, and four more three months later. Six were for the CIA, with the others joining the 100th Strategic Reconnaissance Wing. At the time, the US government was quietly supporting the Nationalist Chinese government by loaning U-2s to its air force to conduct missions over mainland China, flown by native pilots, while the United States looked the other way. Initially the U-2C was involved, but later the U-2R was substituted. The CIA continued to support missions until mid-1974, when agency funding was transferred to

the Air Force and the four U-2Rs re-assigned from August 1.

### Tactical Reconnaissance

Twenty years after Gary Powers made world headline news when his aircraft was shot down over central Russia, the name U-2 was still synonymous with everything bad about intelligence gathering. Consequently, when the US Air Force wished to re-open the production line to construct a version dedicated to battlefield surveillance in Europe, senior personnel considered it prudent to allocate an alternative designation.

Lockheed understood that it was sensible to build new aircraft for the task rather than develop unmanned aerial vehicles. An order was placed for 37 aircraft in November 1979, using existing jigs and tooling, but constructed at Palmdale, California. The majority were to become the TR-1, although some retained the U-2 designation despite an identical external appearance.

First to roll-out from the Palmdale line was TR-1A 80-1066 on July 15, 1981,

with delivery to Beale Air Force Base in September.

Eight were designated U-2Rs, one a U-2R(T) dedicated to training, two as ER-2s for the National Aeronautics and Space Administration, two TR-1B trainer versions and the remaining 24 as operational TR-1A versions.

TR-1A 80-1068 was the first to visit Europe, arriving on August 30, 1982 for display at the Farnborough Air Show. It was hoped to generate export orders, possibly including the UK and Germany, although no further interest was forthcoming.

Earlier, the decision had been made to station TR-1s at RAF Alconbury, England where the 17th Reconnaissance Wing and its flying component, the 95th Reconnaissance Squadron, both activated on October 1, 1982. The wing was accountable to SAC's 7th Air Division, with headquarters at Ramstein Air Base, West Germany, who organised day-to-day tasking on behalf of United States Air Forces in Europe.

The first pair of TR-1As, 80-1068 and 80-1070, was delivered to Alconbury during February 1983, and because

BELOW: *U-2S Dragon Lady 80-1070/BB flies over the Golden Gate Bridge near San Francisco, California on a photo mission from Beale Air Force Base, about 130 miles to the northeast of the city. US Air Force/SSgt Robert Trujillo*

"Twenty years after Gary Powers made world headline news when his aircraft was shot down over central Russia, the name U-2 was still synonymous with everything bad about intelligence gathering."



RIGHT: **U-2S 68-10336** spent much of its service conducting development work. During 2001 the aircraft was assigned to Warner Robins Air Logistics Center, at Robins Air Force Base, Georgia. For a limited period, the aircraft had the tail code 'LR' applied for Lockheed Robins. Bob Archer collection

the TR-1 was capable of assuming the intelligence gathering duties and its own battlefield tasking, the U-2R assigned to Detachment 4 at RAF Mildenhall ceased operations. Consequently, the final resident U-2R, 68-10337 returned to Beale Air Force Base.

RAF Mildenhall's association with the U-2 began in June 1977 on the basis of short-term visits but changed to a full-time operation on March 30, 1979 when 68-10338 arrived.

TR-1A deliveries to Alconbury were slow, largely because the aircraft's dedicated sensors were being developed at a somewhat leisurely pace. Missions were quite often flown to West Germany and the Baltic Sea area, to monitor the traditional Warsaw Pact nations, with sorties lasting up to nine hours.

Thirteen huge, hardened aircraft shelters were constructed by 1989, with roughly that number of aircraft assigned. As new sensors including the Precision Location Strike System and the ASAR-2 were developed, aircraft were either retrofitted at Alconbury, or during Program Depot Maintenance at



the Warner Robins Air Logistics Center in Georgia.

The end of the Cold War largely negated the presence of a TR-1 force in Europe. Consequently, the Alconbury-based 95th Reconnaissance Squadron became a direct reporting unit to the 9th Strategic Reconnaissance Wing and the 17th Reconnaissance Wing was inactivated on June 30, 1991. Its assigned aircraft began to depart in

August 1991. Half the fleet had left the Cambridgeshire base by the year end.

In October 1991, all of the surviving TR-1As were re-designated as U-2R aircraft.

The deteriorating situation in the Balkans required regular monitoring, with the 95th Reconnaissance Squadron supporting a temporary assignment of a Beale based U-2 equipped with the Senior Span system at Naval Air







LEFT: One of six U-2Cs repainted in a two-tone grey tactical camouflage for Operation Constant Treat, and evaluation of the Advanced Location and Strike System from RAF Wethersfield during May 1975. U-2C 56-6716 at Davis-Monthan Air Force Base during September 1978. Mick Roth

BELOW: Originally the two TR-1Bs were painted in an overall white paint scheme, with high visibility markings. 80-1065 of the 9th Strategic Reconnaissance Wing is seen landing at RAF Mildenhall during March 1986. Bob Archer

Station Sigonella, Sicily in April 1992. Later that year, the same jet deployed to Aviano Air Base, Italy. However, neither facility was ideally suited for supporting missions over the Balkans so subsequent sorties were flown from Alconbury.

The 95th Reconnaissance Squadron was inactivated on September 15, 1993, with its subsequent activities falling under Operating Location-United Kingdom (OL-UK). This enabled sorties to be undertaken with temporary duty personnel. RAF Alconbury was reduced to reserve base status, and on March 15, 1995 the remaining three aircraft relocated to RAF Fairford, the new temporary home for OL-UK. To this day, the Gloucestershire base continues to host U-2 operations, and supports transit

flights between the United States, RAF Akrotiri, Cyprus, and the Middle East.

## Current Situation

Pratt & Whitney's J75 engine had powered the U-2 since its earliest days, but developments in design enabled the more powerful and lighter General Electric F118-GE-F29 to be installed for the first time in May 1989. This was a difficult integration. Protracted trials and delayed funding prevented F118 engines from entering service until October 1994 then designated as the U-2S and TU-2S. Thirty-seven aircraft received F118 engines; both NASA ER-2s, all four TU-2S trainer and 31 U-2S aircraft.

The U-2S remains the Air Force's only manned, strategic, high-altitude, long range ISR platform, capable of

signals intelligence (SIGINT), imagery intelligence (IMINT) - the new name for photography, and measurement and signature intelligence (MASINT) collection.

Intelligence gathering requires sensors and the U-2S can carry some of the most advanced devices ever produced. These can be installed in a variety of interchangeable noses, and within slipper tanks, positioned on both wings. These can carry a wide variety of advanced optical, multispectral, synthetic aperture radar, SIGINT, and other payloads simultaneously.

Sensor bays permit rapid installation of new equipment to counter emerging threats and requirements.

U-2s comprise 50% of the high-altitude ISR fleet and are heavily tasked.





Recent improvements to Block 20 configuration, feature a glass cockpit, digital autopilot, modernised electronic warfare system, and updated data links.

Major sensors are Raytheon's ASAR-2A advanced synthetic aperture radar system, the UTC Aerospace SYERS-2A Senior Year electro-optical imagery system, and the enhanced ASIP airborne signals intelligence payload. Data gathered is linked via satellite by the Senior Span and Senior Spur systems housed in a large elliptical radome atop the centre fuselage to ground stations for exploitation. The legacy optical bar camera system is also still used to provide broad-area imagery.

The fleet is currently undergoing upgrades to Block 20.1 standard, adding ASAR-2B, next-generation SIGINT, avionics and navigation improvements, and modernisation of the Link-16 datalink and the multi-function advanced datalink.

ASAR-2B significantly improves the U-2 deep-look radar's ground mapping, moving target, and maritime modes. Two ASAR-2B-equipped aircraft will begin flight testing in FY2022, with initial operational capability expected in FY2023.

U-2S aircraft are also receiving stellar and GPS navigation, quick-change modular mission systems, and upgrades of multispectral sensor and electronic warfare systems. Airframe modifications, refreshing of

helmet and pressure suits, and egress improvements are also ongoing.

A host of contractors sustain the U-2. Lockheed Martin supports the airframes and much of the systems integration, while the following companies support and continue to enhance their sensor systems: Northrop Grumman (ASIP), Raytheon (ASAR), and UTC Aerospace (SYERS/Optical Bar Camera).

At the time of writing, the US Air Force claims its inventory to comprise 27 U-2S and four TU-2S aircraft, which would seem correct. One TR-1A/U-2R was subsequently converted to a TU-2S and was lost, as were two more U-2S aircraft. Another U-2S remains on long-term rebuild at Palmdale, following a serious fire at Al Dhafra Air Base, in the UAE.

Painted in a matt black paint scheme, the sinister-looking U-2 has been the subject of several attempts by various government organisations to retire the type, usually citing that unmanned aerial vehicles and satellites can perform most of the aircraft's mission functions. However, on each occasion the U-2 proved to be more capable, and far more flexible than satellite and unmanned aerial systems.

Under present arrangements, the U-2 has a guaranteed service life until at least 2025, but Lockheed Martin claims the airframes have the ability to fly until at least 2050.

Beale Air Force Base in northern

California is home to the 9th Reconnaissance Wing and its component U-2 squadrons; the 1st Reconnaissance Squadron as the formal training unit, and the 99th Reconnaissance Squadron as the operational squadron. The 1st Reconnaissance Squadron flies the TU-2S two-seat trainer, the U-2S and the T-38C Talon as a proficiency trainer.

Overseas the 5th Reconnaissance Squadron at Osan Air Base in the Republic of Korea monitors activities on the Korean peninsula, China, and eastern Russia. At RAF Akrotiri, Cyprus, Detachment 1 monitors North Africa and eastern Mediterranean nations, while the 99th Expeditionary Reconnaissance Squadron at Al Dhafra Air Base in the UAE provides ISR missions across the Middle East and southwest Asia and retains operational responsibility for U-2S operations at RAF Fairford, England.

Ongoing test and evaluation is performed by Det 2, 563rd Test and Evaluation Group at Beale, but utilises aircraft from the host wing.

Air Force Materiel Command's Warner Robins Air Logistics Complex at Robins Air Force Base, Georgia, occasionally utilises a U-2S for development work. The ALC also performs some Program Depot Maintenance and manages the work to be completed by Lockheed Martin at its Palmdale facility.

In its seventh decade of operation, the U-2 is more effective today than when missions first began. What's more, there is every chance the U-2 will continue for another 20 years, which would continue its operation to nine decades - a truly remarkable achievement.

**BELOW: A pilot steers a U-2S to its parking spot while being marshalled by a crew chief. The aircraft is assigned to the 99th Expeditionary Reconnaissance Squadron at Al Dhafra Air Base, United Arab Emirates.**  
US Air Force/MSgt Jenifer Calhoun





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# Baltic Breguet

**Mark Ayton** details Germany's long-retired Breguet Atlantic SIGINT aircraft

**L**ocated on the North Sea coastline of Lower Saxony, Naval Air Station Nordholz was the chosen home station of Germany's fleet of five SIGINT-

configured Atlantic aircraft designated BR.1150Ms.

The aircraft was the weapon system chosen to meet the Signalerfassende Luftgestützte Weiträumige Überwachung und Aufklärung requirement (SLWÜA or signal-recording airborne long-range surveillance and reconnaissance), for use as a joint-service asset.

The Bundeswehr managed the Peace Peek programme which was funded through a government-to-government agreement between the West German

and US governments. Germany's participation in the Peace Peek programme enabled the Bundeswehr and the Bundesnachrichtendienst (Federal Intelligence Service) to maintain an extensive data bus of Soviet and Warsaw Pact weapon systems comprising signals, frequencies, and locations.

## 'Made' in Texas

All five aircraft were converted by American company LTV-Electrosystems at its Greenville, Texas, facility between





BELOW: *This underside view of Peace Peek Atlantic 61+06 shows the canoe-shaped radome installed mid-fuselage to housing COMINT antennas, and the wing tip pods. This aircraft is preserved at Nordholz serving as the base gate guard.*  
AirTeamImages/Wolfgang Mendorf

1968 and 1970 under the US Foreign Military Sales (FMS) programme known as Peace Peek.

Throughout the type's service life, the FMS contract secured the ownership and maintenance of the SIGINT equipment and the SIGINT data; German operators were obliged to pass-on all informed contacts and findings to the United States. The Marineflieger nor the Bundeswehr were not allowed to make changes to the system without American consent. Furthermore, if any maintenance undertaken by Dornier was expected to last for more than two weeks, the Peace Peek mission equipment had to be removed in the United States before the aircraft could be flown back to Dornier's facility for overhaul.

Designed as a maritime patrol aircraft, the five Atlantics were converted to a SIGINT configuration by LTV ElectroSystems which installed each aircraft with

- A SIGINT collection system
- Seven operator workstations each covering the frequency range between 30MHz and 18GHz; one for the mission lead; three for standard COMINT; one for multi-channel/directional radio COMINT; and two for ELINT
- Racks hosting mission system units
- A canoe-shaped radome installed under the mid-fuselage to house COMINT antennas
- Wing tip pods

It's worth explaining the two types of intelligence discussed throughout this feature.

COMINT is information derived from the interception of messages or voice communications among people that provides information about who is transmitting, their fixed location or in the case of a moving transmitter, a plot of the signal against location, the time and duration of transmission, the frequencies, and other technical characteristics of the transmission.

Gathering of ELINT with electronic sensors is focussed on non-communication signals, more specifically electromagnetic radiations that provide technical and geolocation information.

Analysis of an acquired signal's parameters helps identification by matching it to criteria held in a database

or by recording the data as a new type of emitter. ELINT is primarily focussed on the emissions from radars, sensors, weapons control signals, and missile systems of land-based, naval and aircraft including IFF transponders.

## Peace Peek Crew

A standard crew comprised a pilot commander, co-pilot, radio operator, two operations officers, a mix of eight COMINT and ELINT specialists, a radar operator, an ELINT technician and a mechanic.

COMINT specialists were linguists, fluent in the Czech, Polish or Russian languages, and additionally skilled in understanding the many regional dialects from the various Warsaw Pact nations.

LTV ElectroSystems also supplied two ground stations and installed INS and HF probe antennas at a later date.

Despite the secrecy of the mission, it is likely that the Peace Peek mission crew conducted a variety of tasks that included

- Target analysis derived by signal detection and direction-finding systems.
- Using receivers, pre-set to the frequencies generated by a transmitter of interest.
- Filtering signals to focus on the most pertinent information transmitted.
- Recording the energy level of a particular frequency transmission.
- Listening to intelligible signals as part of the COMINT discipline.
- Using a spectrum analyser to determine the power of an unknown primary or side band frequency.
- Using the data acquired from the spectrum analyser for tuning the receivers to the signals of interest.
- Undertaking traffic analysis, the discipline of drawing patterns from the information flow between senders and receivers.

## Graf Zeppelin

The first aircraft entered service at Nordholz with Marinefliegergeschwader 3 'Graf Zeppelin' in November 1971 and was tasked with airborne Fernmelde und Elektronischen Aufklärung (FmElo Aufkl or communication and electronic reconnaissance) of Warsaw Pact weapon systems.

The majority of missions were flown over eastern sectors of the Baltic Sea, less than 90 minutes flying time from Nordholz. Many were flown along the border with the German Democratic Republic and Czechoslovakia, stretching some 1,250 miles.

Despite their assignment to, and operation by, a Marineflieger unit, only flight crew members were German sailors. The mission crew was joint in its composition and comprised specialists from the marine, Luftwaffe

and Heer ranks, all of whom were originally assigned to a Trier-based unit named Fernmeldebereich 70 (FmBer 70 or Telecommunications Office 70). In the years before the Atlantic's retirement, the mission crew's unit was Fernmeldebereich 92 (renumbered on July 1, 2002) which was subordinate to the Strategisches Aufklärungskommando (Strategic Reconnaissance Command).

Perhaps a reflection on the classified nature of the mission system crew's work and FmBer 70 or 92's Trier base, unusually they joined the aircraft at bases near Trier: either Büchel (Luftwaffe), Bitburg or Spangdahlem (US Air Force).

Once airborne, specialists undertook real-time evaluation of the signals being captured and downlinked the information to a ground station. Some missions lasted for several hours which was too long for the specialist system operators to endure without rest periods, so the aircraft carried two SIGINT crews on such missions.

## End of the Line

After the end of the Cold War, the aircraft's tasking and use changed significantly to one that acquired SIGNALS intelligence of Russian military weapon systems and for search and rescue operations.

In July 1995, Peace Peek Atlantic aircraft were deployed to conduct SIGINT missions over the Adriatic Sea and some of the Balkan nations.

Four years later during Operation Allied Force, Peace Peek Atlantic aircraft were deployed and flew numerous missions around Kosovo, providing invaluable intelligence to the peacekeepers.

Despite continuous upgrades, including in 1980 on the mission system, the Peace Peek Atlantic aircraft were costly to operate, about €20,000 per hour, a factor that led to the type-configuration losing out in Bundeswehr budget cuts and the decision to stop operations. Atlantic 61+03 completed the type's last flight with the Marineflieger on June 20, 2010, ending more than 40-years of service, and participation in the American-led SIGINT operator group. Years after its retirement, the Peace Peek mission systems remain classified.

At Nordholz, aircraft 61+06, which flew its final flight on May 15, 2009, today guards the main gate at the base.

On March 7, 2017, the Bundeswehr announced it would procure Northrop Grumman MQ-4 Triton unmanned aerial vehicles as its future airborne SIGINT platform through the US Foreign Military Sales programme. Germany's choice is a strange one. The MQ-4 Triton was designed for, and is operated, as a wide area ocean surveillance, but not the SIGINT role.



# 60 Years of Reconnaissance

## The RC-135 Series and More

Sixty years ago, the first reconnaissance related missions involving modified KC-135s began. Seven decades later, the type remains at the forefront of intelligence operations. **Bob Archer** chronicles their evolution







ABOVE: **C-135B-II Lisa Ann 62-4137** fitted with a phased array radar housed behind the massive fibre glass panel seen on the forward fuselage. Note the Military Air Transport Service markings still visible. This aircraft crashed in the Bering Sea configured as a RC-135E Rivet Amber on June 5, 1969 killing all 19 members of the crew. Ling-Temco-Vought via Bob Archer

BELOW: **RC-135D Rivet Brass 60-0357** at RAF Mildenhall, England in February 1974. Bob Archer collection

Every minute of every day, an RC-135 is airborne somewhere in the world, quietly listening and watching events unfold which might jeopardise the peace and comparative tranquillity which western nations take for granted. For 60 years, the Boeing C-135 Stratotanker series has performed this task, quietly and without fanfare. Once upon a time, the task was straightforward, with a clearly defined foe, producing its brand of secrecy behind a mask of federal socialism imparted by the communist Union of Soviet Socialist Republics. After the Cold War ended, relations between former USSR states in the East and nations in the West thawed,

which led to the emergence of a very unpredictable new world order.

When the first KC-135A emerged from Boeing's Renton, Washington production line on July 18, 1956, intelligence gathering was a rudimentary activity, in the process of being switched from elderly Boeing RB-29 and RB-50s to new Boeing RB-47 Stratojets. Although it offered a huge capability improvement in terms of speed and altitude, the RB-47's single biggest drawback was limited space for additional sensors and operators. While Strategic Air Command was deploying RB-47s across the world, the command was already looking at future types

capable of conducting strategic reconnaissance. The KC-135A was rapidly joining Bombardment Wings, matching the bombers in speed, range, and altitude. Visionaries within SAC were not slow to realise that the airframe was largely empty during aerial refuelling missions. Furthermore, KC-135s employed for evaluation by Air Force Systems Command, were being retained, and operated as platforms for testing of new systems.

Technological development was moving at a rapid rate, with all manner of scientific breakthroughs being produced to match those of the West's main adversaries. Such nations were rushing to improve all aspects of their respective nuclear weapons technology. That fact alone was creating grave concerns in the corridors of the Pentagon and the US government. Most notably, and of primary concern, was the lack of knowledge about those developments. However, ingenious young engineers working for America's leading defence companies were developing a solution, by devising sensors which could gather all kinds of data, information, and statistics about such systems by simply photographing explosions and gathering atmospheric samples. Armed with such data, scientists at specialist laboratories could determine more detail and vast amounts of it. By monitoring US weapons tests, information was readily available, and





BOEING RC-135 SERIES

could be used to compare with those of other nations.

America’s First RC-135s

In its definition for a new generation of reconnaissance platforms, the US Air Force specified two distinct versions as a primary requirement. The first was a version tailored to acquiring strategic intelligence, including the order of battle of an adversary, the location and capabilities of their weapon systems, and defence-related communications.

The second version was far more specialised - to determine as much data as possible on emerging missile technology.

Version one was designated as the KC-135A-II and the second as the RC-135S.

The Soviet Union was the major source of concern, as its veil of secrecy on all nuclear matters was very tight, so the lack of accurate data was a constant worry to American intelligence agencies and the government though some, limited, data was available through various means. One example which could yield good sources of intelligence were the Soviet test sites. Despite a vast uninhabited land mass, one of the main weapon test facilities was the Northern Test Site on the island of Novaya Zemlya located within the Soviet arctic. Another was



the Southern Test Site at Semipalatinsk in Kazakhstan.

During a speech in May 1961, Soviet premier Nikita Khrushchev boasted that his scientists had developed an enormous 100 megaton nuclear weapon, nicknamed the ‘Tzar Bomba’. If true, the United States needed to understand as much about the weapon that could be determined. The US Air Force was tasked with preparing the necessary platform to house sensors designed to record vital data.

During September 1961, the Soviets unilaterally abandoned the informal nuclear test ban, so as to resume atmospheric nuclear testing. They also announced that the Tzar Bomba would be exploded above Novaya Zemlya on October 30, 1961.

Speed Light

With time being short, the Air Force contacted the Big Safari office, who in turn liaised with General Dynamics at Fort Worth, Texas to prepare an

ABOVE: *Lacking many of the antennas fitted earlier in its career, RC-135T Rivet Dandy 55-3121 at Kadena Air Base, Okinawa in July 1975.*  
Bob Archer collection





ABOVE: A rare image of RC-135V Rivet Joint 64-14844/OF over the Barents Sea, taken by the crew of a Russian MiG-31 Foxhound interceptor. TASS via Bob Archer

BELOW LEFT: RC-135M Rivet Card 62-4135 seen at Kadena Air Base, Okinawa on November 11, 1967. RC-135Ms flew daily missions across South East Asia to provide timely warnings of North Vietnamese MiG activity relayed to American strike packages heading north. Bob Archer collection

aircraft to monitor the detonation. JKC-135A 55-3127 was selected, as an earlier programme had involved the installation of observation windows mounted in an elongated inverted canoe shaped fairing above the fuselage. The large additional structure could house the necessary optical instrumentation to record the visible, infrared, and ultraviolet radiation. Conversion was carried out in a matter of days, enabling the aircraft to be flown to RAF Brize Norton, England. JKC-135A 55-3127 was named *Speed Light-Bravo*. The jet launched early on October 30, 1961 and established an orbit to the west of Novaya Zemlya. At 11.32AM (Moscow time) the massive bomb was air delivered by a specially modified Tupolev Tu-95 'Bear', with the weapon detonating above the Mityushikha Bay Nuclear Testing Range. Cameras and sensors aboard the modified tanker captured a host of data, which was hurriedly sent to the United States for scientific examination.

While this was not a pure reconnaissance mission in the true sense, it was the first such occasion that intelligence had been gathered by a Stratotanker. At the same time as *Speed-Light Bravo* was being prepared, KC-135A 59-1491 was delivered to Wright-Patterson Air Force Base, Ohio for conversion to a reconnaissance-configured standard under the *Nancy Rae* programme.

The aircraft was operated by Air Force Systems Command to perform test and evaluation of onboard

systems used to track a ballistic missile's re-entry into the earth's atmosphere. Using film cameras and various specialised sensors, *Nancy Rae* was able to record the entire re-entry process and measure the missile's spectral irradiance by analysis of changes in light and radiation on the missile's nose cone as it returned to earth. In addition to its dedicated test mission, *Nancy Rae* was flown on live reconnaissance missions with a mixed crew comprising Air Force Systems Command and contractor personnel. The aircraft arrived at Shemya Air Force Station, Alaska on December 31, 1961 and conducted at least one such mission thereafter. In doing so, *Nancy Rae* became the first KC-135 to perform a dedicated reconnaissance mission.

*Nancy Rae* was transferred to Strategic Air Command's 4157th Strategic Wing at Eielson Air Force Base on March 1, 1963. Just over seven months later, *Nancy Rae* entered another conversion programme with General Dynamics/LTV Electrosystems on October 7, 1963. Upon completion of the conversion, the aircraft was configured to RC-135S standard, renamed *Wanda Belle*, and assigned to the 4157th Strategic Wing based at Eielson Air Force Base, Alaska. It then operated solely between Eielson and Shemya Air Force Station, and rarely ventured anywhere else.

In January 1967 RC-135S *Wanda Belle* was renamed *Rivet Ball*. On March 25, 1967, the 4157th Strategic Wing was replaced at Eielson by

the 6th Strategic Wing with the 24th Strategic Reconnaissance Squadron as its operational squadron.

On January 12, 1969, 59-1491 hydroplaned off the end of Shemya's runway 28 and was destroyed beyond repair. Thankfully, the aircraft did not catch on fire, and no one was seriously injured. But losing the aircraft effectively eliminated the Air Force's missile tracking capability. Consequently, a swift replacement programme was launched. The replacement system was the RC-135 Cobra Ball.

## Dedicated to Recce

The first dedicated C-135 reconnaissance programme involved three 'falsie' C-135A transporters (60-0356, 60-0357 and 60-0362) produced as standard KC-135As but without any aerial refuelling equipment installed. They were flown to Majors Field, Greenville, Texas for conversion to KC-135R standard (nothing even similar to the current KC-135R tanker) and fitted with SIGINT systems by Ling-TEMCO-Vought under the Office Boy programme.

Work began during September 1961, with a signals intelligence system fitted internally, and an elongated fairing forward of the wing root containing the Coherent Automatic Signal Tracking (CAST) system. CAST was a direction finder, which guided sensor operators with all manner of data relating to SIGINT gathering. First of the three aircraft was delivered to the SAC's 4157th Strategic Wing at Eielson Air







LEFT: *RC-135C Big Team 63-9792 on the ramp at Offutt Air Force Base, Nebraska in August 1967, shortly after conversion from RC-135B standard.*  
Frank O'Rear via Bob Archer

Force Base, Alaska in December 1962; the other two aircraft arrived by April 1963. Missions were to the usual areas, with one regular sortie departing Eielson, flying over the North Pole, and routing adjacent to the northwest Russian coast, before landing at RAF Brize Norton and later RAF Upper Heyford in England.

In January 1967, all three KC-135R Office Boys were re-designated as RC-135D Rivet Brass aircraft.

As the war in South East Asia intensified, Rivet Brass aircraft were deployed to Kadena Air Base, Okinawa from where they flew a handful of 18-plus hour missions named Combat Apple. Mission crews included linguists dedicated to monitoring North Vietnamese communications.

RC-135D Rivet Brass 60-0362 was

further modified. The CAST system was removed and replaced with a circular steerable antenna housed in a radome integrated on the lower forward fuselage. Rivet Brass continued in service until mid-1975 when the type's tasking was replaced by new RC-135 Rivet Joint aircraft.

### Lisa Ann and Rivet Amber

The proliferation of ballistic missiles technology was an ongoing thorn-in-the-side for the US government. The need to maintain a watch of developments by potential adversaries was ongoing. One programme involved the acquisition of TELEmetry INTElligence (TELINT), whereby specialised equipment was developed to record the re-entry and impact of these weapons for subsequent

analysis. During September 1963, C-135B 62-4137 was flown to Greenville where LTV ElectroSystems Division installed a massive phased-array radar behind a huge, laminated fibreglass panel cut into the forward fuselage. The radar could track a small object up to a range of 300 nautical miles. Post conversion the aircraft was designated as a C-135B-II named *Lisa Ann*. *Lisa Ann* flew missions from Shemya to locations over the western Pacific Ocean where an intercontinental ballistic missile would likely land, the first took place on September 28, 1966.

In January 1967, *Lisa Ann* was re-designated as an RC-135E and re-named *Rivet Amber*.

However, on June 5, 1969, the aircraft disappeared over the Bering Sea while on a flight from Shemya to Eielson Air

BELOW: *The grand-daddy of Stratotanker reconnaissance, JKC-135A 55-3127 monitored the Soviet Tzar Bomba in October 1961. The configuration at that time was very similar to the one shown in this image.*  
Bob Archer collection





RIGHT: **RC-135C Big Team 64-14841** on the ramp at **RAF Marham, England** in April 1971. Note the additional sixth digit used for the tail number, no doubt a deceptive tactic for observers from the Soviet Union.  
*Paul Bennett via Bob Archer*



Force Base, with no trace of wreckage or any of the 19 crewmembers being found.

## Big Team

The success of the Nancy Rae and Office Boy programmes encouraged Strategic Air Command to fund a replacement of the RB-47 with further C-135 variants. The new aircraft was to be equipped with the sensors installed in the RB-47, together with others being developed by industry. These included the AIL-Melpar-GTE ASD-1 Automated Electronic Intelligence system, which was to be the heart of the acquisition capability of the new aircraft.

JKC-135A 55-3132, was involved in testing the prototype XH-1 Electronic Reconnaissance System, under the Golden Pheasant programme. Overseas deployments were carried out in 1963 and 1964 to Eielson Air Force Base, Incirlik Air Base, Turkey, and RAF Brize Norton, England.

The XH-1 system worked as required, as a shape-modified version evolved into the ASD-1. New RC-135B aircraft (the as-built, un-equipped standard) were ordered in 1963 and 1964 under the name Big Team to fitted with the ASD-1. All ten bare airframes were flown to the Martin Aircraft Company plant at Baltimore Airport, Maryland for conversion. Each aircraft entered the lengthy modification process, involving installation of workstations and consoles within the fuselage.

The ASD-1 system was installed within cheeks mounted on the forward fuselage. Each cheek housed a variety of signal acquisition systems, which were believed to be tuned to different frequencies. A small circular radome was installed beneath the forward fuselage, possibly a version of the steerable beam antennae from

the latter days of the Rivet Brass programme. A KA-59 panoramic camera was installed beneath the aft fuselage, although this was not very effective.

Each modification took more than two years to complete.

Post conversion, each aircraft was flown to Offutt Air Force Base, Nebraska to join the 55th Strategic Reconnaissance Wing designated as an RC-135C. The first arrived there on February 25, 1967. All ten had arrived by November, enabling the last RB-47 to be retired on December 29, 1967.

The RC-135C was soon deployed to Europe and the Far East, with Upper Heyford, Eielson and Kadena all regularly hosting short deployments.

Like the RC-135D Rivet Brass aircraft, the RC-135Cs were included in the composition of the reconnaissance capabilities requested to monitor North Vietnamese communications.

RB-47s had regularly flown missions in the region, followed by the more capable RC-135s, whose crew complement included linguists listening to transmissions. However, Strategic Air Command leaders were extremely unhappy about diverting these strategically important aircraft to the largely tactical Vietnam campaign.

Consequently, beginning in 1965, six C-135Bs, which had briefly served with the Military Air Transport Service, were supplanted by the delivery of new Lockheed C-141 Starlifters. The C-135Bs were flown to Majors Field for conversion to RC-135M standard by Ling-Temco-Vought, specifically tailored for operations in South East Asia. The first was completed by the spring of 1967, and stationed at Kadena Air Base, Okinawa. Acquired under the Rivet Card programme, RC-135Ms flew daily missions across South East Asia, with timely warnings of MiG activity

relayed to American strike packages heading north. Once America's then bloodiest war came to an end, the RC-135Ms returned to the United States and were assigned to the 55th Strategic Reconnaissance Wing based at Offutt Air Force Base, Nebraska.

However, their configuration was not suited to the worldwide SIGINT role, so funds were made available for the six RC-135M aircraft to be converted to RC-135W Rivet Joint aircraft. The first aircraft was completed by E-Systems during November 1980 and was subsequently delivered to the 55th Strategic Reconnaissance Wing based at Offutt.

## Combat Sent

As the 1960s drew to a close, the Air Force recognised the need to diversify its Big Team activities. Instead of being 'jack of all trades', whereby all ten RC-135C aircraft conducted the same intelligence missions, the Air Force agreed in conjunction with the Central Intelligence Agency to fund the upgrade of three aircraft to a specific tasking. Each would act as a 'flying database' equipped with powerful computers holding all known details on emitters, tasked with acquiring new information, and updating existing data banks accordingly. The remaining seven aircraft would also be upgraded, but to an enhanced intelligence gathering capability. The mission task was described as scientific and technical or highly specialised. Named Combat Sent, the programme continues to the present day.

Two aircraft were budgeted by the Air Force, while the third was funded by the CIA. All three were converted during 1971, with the RC-135U designation applied. Missions were all performed by US Air Force personnel, but for those flown on behalf of



## BOEING RC-135 SERIES

the agency, the intelligence ‘take’ was reported to their government paymasters. However, by 1975 the CIA had no further requirement for the mission. Given the possibility of the aircraft no longer being required, the Air Force was unable to fund three Combat Sent aircraft for their original intended tasking, but the funding necessary to modify the aircraft for regular intelligence collection was awarded.

### Rivet Joint

At the end of 1972, E-Systems at Greenville began to implement a major upgrade to the seven remaining RC-135C Big Team aircraft. Configured to acquire all types of SIGINT information, post-upgrade each aircraft was re-designated as an RC-135V with the new Rivet Joint programme name, one that remains in operation today. The first upgraded aircraft was RC-135V Rivet Joint, 64-14848, which was delivered back to the 55th Strategic Reconnaissance Wing at Offutt on August 6, 1973.

Gone was the original ASD-1 system, replaced by the Automatic Electronic Emitter Location System or AEELS but

housed in the nose mounted cheeks.

Aircraft 64-14848 was deployed to RAF Mildenhall early in 1974 for missions around the Baltic Sea and the Soviet Arctic. Results were disappointing, with the intelligence take not meeting expectation. Other converted Rivet Joints also showed similar shortcomings such that the commander of Strategic Air Command held E-Systems responsible for the problem. After a prolonged investigation, 64-14842 was upgraded with an improved AEELS system and deployed to RAF Mildenhall during November 1977. Missions flown to the same areas showed considerable improvement, enabling the conversion programme to continue, including the displaced former CIA Combat Sent.

In addition to the six RC-135W aircraft converted from former RC-135Ms, the Air Force’s demand for the Rivet Joint’s role was so great that another three C-135Bs had been converted to RC-135W Rivet Joint configuration by November 2006. Despite operating two different suffix designations, RC-135Vs and RC-135s have virtually the same configuration but for some very minor differences.

### New Cobra Ball

As stated earlier, the sole RC-135S was destroyed in a crash at Shemya. SAC needed an urgent replacement but was insistent that the new RC-135S would be powered by Pratt & Whitney TF33 engines equipped with thrust reversers. The TF33s offered more power during take-off, and the thrust reversers helped greatly when landing at Shemya, where the weather conditions defied the norm. Combined fog and strong winds frequently tested the most competent pilots. Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio was the primary operator of C-135B Stratojet aircraft dedicated to test activities. One such jet, C-135B 61-2663, was chosen as the replacement. Flown to Majors Field during April 1969, conversion to RC-135S Rivet Ball standard took E-Systems six months to complete. The aircraft featured some systems salvaged from the Rivet Ball including the gyro-stabilised Ballistic Streak Camera which recorded the

MAIN IMAGE: *Artwork applied to SAC reconnaissance aircraft was quite rare. Seen at Offutt Air Force Base, Nebraska in October 1973, RC-135U 64-14849 had a shark’s mouth markings, eyes, and the name ‘Gotcha’ applied.*  
Bob Archer collection





RIGHT: **RC-135S Cobra Ball I 61-2663** after landing at RAF Mildenhall, England on August 28, 2008. The aircraft has a black-coloured tail band denoting its assignment to the 45th Reconnaissance Squadron.  
Bob Archer

Soviet Union's first intercontinental ballistic missile test armed with multiple re-entry vehicles on October 4, 1968.

Re-worked, the shiny Rivet Ball II aircraft was assigned to the 6th Strategic Wing at Eielson, taking up duties vacated by Rivet Ball 59-1491. Rivet Ball II was re-named as Cobra Ball I (Minimum).

To ensure there was no coverage gap in the Cobra Ball's primary Measurement and Signature INTelligence (MASINT) and TELINT ballistic missile monitoring mission, a second aircraft was budgeted. Completed in March 1972, RC-135S Cobra Ball II 61-2664 was delivered to the 6th Strategic Wing.

Nine years later, on March 15, 1981, Cobra Ball II arrived at Shemya in atrocious weather conditions which caused the aircraft to crash land, tragically killing six of the 24 people onboard. Once again, the Air Force faced a potential coverage gap

with just Cobra Ball I (Minimum) in service and in early April 1981, President Ronald Reagan authorised a replacement. Aeronautical Systems Division selected NC-135B 61-2662 for conversion and by November 1983 E-Systems had completed the

work at its Majors Field facility. Post conversion, RC-135S Cobra Ball II 61-2662 was delivered to the 6th Strategic Wing on November 11.

The importance of the Cobra Ball programme was enhanced when another aircraft (the fourth to be



**"The importance of the Cobra Ball programme was enhanced when another aircraft (the fourth to be converted) was added."**





## BOEING RC-135 SERIES

converted) was added. The defunct RC-135X Cobra Eye 62-4128 (see later) had no future, and after a short period of storage, entered its conversion programme in 1995. Work was completed by E Systems at Majors Field by June 1999. The aircraft was delivered to the 45th Reconnaissance Squadron at Offutt, the new Cobra Ball unit re-activated on July 1, 1994. After more than 27 years of operating Rivet Ball and Cobra Ball aircraft, the 24th Reconnaissance Squadron was inactivated the previous day, a move made by the then Air Force Chief of Staff, General Merrill McPeak.

### RC-135T

One aircraft which stands head and shoulders above the rest is 55-3121. Having begun life as a JKC-135A test aircraft, LTV at Fort Worth, Texas modified the aircraft for the Speed-Light reconnaissance programme, along with 55-3127 and 59-1514. These became Speed Light Echo, Bravo, and Delta, respectively. The task was initially to monitor US nuclear tests in the Pacific Ocean, before switching to intelligence gathering for Soviet detonations. Other reconnaissance roles followed for 55-3121, with bizarre names including Briar Patch (a CIA-sponsored ELINT programme, see below), Garlic Salt, Rivet Stand, and Rivet Jaw as a KC-135R, Cobra Jaw as a KC-135T, and finally Rivet Dandy as an RC-135T. These names and

designations were for reconnaissance tasks tailored exclusively to 55-3121.

Likewise, there were other reconnaissance related programmes involving individual KC-135s, which were not designated with the 'R' prefix for these short-term tasks. These included KC-135Rs 58-0126 and 59-1465 for the Rivet Quick programme. In each instance, both internal and external modifications, were for a specific tasking.

One such adaptation to 55-3121 was sponsored by the CIA for the acquisition of Soviet fine-grain electronic intelligence signals. With the addition of a direction-finding system, a signals receiver, as well as Long Range Air Navigation towed rails, the aircraft could be positioned to seek individual emitters. The most unusual feature was the 1,000ft trailing wire assembly, fitted in place of the aerial refuelling boom. An acquisition sensor known as a blivet, was attached to the end of the cable which was extended and retracted by a winch. Once extended, the blivet could be flown through the beam of the air defence radar under scrutiny and capture the necessary data.

### RC-135X

A former telemetry instrumented aircraft, serial 62-4128, was acquired for a unique programme named Cobra Eye. The joint Air Force/Army requirement was for an airborne platform to collect and record spectral

data during the re-entry of ballistic missiles. E-Systems at Greenville carried out the modification, which included a massive infra-red sensor, mounted behind a large external sliding door. The first sortie took place in August 1989, although events shortly after, which signalled the beginning of the end of the Cold War, largely eliminated the Cobra Eye mission. The aircraft was stored at Greenville from February 1993, until the funding was made available for the RC-135X to become a Cobra Ball aircraft.

### RC-135A

Not all RC series Stratotankers and Stratojets were dedicated to acquiring strategic intelligence. Four RC-135A aircraft (63-8058, 63-8059, 63-8060 and 63-8061) were fitted with an electro photo mapping system which was housed beneath the nose designed for aerial photo mapping and geodetic survey work under Pacer Swan. Aircraft 63-8058 joined the 1370th Photo Mapping Wing at Turner Air Force Base, Albany, Georgia on September 14, 1965.

However, refining the equipment was problematic, and it was soon outmoded, as satellites could perform the task effectively. The RC-135As became redundant and were subsequently converted to KC-135D standard and flown as aircrew trainers for units transitioning to the KC-135 from other types.

BELOW: ***JKC-135A 55-3121 Rivet Stand** at Wright-Patterson Air Force Base, Ohio in June 1965. Aircraft 55-2121 performed many unique reconnaissance tasks.*  
*Richard Sullivan via Bob Archer*

**"With the addition of a direction-finding system, a signals receiver, as well as Long Range Air Navigation towed rails, the aircraft could be positioned to seek individual emitters."**





RIGHT: *Speed Light Delta KC-135R 59-1514 was one of three such aircraft configured to monitor US nuclear tests in the Pacific Ocean, before switching to intelligence gathering for Soviet detonations. The aircraft is seen at RAF Upper Heyford, England October 5, 1969.*  
*Bob Archer collection*



BELOW: *Silver RC-135U 64-14847 wearing a tail badge for the US bi-centennial landing at RAF Mildenhall, England during 1976.*  
*Paul Bennett*

## The Present

The 55th Strategic Reconnaissance Wing was redesignated as the 55th Wing at Offutt Air Force Base, Nebraska on September 1, 1991. The 'Fighting Fifty-Fifth' is the custodian of the entire US Air Force RC-135 fleet comprising three RC-135S Cobra Ball aircraft, 17 RC-135V and RC-135W Rivet Joints, and two RC-135U Combat Sent aircraft. Rarely is more than one third of the 22 airframes at the Nebraska super base at any given time. Regular major overhauls occupy a portion of the annual operational programme, while at least half of the fleet is deployed overseas on tasking.

At present, Rivet Joint operations are flown by the 38th and 343rd Reconnaissance Squadrons, while Cobra Ball and Combat Sent aircraft are flown by the 45th Reconnaissance

Squadron. Training is dedicated to the 338th Combat Training Squadron, using both mission aircraft and TC-135 trainers, along with an Air National Guard unit to shadow the squadron. A detachment at Eielson Air Force Base, Alaska administers aircraft deployed from Offutt to America's near arctic super base. Overseas, the 82nd Reconnaissance Squadron at Kadena Air Base, Okinawa, and 95th Reconnaissance Squadron at RAF Mildenhall, England also utilise jets from Offutt as required. The 95th is responsible for Detachment 1 at Souda Bay, Crete, where the 21st Expeditionary Reconnaissance Squadron administers operations. The main overseas activity is at Al Udeid Air Base, Qatar, where the 763rd Expeditionary Reconnaissance Squadron oversees all activities in the

US Central Command region.

While several overseas air arms operate Boeing 707 series aircraft with similarities to the RC-135 fleet, only the Royal Air Force has received examples identical to those flown by the US Air Force. The Royal Air Force obtained three Rivet Joints beginning in 2013, flown by 51 Squadron currently based at RAF Waddington, England. The two air arms dovetail operations neatly to reduce the likelihood of duplication.

RC-135s are amongst the oldest airframes in the US Air Force inventory but are cared for and maintained in first-class fashion and remain in immaculate condition. There are no current plans to replace the types, such that all three versions are expected to remain in frontline service until at least 2040.





# From Sharp Cut to Second Slice

## RB-57 Strategic Surveillance Operations

**Dave Willis** explains how the British Canberra bomber met the needs of a US Air Force requirement for a high-flying reconnaissance aircraft





RIGHT: *Although wearing 'Weather' titles, RB-57D 53-3977 has the black and white scheme applied to a number of aircraft used for the Operation Bordertown deployment to West Germany in 1959.*  
US Air Force

BELOW RIGHT: *Former 6091st Reconnaissance Squadron WB-57F 68-13501 was originally loaned, then transferred, to NASA after modification under the Rivet Rap programme. It was retired in 1982.*  
David Willis

LEFT: *RB-57F Rivet Slice 63-13502 was one of four equipped for long-range photography for units in West Germany and Japan.*  
US Air Force

In 1951 the US Air Force selected the English Electric Canberra to fulfil the night interdiction and tactical reconnaissance roles to replace the Douglas B-26 Invader. The Glenn L Martin Company built just over 400 B-57 aircraft in RB-57A photo-reconnaissance, B-57A and B-57B tactical bomber and B-57C and B-57E trainer and target-tug versions. Martin also created the RB-57D for high-altitude strategic reconnaissance, while General Dynamics later created the RB-57F. Both of these variants played an important role in monitoring activity in the Soviet Union and People's Republic of China, as well as their allies, during the Cold War. But before they became available the US Air Force had to make use of specially converted versions of the RB-57A to monitor its potential adversaries.

### Sharp Cut and Heart Throb

Strategic surveillance along the Iron Curtain in Europe was the main role of the 7499th Support Group based at Wiesbaden West Germany. One of its flying units was the 7407th Support Squadron (SS), activated at Rhein-Main Air Base on May 10, 1955, to operate jet aircraft specially configured for strategic reconnaissance missions.

Its first assigned aircraft was RB-57A 52-1492, which was prepared by Convair for Project Sharp Cut. The aircraft carried a Boston University-designed 6,000mm focal length camera in the bomb bay, shooting obliquely. It remained in West Germany until November 1960, before re-assignment to the 6091st Reconnaissance Squadron (RS) based at Yokota Air Base, Japan under the Switch Blade programme.

The 6091st RS (previously the 6021st RS) performed a similar role in the Far East to the 7407th SS in Europe. During its time in Japan Sharp Cut adopted the identity of the first Martin B-57A built, serial number 52-1418, and possibly



others, only returning to its correct serial on February 3, 1965. The aircraft was retired in 1968.

On August 23, 1955, the 7407th SS received a further six RB-57As from a batch of ten (serial numbers 52-1427, 52-1429, 52-1431, 52-1432, 52-1433, 52-1439, 52-1440, 52-1442, 52-1462 and 52-1464) unofficially known as RB-57A-1s, which had been modified under Project Lightweight by Martin and the Wright Aeronautical Development Center at Wright-Patterson Air Force Base. The aircraft were stripped of as much equipment as possible (including the second crew member) to reduce weight by 5,665lb so they could fly higher and faster to avoid interception. The RB-57A-1 aircraft had higher thrust-rated Wright J65-W-7 turbojets installed in place of the standard J65-W-5s, and could reach at least 55,000ft altitude - much higher when fuel burnt off, requiring the pilot to wear a pressure suit. The Lightweight code-name was later replaced by Heart Throb, possibly because the original hinted too closely at the truth.

Between September 1955 and August 1956, the 7407th SS used its six aircraft to fly shallow penetration flights over Czechoslovakia, Hungary

and Yugoslavia, by when the Lockheed U-2 had entered service. At least 19 such sorties were undertaken. By mid-1959 the squadron's Heart Throbs had been replaced by RB-57Ds and were transferred to Arkansas Air National Guard's 154th Tactical Reconnaissance Squadron based at Adams Field, later re-named Little Rock Air Force Base.

Other RB-57A-1s served with the 6021st RS at Yokota from September 1955 until August 1957, with at least two later passing to the Republic of China Air Force (ROCAF).

### Bald Eagle

Studies for a dedicated strategic reconnaissance version of the B-57 began at the WADC in late 1952. On March 27, 1953, the US Department of Defense issued a requirement for a single-seat, high-altitude reconnaissance aircraft, with a combat radius of around 2,000nm able to reach at least 65,000ft, designated Weapon System MX-2147, with the project name Bald Eagle. Bell, Fairchild and Martin each received design contracts for their Models 67, 195 and 294, respectively.

Bell's design was considered the most promising and a development contract was placed as the X-16. Martin's Model 294, which combined the fuselage of the B-57B with an enlarged wing, was available quicker and so was ordered as an interim type. An existing contract covering 20 B-57B airframes (serial numbers 53-3963 to 53-3982) was modified to B-57Ds in August 1954 and, in April 1955, RB-57Ds. The X-16 was later cancelled.

Wingspan was increased from 64ft to 106ft, with a wider chord. The wing was made of a honeycomb material, the first time such a material had been used on a manned aircraft. Integral fuel cells in the wing replaced the tanks in the fuselage, while Pratt & Whitney J57-P-9s rated at 10,000lbf were installed in larger nacelles with anti-icing gear. The bomb bay was permanently sealed. Its space occupied by mission equipment.





## MARTIN RB-57 CANBERRA



An all-flying, variable incidence horizontal stabiliser was fitted, along with a power-driven rudder and yaw dampener.

Four different RB-57D configurations were built. The first two – both designated RB-57D-0 – were single-seat, high-altitude photographic reconnaissance aircraft. They carried a pair of K-38 and two obliquely mounted KC-1 split vertical cameras mounted in the lower forward fuselage, with viewing ports in front of the nose wheel well.

Six Model 294s (serial numbers

53-3977 to 53-3982) were completed as Group A aircraft and seven as Model 744 Group Bs (serial numbers 53-3970 to 53-3976), the latter with an aerial refuelling receptacle aft of the canopy, an autopilot and folding rudder pedals to allow the pilot to stretch his legs on long missions.

One Model 797 (Group D) aircraft was produced as the RB-57D-1 (serial number 53-3963), a single-seater with an aerial refuelling receptacle. It was equipped for electronic (radar) reconnaissance with a Westinghouse APQ-56 side-looking, airborne mapping

radar housed in the fuselage, with associated antennas fitted under the wing roots that extended slightly aft of the trailing-edge. A bulbous nose radome housed an antenna for the APN-107 navigation radar, which had another antenna in the extended tail cone.

Six Model 796 (Group C) aircraft were completed as RB-57D-2s (serial numbers 53-3964 to 53-3969), an electronic intelligence variant that also carried an electronic warfare officer. This variant carried an APA-69A direction finding radar set, with an antenna mounted in a distinctive belly radome; an APN-107 navigation radar with nose and tail antennas; APR-9 D-through I-band radar intercept receiver; and an APR-14 panoramic radar receiver. The RB-57D-2s also had provision for aerial refuelling.

### Service Entry

On November 3, 1955, the RB-57D made its first flight and deliveries to Strategic Air Command's 4080th Strategic Reconnaissance Wing (SRW) at Lockbourne Air Force Base, Ohio, were under way by April 1956. On May 1 the Wing moved to Turner Air Force Base, Georgia, and the 4025th Strategic Reconnaissance Squadron, Light or SRS(L) was activated the same day as the operating unit.

Turner-based RB-57Ds were operated

**LEFT: RB-57D 53-3977** was the first of the initial long-wing version to be completed. This was a Group A aircraft operated by a pilot only without the Group B aerial refuelling capability.

US Air Force

**BELOW: One important role for the RB-57D was the collection of high-altitude samples from nuclear weapon tests, for which they carried large pods on the wings.** Group A aircraft 53-3979 assigned to Det 7, 4025th SRS(L) during Operation Hardtack, supported the Juniper shot over Bikini Atoll on July 22, 1958.

US Air Force





from various locations to fly around the peripheries (and occasionally over) target countries.

Under Project Sea Lion, all six Group A aircraft were deployed to Yokota, Japan from September 11, 1956, and became Det 1 of the 4080th Strategic Reconnaissance Wing.

Taking different routes, three RB-57Ds penetrated Soviet airspace south of Vladivostok on December 11, 1956. All three returned safely but had been tracked by Soviet air defences and when the camera film was developed, several frames showed MiGs attempting to climb up towards the RB-57Ds. On December 14, the Soviet Union officially complained about the intrusion of its airspace, which resulted in President Dwight D Eisenhower halting overflights by RB-57Ds.

All aircraft assigned to Det 1 were returned to the United States in late 1957, landing at Laughlin Air Force Base, Texas. They were immediately assigned to the 4080th Strategic Reconnaissance Wing that had relocated to the Texas base on April 1, 1957.

Under Operation Bordertown, four RB-57Ds were initially deployed by the 4025th SRS(L) to Rhein-Main to fly missions along the border with the German Democratic Republic and over the Baltic Sea. A further two, including the sole Group D aircraft followed. On June 9, 1959, all RB-57D aircraft were transferred to the 7407th SS.

In addition to the more traditional reconnaissance role RB-57Ds were used to collect samples from fallout of Soviet and Chinese nuclear tests, as well as supporting US weapons trials. Six aircraft were deployed to Eniwetok Atoll in the Marshall Islands between April 14 and August 11, 1958 for Operation Hardtack, operating as Det 7.

Between April 14 and August 11, 1958, the four RB-57s used pods to collect

samples of fallout from each of a series of 35 nuclear detonations in the Pacific Proving Grounds, for later analysis.

## Taiwanese Operations

In 1956 an agreement was signed between the United States and the Chinese Nationalists on Taiwan for overflights of the People's Republic of China. America would provide the aircraft and support, which would be flown by Taiwanese crews.

Former 6021st RS Heart Throbs 52-1427 and 52-1431 were delivered to the ROCAF on September 25, 1957, becoming 5641 and 5642. They were assigned to the 4th Tactical Reconnaissance Squadron of the 5th Fighter Wing based at Taoyuan Air Base. Major Si-Liang Lu flew the first overflight by the aircraft on December 6, 1957, and additional sorties followed on December 15 and January 7, 1958. During the fourth flight on February 18, 1958, Captain Kwan-Hua Chao in 5642 was intercepted by a People's Liberation Army Navy Air Force Shenyang J-5As. The surveillance aircraft crashed into the Yellow Sea close to Chingtao and Captain Kwan-Hua Chao was killed. No further missions with 5641 were attempted; it returned to the US Air Force in February 1959.

On October 1, 1958, two RB-57Ds (serial numbers 53-3978 and 53-3981) were supplied to Taiwan, becoming 5643 and 5644. Pilot conversion was aided by the loan of a pair of 3rd Bombardment Wing B-57Cs under the Diamond Lil programme, but as clashes with Chinese aircraft increased the project was cut short after just two pilots had converted to type. However, on January 6, 1959, Si-Liang Lu flew the first RB-57D sortie over China and 11 missions had been completed by March, with five more in April and three in June. Flights resumed in October, but

during the third that month (on October 7) 5643 was shot down over Peking by a SA-2 *Guideline*, the surface-to-air missile's first victim. Pilot 1st Lt Ying-Chin Wang was killed, and the joint overflight programme terminated, although 5644 subsequently flew two border surveillance missions. It was returned to the US Air Force in September 1963.

## Broken Wings

The Achilles' Heel of the RB-57D was its wing. By 1959 several had suffered wing failures – in two cases the outer sections had broken off after landing – resulting in some of the fleet entering storage. In June 1960, the 4025th SRS(L) deactivated, with some of its RB-57Ds going to the 4677th Defense Systems Evaluation Squadron (DSES) at Hill Air Force Base, Utah, to act as high-altitude targets for the interceptors of Air Defence Command.

However, operations by RB-57Ds assigned to the 7407th SS continued. From July 1960, RB-57D 53-3975 was modified under the Big Safari's Paper Doll (later Black Knight 1) project to replace the Sharp Cut RB-57A. It was equipped with a Bulova 707-1000 6,000mm focal length oblique camera and electronic sensors, and a mission crew position was added. In February 1961 the aircraft was redelivered to the 7407th SS, but fatigue cracks were discovered in the front wing spar and it was grounded in June 1962. Three more of the unit's RB-57Ds (serial numbers 53-3970, 53-3974 and 53-3963) were similarly equipped and referred to as Black Knight 2, 3 and 4.

Between 1962 and 1964 under the Dinah Lee programme, RB-57D 53-3972 was fitted with an Itek 66D high-acuity camera system with a 1,600mm focal length. The systems required a dedicated mission systems operator.

BELOW: *The majority of RB-57Fs were built as First Chip/Rivet Chip high-altitude sampling aircraft for the 9th Weather Reconnaissance Wing. RB-57F 63-13296 is seen at Webb Air Force Base, Texas on May 8, 1965, when assigned to the Wing's 58th Weather Reconnaissance Squadron.*  
US Air Force





## MARTIN RB-57 CANBERRA

Operational testing by the 7407th SS proved the usefulness of the camera, but the aircraft suffered a wing spar failure grounding it before it was used for an operational mission.

In January 1964 both wings of RB-57D 53-3973 assigned to the Wright Aeronautical Development Center failed at 50,000ft, grounding the fleet for a second time and ending its reconnaissance career. Of the five aircraft still assigned to the 7407th SS, two were in such poor condition that they had to be dismantled for transport back to the United States. The final pair flew out of Rhein-Main on May 20, 1964.

### Pee Wee

In August 1962 General Dynamics was contracted by the Big Safari programme office to modify two B-57Bs to monitor telemetry during Soviet missile launches, a mission known as Little Cloud. The US Navy had undertaken the role from a base in Pakistan but was 'expelled' after repeated violations of Indian and Afghan airspace. An agreement was reached that the mission could continue from Peshawar if flown by Pakistani crews in an aircraft type already in its inventory.

Between August and December 1962, B-57B 52-1536 was modified at Fort Worth referred to as Pee Wee I, followed by 52-1573 between September 1962 and January 1963 as Pee Wee II. Both were equipped to collect Soviet range and missile telemetry signals with antennas housed in an elongated nose, and telemetry receivers and ancillary equipment in the bomb bay. A second crew member operated and monitored the equipment from a workstation positioned behind the pilot. Both aircraft served in the role with the Pakistan Air Force's 24th Electronic Intelligence Squadron for just over a year.

### Growth Version

General Dynamics' Fort Worth



Division was responsible for the maintenance of the RB-57D. Its team investigated ways of overcoming the aircraft's shortcomings – especially the problematic wing – and improving its performance. On October 2, 1962, the company was contracted to create a new version to undertake the Pee Wee mission. This was the genesis of the RB-57F, which featured an even bigger wing with a span of 122ft 5in with three spars. Extensive use was made of honeycomb sandwich panels, while additional sensors could be carried in the plastic wingtips or on four hardpoints (two under each wing). All fuel was accommodated outboard of the nacelles.

Power was provided by two 16,500lbf Pratt & Whitney TF33-P-11As in the nacelles, plus auxiliary Pratt & Whitney J60-P-9s in detachable under wing pods, which added 2,000 to 3,000ft to the aircraft's maximum ceiling. The height and width of the vertical stabiliser was increased to improve yaw response at high-altitude. The nose was

extended (increasing length to 68ft 10in) to house navigational equipment and additional avionics, while a modified Lear MC-1 autopilot was fitted to ease pilot workload.

Maximum speed was 475kts, and range some 3,475nm. No definitive service ceiling was released, although NASA (the final operator) states 'above 65,000ft'; this figure is understood to be extremely conservative.

RB-57Fs were officially conversions of existing aircraft, but only the basic fuselage structure, horizontal stabiliser and landing gear was recycled. The first (serial number 63-13286) used B-57B 52-1559 as a donor airframe. Captain Edward Sturmthal made its maiden flight on June 23, 1963, the first time a serving US Air Force officer completed the initial sortie of a new aircraft. The first two RB-57Fs were produced for the Pakistani mission under the Pee Wee III programme, equipped with the HRB-Singer 'System 365' semi-automatic signals collector.

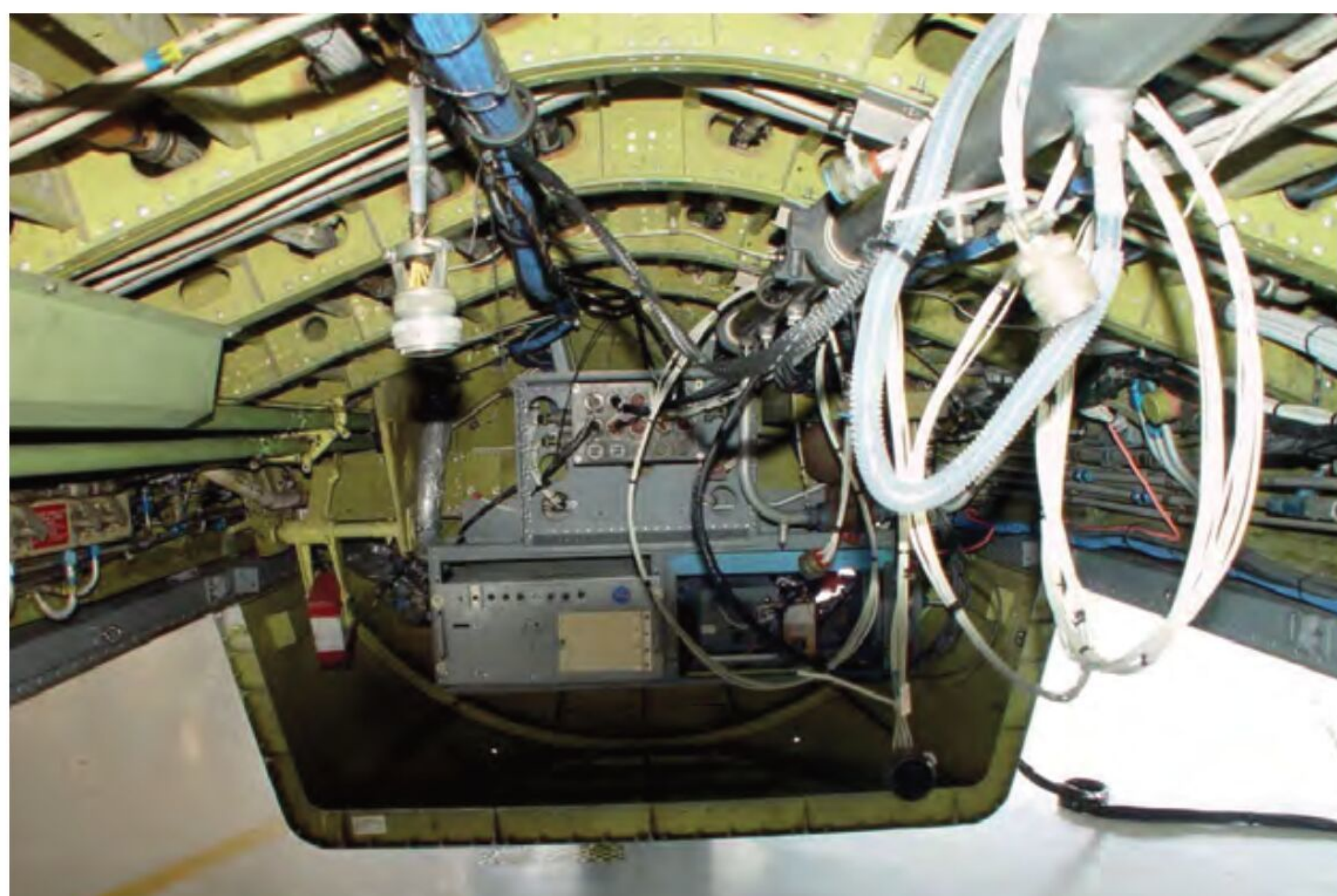
Operational testing was undertaken by the 7407th SS at Rhein-Main Air Base, West Germany during late-1963, before delivery to Peshawar Air Base, Pakistan in March 1964. The 24th Electronic Intelligence Squadron was the Pakistani unit assigned to operate and maintain the aircraft. RB-57F 63-13286 was in Pakistan on September 1 at the start of the 1965 Indo-Pak War and was damaged during the conflict. How the damage occurred, and what the aircraft did during the war has been the subject of much speculation over the years, but it is understood to have been caught refuelling on the ground during an attack by the Indian Air Force on September 7. The aircraft was later retrieved by a US crew and ferried to Fort Worth for repair.

Pee Wee III RB-57F 63-13287 was reassigned to the 7407th SS in late

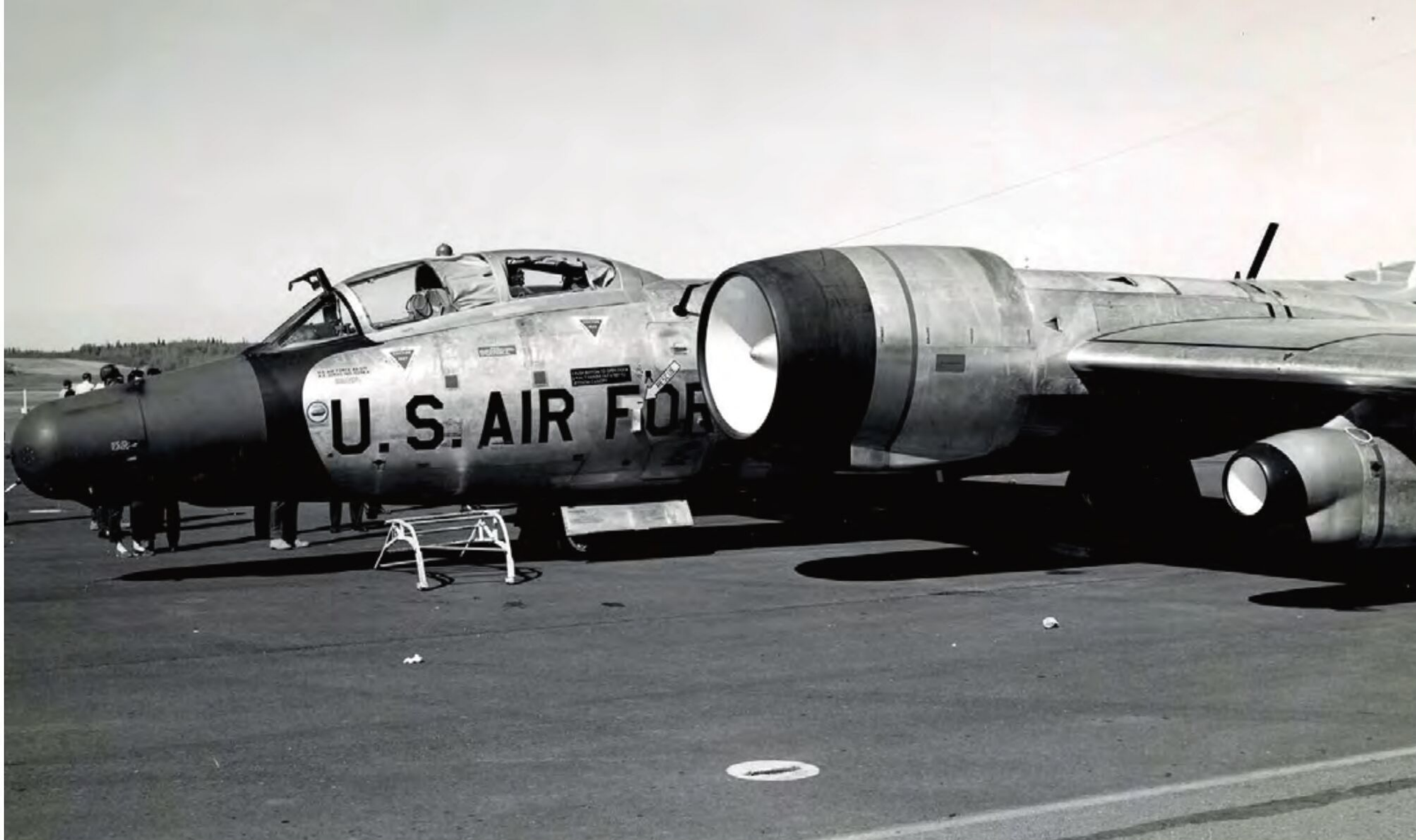
ABOVE: *Front cockpit of a NASA WB-57F. Little changed in its layout from its days with the US Air Force.*

David Willis

LEFT: *Looking forward inside the mission bay of the WB-57F.*  
NASA







ABOVE: *In addition to the main Pratt & Whitney TF33-P-11A engines housed in the nacelles, the RB-57F also carried a pair of Pratt & Whitney J60-P-9 engines in detachable under wing pods, as seen on 63-13294.*  
US Air Force

BELOW: *The RB-57F was designed to complement the Lockheed U-2; it could carry a much heavier payload, making it ideal for the stand-off surveillance role.*  
US Air Force

October 1965 and continued to collect Soviet missile telemetry while operating out of Incirlik Air Base in Turkey. On December 14 that year, the aircraft disappeared over the Black Sea along with Captains Lester Lackey and Robert Yates. Their fate has never been fully explained. While the aircraft's slow decent and irregular flight path probably indicated a failure in the oxygen system, examination of wreckage reportedly pointed towards an external explosion, possibly indicating it was shot down.

## Second Slice

In August 1963 production of 12 more RB-57Fs (serial numbers 63-13288 to 63-13299) began under Big Safari's First Chip programme, using B-57B donor airframes, for the high-altitude

air sampling role. They were equipped with the Particulate Sampling System installed outboard of the J60 engines, plus other collection equipment. Three further First Chip RB-57Fs (serial numbers 63-13300 to 63-13302) were created from RB-57As, the last of which was delivered in March 1967. First Chip had been renamed Rivet Chip by March 1968, when the first RB-57F (63-13286) was also converted to the configuration. Later that year all Rivet Chip RB-57Fs were redesignated WB-57Fs. Most First Chip/Rivet Chip aircraft were assigned to the 9th Weather Reconnaissance Wing (WRW), which had squadrons at McClellan Air Force Base, California; Kirtland Air Force Base, New Mexico; Yokota Air Base, Japan; and Avalon in Australia.

The final RB-57Fs were created as

dedicated reconnaissance aircraft to two different configurations under Big Safari's Second (later) Rivet Slice programme. RB-57Fs 63-13500 and 63-13502 were produced from RB-57Ds 53-3972 (the Dinah Lee aircraft) and 53-3970. Both carried the Itek 66D camera behind a covert sliding door, APN-102 Doppler radar equipment and a solid-state electronic programmer. Additional cameras, plus an AVQ-20 weather radar, could be carried in the nose. They were delivered in April 1965 and February 1966.

Black Knight 1, aircraft 53-3975, supplied parts for RB-57F 63-13503, which retained the Bulova 707-1000 oblique camera as its primary sensor, plus a 900mm KA-1 or 300mm KA-2 camera in the nose. The same equipment was installed in 63-13501, delivered in June 1965, one month after 63-13503.

Second Slice aircraft were flown by the 7407th SS in West Germany and the 6091st RS in Japan. The latter received its aircraft on May 16, 1965; they regularly adopted false identities – one becoming '63-13499'. In addition to collecting intelligence, the 6091st RS also used its RB-57Fs to provide bomb damage assessment for US strikes against North Vietnam. The squadron inactivated on July 1, 1968, with aircraft 68-13501 subsequently going to NASA for modification under the Rivet Rap programme to support its Earth Resources Technology Satellite project.

The last RB-57F of the 7407th SS departed Rhein-Main for the 58th Weather Reconnaissance Squadron, a component of the 9th WRW on October 1, 1968, the day West German-based unit disbanded. The 58th WRS retired its final WB-57F in July 1974.





# Q-Birds

**Mark Ayton** reviews the US Navy's EP-3E Aries fleet of multi-intelligence reconnaissance aircraft

**N**aval Air Station Whidbey Island, Washington is the current and last home station for the US Navy EP-3E ARIES II aircraft.

An EP-3E is an extensively modified P-3 Orion fitted with the Airborne Reconnaissance Integrated Electronic System dubbed ARIES. Originally introduced to fleet service in 1971 and configured for signals intelligence, today the EP-3E is classed as a multi-intelligence reconnaissance aircraft with a much-improved SIGINT and full motion video capability. According to Naval Air Systems Command, the EP-3E is equipped with sensitive receivers and high-gain dish antennas

used for the exploitation of a wide range of electronic emissions from deep within targeted territory while operating in international airspace.

The crew fuses the collected intelligence along with off-board data and disseminates the collaborated information for direct threat warning, indications and warnings, information dominance, battle space situational awareness, suppression of enemy air defences, destruction of enemy air-defence, anti-air warfare and anti-submarine warfare applications. Additionally, an EP-3E's crew gathers technical information and intelligence about weapon systems in use by potential adversary nations.

The first ten EP-3Es were modified P-3A-model Orion maritime patrol aircraft configured to ARIES I standard. These were replaced by 12 former P-3Cs modified to the new generation ARIES II standard. Lockheed undertook modification of the first five aircraft between 1986 and 1991 at its Greenville, South Carolina facility, when the programme was transferred to the Naval Air Depots at Alameda, California and Jacksonville, Florida. EP-3E ARIES II BuNo 156507 made the type's first flight from Greenville on April 11, 1990. The last ARIES II aircraft entered fleet service in 1997.

*BELOW: Three VQ-1 EP-3E ARIES II aircraft share a flight line at Naval Air Station Whidbey Island with a grey P-3C Orion. The close proximity to camera of aircraft 325 shows some of the aircraft's antennas and radomes.*  
Matthew Clements





RIGHT: *Aviation Technicians prepare an EP-3E ARIES II for routine maintenance procedures at Naval Support Activity Souda Bay, Crete during a detachment to the US 6th Fleet area of operations.*  
US Navy/Heather Judkins

## Q-birds

Whidbey-based Fleet Air Reconnaissance Squadron One (VQ-1) 'World Watchers' is the last remnant of a community that has collected SIGINT and provided early warning since the 1950s. VQ-1, having grown from the absorption of VQ-2, operates 12 EP-3E ARIES II aircraft, with large crews comprising evaluators, intercept operators and linguists who deploy worldwide, often in response to tasking from national command authorities. Colloquially, EP-3E ARIES II aircraft are referred to as Q-birds, a term derived from the VQ squadron designation.

During the early 1990s, the Conversion-in-Lieu-of-Procurement programme converted 12 P-3Cs to EP-3E ARIES II configuration, using in part mission systems transferred from two EP-3B and the ten original EP-3E ARIES I aircraft.

An EP-3E is manned by a crew of up to 24 comprising three pilots, one electronic warfare aircraft navigator (EWAN), one flight engineer, an electronic warfare aircraft commander



(EWAC), a senior electronic warfare tactical evaluator (SEVAL), a mission Commander and two electronic warfare operators.

The EWAC datalinks intelligence

information directly to all commanders. The EWAN maintains the aircraft's position and navigation throughout the mission. The SEVAL manages mission planning, collection, and reporting







requirements, determines the tactical scenario based on SIGINT available and compiles operational intelligence reports for use by all commanders.

## ARIES Upgrades

The EP-3E also has gone through upgrades to increase its capabilities. In 2003, Naval Air Systems Command's Maritime Patrol and Reconnaissance Aircraft (MPRA) program office PMA-290, began the JCC upgrade to incrementally improve the EP-3E's SIGINT sensor system capabilities. JCC refers to the awkwardly named Joint airborne SIGINT architecture modernization Common Configuration.

Commenting, a PMA-290 official said: "JCC upgrades provided the Navy with an automated electronic surveillance measures capability, connectivity to the classified airborne ForceNET network, precision direction

finding, low-band multiplatform geolocation communications collection, recording and information operations capabilities."

The JCC upgrade package was first installed on the final five P-3C aircraft modified to EP-3E configuration, followed by each of the 12 aircraft in fleet service as they went through depot maintenance or special structural inspections. The first EP-3E configured with the JCC entered fleet service in 2005.

Both the JCC and another modification known as Task Force Intelligence, Surveillance and Reconnaissance (TF-ISR) included hardware and software upgrades that aligned the EP-3E with the Navy's cryptologic architecture. These modifications bridged the gap between its present capabilities and future manned/

unmanned reconnaissance aircraft, and integrated Link 16 mission management capabilities.

Another modification, known as the Sensor System Improvement Program (SSIP) upgraded the type's communication suite, and enhanced signals intelligence collection and data-automation capabilities.

According to Naval Air Systems Command, the SSIP passed an operational assessment by the commander, operational test and evaluation force in September 2004 and found SSIP to be operationally effective and suitable, a significant improvement in capability over previous versions and was recommended for fleet introduction.

Developmental testing of SSIP occurred in FY2003 split between the software integration lab at the Raytheon Technical Service Company facility in Indianapolis, Indiana and by NAVAIR at Naval Air Station Patuxent River, Maryland.

In 2007, PMA-290 implemented upgrades of the EP-3E's electro-optical/infrared (EO/IR) and ForceNET systems to meet emerging TF-ISR requirements. This effort included installation of a turret under the forward fuselage, improved international maritime satellite connectivity, additional special signals boxes and line-of-sight wide-band data links for full-motion video.

During 2010, L-3 Communications delivered a prototype EP-3E configured with its Spiral 3 modification for operational testing. L-3's Spiral 3 fit comprised an

**LEFT: October 2008:**  
**VO-1 EP-3E ARIES II BuNo 157325** at RAF Mildenhall, England in an earlier configuration, fitted with many more antennas under the outboard wings and the under fuselage, to aircraft 318 from October 2017 shown below.

Lindsay Peacock

**BELOW: October 2017:**  
**VO-1 EP-3E ARIES II BuNo 157318** at Naval Air Station Whidbey Island, Washington configured with a circular radome atop the forward fuselage and far fewer antennas fitted to aircraft 325 shown in the accompanying photo above from October 2008. The radome atop the fuselage might contain antenna for the ForceNET systems.

Matthew Clements







ABOVE: A rare night-time shot of two EP-3E ARIES II aircraft on the flight line at Naval Air Station Whidbey Island, Washington, the home station of VQ-1.  
Matthew Clements

upgraded ISR mission avionics suite featuring new communications intelligence (COMINT) equipment, new sensors and improved network capabilities.

Used on a mission, the modifications improve onboard data analysis and enable real-time tactical intelligence dissemination. Spiral 3 was under its operational test during 2011 leading to a full-rate production decision under which L-3 manufactured and installed the suite on three EP-3E aircraft.

Because of obsolescence, PMA-290 also began to upgrade the EP-3E's electronic surveillance measures in 2016.

In order to comply with Federal Aviation Administration airspace regulations, the EP-3E fleet has been modified under the Communications, Navigation and Surveillance/Air Traffic Management programme. EP-3Es have been updated with a new communications suite, the

protected instrument landing system, identification friend-or-foe Mode S, traffic collision avoidance system and the required navigation performance enhancements including GPS and ADS-B capability.

The Navy is keeping the EP-3E modernised until the end of its service life by replacing capabilities resident in the aircraft, which is no small chore. Eventually the Navy will transition many of the EP-3E's capabilities to the MQ-4C Triton unmanned aerial system.

### Still Going Strong

In 2021, the ruggedness of the EP-3E is evident by its ongoing operation with the US Navy conducting a type of mission that the P-3 was not originally designed to conduct, but nevertheless doing so very effectively. For 20 years, Navy EP-3s were heavily tasked with Cold War operations, every conflict since, and a lot of clandestine work that remains classified.

Lockheed EP-3s replaced Lockheed EC-121Ms. The first two EP-3B aircraft entered service with VQ-1 in 1969. The first EP-3E ARIES I aircraft was assigned to the fleet in 1991. The type served until it was replaced with ARIES II standard aircraft between 1991 and 1997. Even though the same airframes remain in Navy service today, their mission systems have changed considerably. Not least because Chinese specialists were able to analyse the systems on board aircraft BuNo 156511 following the most famous EP-3E mission ever.

On April 1, 2001, aircraft BuNo 156511 survived a mid-air collision with a People's Liberation Army Naval Air Force J-8 fighter and diverted to Lingshui Air Base on Hainan Island. The aircraft was very badly damaged and eventually dismantled by a Lockheed Martin recovery team and airlifted back to the United States where it was re-built.

Operators from all of the US armed services who operate the EP-3E as mission crew like the ARIES system because it fully-integrates data from across the RF spectrum, provides real-time battlespace situational awareness, and records signals for post-mission technical analysis.

Fleet commanders appreciate having an EP-3E airborne because of the flexibility held by the crew that enables them to easily switch reconnaissance tasking when new and tactically significant information is prosecuted. Intelligence that commanders needed to know about. Furthermore, an EP-3E's architecture can be reconfigured by the squadron at its home station or forward operating base. A beneficial attribute for dealing with a real-world scenario, and one that has paid off many times.

RIGHT: EP-3E ARIES II BuNo 156511 taxiing out to the runway at Naval Support Authority Souda Bay, Crete in August 2017 showing all four radomes atop and underneath the fuselage.  
Matthew Clements





# Habu

**David Isby** writes about the Lockheed SR-71 Blackbird, the world's fastest and highest-flying production aircraft

**T**he Lockheed SR-71 Blackbird flew faster and higher than any other manned military aircraft, at speeds over Mach 3.3 and altitudes above 90,000ft. Yet today it is literally a museum piece, albeit one that always seems to draw a crowd. "It always felt good flying the highest and fastest aircraft in the world," said retired Lieutenant Colonel Tony Bevacqua, "there's nothing else like it."

In the mid-1950s, fearing a Soviet build-up of long-range bombers and ballistic missiles, the United States relied on manned aircraft to conduct intelligence, surveillance, and reconnaissance (ISR) missions. Most were flown at standoff distance, in international or friendly airspace, gathering oblique photographs and signals intelligence (SIGINT). But overflights of Soviet territory provided such valuable intelligence that, despite the risks of interception, the United States flew many such missions.

In 1954, the Central Intelligence Agency (CIA) wanted a high-altitude

ISR aircraft to overfly the Soviet Union. Even though airborne ISR was normally the responsibility of the air force and the navy, President Dwight Eisenhower thought the diplomatic tensions caused by military overflights in peacetime – especially if one were to be shot down – would be mitigated by using at least nominally civilian aircraft and pilots. The CIA turned to Kelly Johnson of Lockheed. His Skunk Works team had a reputation for putting amazing designs into the air quickly. One of these was the Lockheed U-2, a subsonic single-seat high-altitude ISR aircraft whose basic design was so sound it remains operational today. In 1956, the CIA commenced U-2 overflights of the Soviet Union. But radar and surface-to-air-missile (SAM) technology was improving. The U-2, it was thought, would be vulnerable in the future. 'The future' turned out to be May 1, 1960, when one was shot down by a SAM.

The CIA wanted a follow-on single-seat ISR aircraft, capable of exceeding Mach 3 at 90,000ft. The high-speed,

high-altitude requirements were intended to allow it to fly above most radar coverage. Two competing paper designs were evaluated: The Skunk Works' Lockheed A-11 and the Convair Kingfish. On August 20, 1959, a joint decision by a panel comprising representatives from the CIA, Department of Defense and the US Air Force decided to procure an improved A-11 designated the A-12, and code-named Oxcart. The A-12s would be civil-registered CIA aircraft, supported by US Air Force training and tanker aircraft, logistics and infrastructure.

The top-secret, CIA-managed programme proved tremendously challenging. No one had built such an aircraft before. Aerodynamic heating of up to 500°C required such extensive use of structural titanium that the CIA had to set up overseas front companies to import it from the Soviet Union. Tooling and the know-how of how to build an aircraft from titanium all had to be invented from scratch. The design introduced stealth technology: the use of radar-

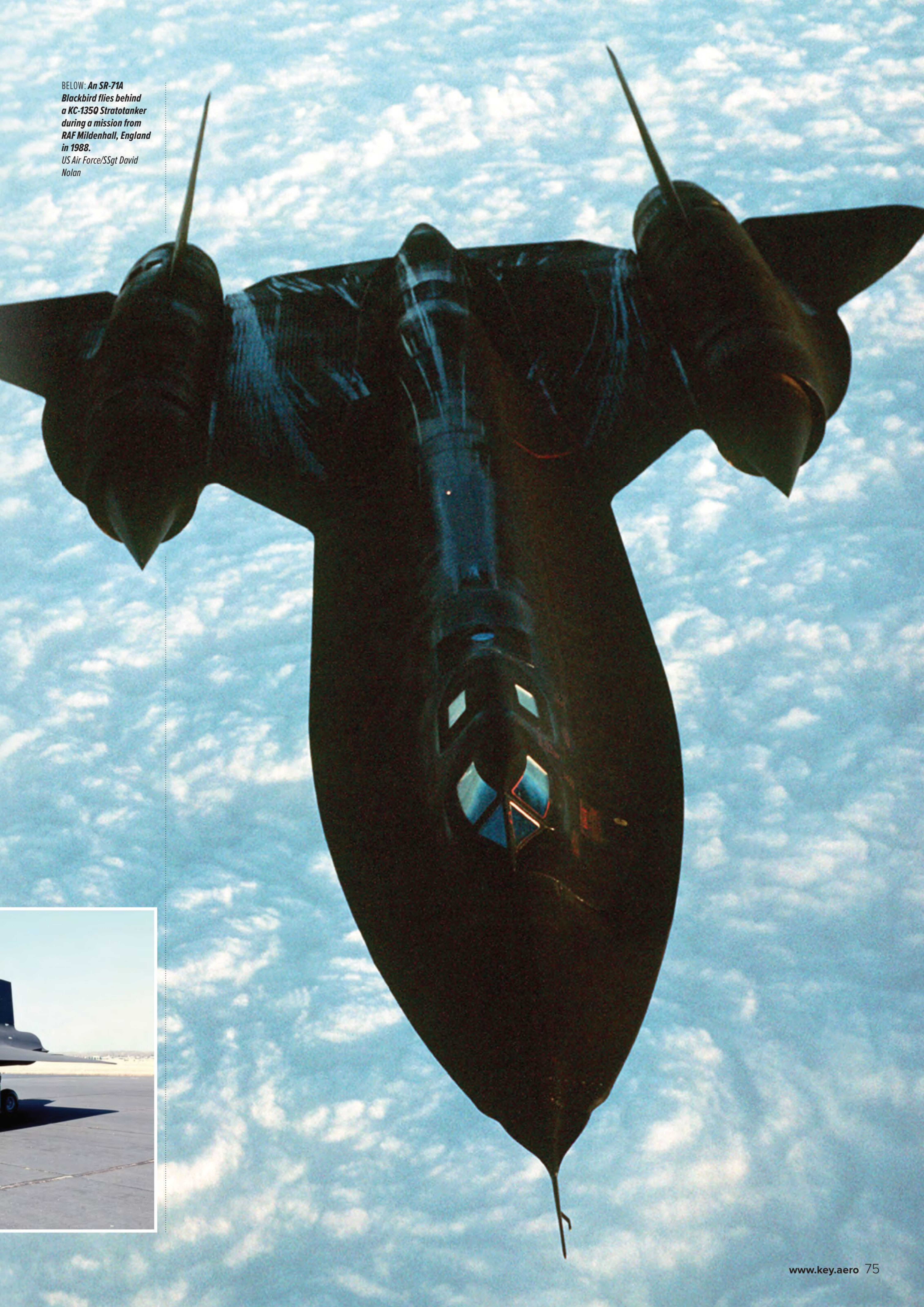
BELOW LEFT: **SR-71A 64-17967** taxiing to RAF Mildenhall's runway 29 for a mission in June 1989. This aircraft has a discrete red tail number and no unit markings, typical toward the end of the Cold War.  
*Bob Archer*

BELOW RIGHT: **A Lockheed D-21B** ramjet-powered, remotely piloted aircraft, which was designed to carry out high-speed, high-altitude strategic reconnaissance missions over hostile territory. D-21Bs were used on four overflights of the People's Republic of China under the code name *Senior Bowl*.  
*US Air Force*





BELOW: **An SR-71A**  
**Blackbird flies behind**  
**a KC-135Q Stratotanker**  
**during a mission from**  
**RAF Mildenhall, England**  
**in 1988.**  
*US Air Force/SSgt David*  
*Nolan*







absorbing composite materials on leading edges and tail fins, and a distinctive black coating impregnated with radar-deflecting ferrite particles. Configured with blended wings and fuselage and side chines reducing radar cross-section, the A-12 made its first flight on April 25, 1962.

## UAV Mothership

In 1962, the CIA, aware of the increasing SAM threat to future overflights, turned to Kelly Johnson for a solution. He designed the D-21 Tagboard drone. Air-launched, it was carried to altitude atop the M-12, a modified A-12 two-seat mothership that could standoff in international airspace. The D-21 looked like a miniature unmanned A-12, powered by a single ramjet for Mach 3.3 cruise, it measured 43ft in length with a 19ft wingspan. A D-21 could fly 3,500 mile-missions at

95,000ft. Its cassette of photographs – called a hatch – was designed to eject in mid-air and get scooped up in its parachute by a waiting aircraft.

In 1963, the CIA transferred the D-21 programme to the air force. The integration required for launching a Mach 3 drone from a Mach 3 mothership proved challenging. A failed D-21 launch in 1966 destroyed the M-12, one of its pilots died. The air force redesignated the D-21 as the D-21B Senior Bowl, which was launched from a modified B-52H bomber. Finally, operational, the D-21 made four overflights of People's Republic of China airspace in 1969-1971, its objective the missile testing site at Lop Nor. The programme came to an end after all four D-21B missions failed. One D-21B was said to have lost guidance, failed to self-destruct, and eventually crashed in Siberia.

## Oxcart Operational

The A-12 came in from the black world of classified programmes during President Lyndon Johnson's news conference of February 29, 1964. The A-12 finished testing in November 1966. It became operational at its home base of Beale Air Force Base, California in 1966. Burning 11 tons of its special JP-7 fuel per hour, the A-12s relied on modified KC-135Q Stratotankers assigned to the US Air Force's 903rd Air Refueling Squadron: JP-7 tank farms were prepared at Kadena Air Base, Okinawa, later in Alaska, Greenland, Spain, and Turkey. Specialised processing systems were required for rapid post-mission analysis of the A-12's massive film cameras. But the CIA, halting production at 18 A-12s (including one two-seat trainer version) in 1964, realised it would be detectable and

ABOVE: YF-12A serial number 60-6936/FX-936 over the Mojave Desert on a mission from Edwards Air Force Base, California. The type was a two-seat version of the Lockheed A-12 and featured a modified chine to facilitate a nose radome capable of housing a Hughes ASG-18 fire control radar. This aircraft crashed on June 24, 1971 caused by a failed fuel line and a fire.  
US Air Force





ABOVE: **The SR-71** pilot's instrument panel.  
US Air Force/TSgt Michael Haggerty

vulnerable over the Soviet Union and People's Republic of China. It would never overfly these countries.

In May 1967, President Johnson ordered the deployment of three CIA A-12s to Kadena for Operation Black Shield. Intelligence reports from the time indicated that North Vietnam was receiving surface-to-surface missiles, a major escalation of the Vietnam conflict. Nine A-12 sorties, flown over North Vietnam in May, June, and July, found no such missiles. They brought back much needed intelligence including oblique photographs of People's Republic of China territory. Fitted with improved Pin Peg radar warning systems, Mad Moth and Blue Dog jammers before deployment, the A-12s were repeatedly fired upon by S-75 Dvina (SA-2 Guideline) SAMs. One even suffered slight fragment damage although the pilot was unaware of this until the aircraft was back at Kadena.

The US National Command Authority (NCA) used the A-12 in areas where high-altitude SAMs prevented the use of U-2s. A-12s provided higher-resolution and more timely photographs than the KH-04 Corona reconnaissance satellites then in service.

On January 23, 1968, North Korea captured the USS *Pueblo*, while gathering COMINT in the Sea of Japan. The first A-12 mission over North Korea was flown three days later. The aircraft collected and brought back photographic evidence that the crew was not being held on board. Planning for a rescue mission was halted. Negotiations would be

required to release the crew. A-12 overflights of North Korea continued until May and found no evidence that the North Koreans planned further escalation.

With the Vietnam War escalating, there were fewer resources for two parallel forces of ISR aircraft, and amidst bureaucratic battles in Washington, in December 1966, the CIA agreed to retire the A-12 in 1968. The *Pueblo* crisis marked the end of CIA A-12 operations: three air force SR-71s arrived at Operating Location 8, the 9th Strategic Reconnaissance Wing's facility at Kadena on March 8, 1968, to replace them. The A-12s based at Kadena – minus one that had crashed during a test flight – returned to the Lockheed plant at Palmdale and were placed in storage.

## The SR-71 Goes Operational

The SR-71 was – along with the A-12 and the YF-12 – one of three Lockheed designs evolved from Kelly Johnson's original A-11. The YF-12, a two-seat interceptor version armed with long-range Hughes AIM-47 missiles, was intended to defeat Mach 2 Soviet high-altitude bombers. Strategic Air Command had first ordered U-2s in 1955 and overflights of Cuba undertaken by the high-flying jet had proven crucial during the 1962 missile crisis.

Just like the CIA's A-12 was a follow-on to its U-2 programme, the SR-71 was the air force's follow-on programme to the U-2. Code-named Senior Crown, the air force ordered six in December 1962, a follow-up order in 1963 increased the total to 31, plus two two-seat trainer versions.

Kelly Johnson's SR-71 design was similar to the A-12 but used improved technologies. Maximum speed and altitude were less than that of the A-12, reflecting that its design incorporated two seats (one for the pilot and one for the reconnaissance systems operator), additional sensors including SIGINT and side looking airborne radar, an expanded communications suite and enhanced self-defence

electronic countermeasures. The SR-71's cameras – infrared and conventional – were more compact than those in the A-12. The first production-standard SR-71 arrived at Beale Air Force Base in January 1966 for assignment to the air force's 9th Strategic Reconnaissance Wing. The SR-71 took over from the A-12 in 1966, using the same tankers, fuel, and facilities at Beale and Kadena. It even adopted Habu, a viper native to Okinawa, as its nickname, that had previously supported the CIA programme.

By this time, the Department of Defense had three YF-12A aircraft and the programme was revealed by President Johnson on July 25, 1964, during his presidential election campaign. But development funding was cut back and the YF-12 programme was finally cancelled in 1968, with each of the three aircraft going to the National Aeronautics and Space Administration for research flying.

## Flying the SR-71

The SR-71 required aircrew to wear hard-helmet flight suits similar to those of Gemini programme astronauts. Before flights, SR-71 crews had to breathe pure oxygen and undergo pre-flight physical examinations. SR-71 take-offs had the drama of a rocket launch: the Pratt & Whitney J58 engines' tremendous acceleration left a trail of fiery shock diamonds in the engine exhaust and sonic booms behind.

Describing flight immediately after take-off, SR-71 pilot Captain Richard McCrary said: "You start to climb up through Mach 1, and it's a big punch with a lot of air resistance. What we'd typically do is climb up, put the nose down just before Mach 1, and then lift back up and punch through it all the way to Mach 3."

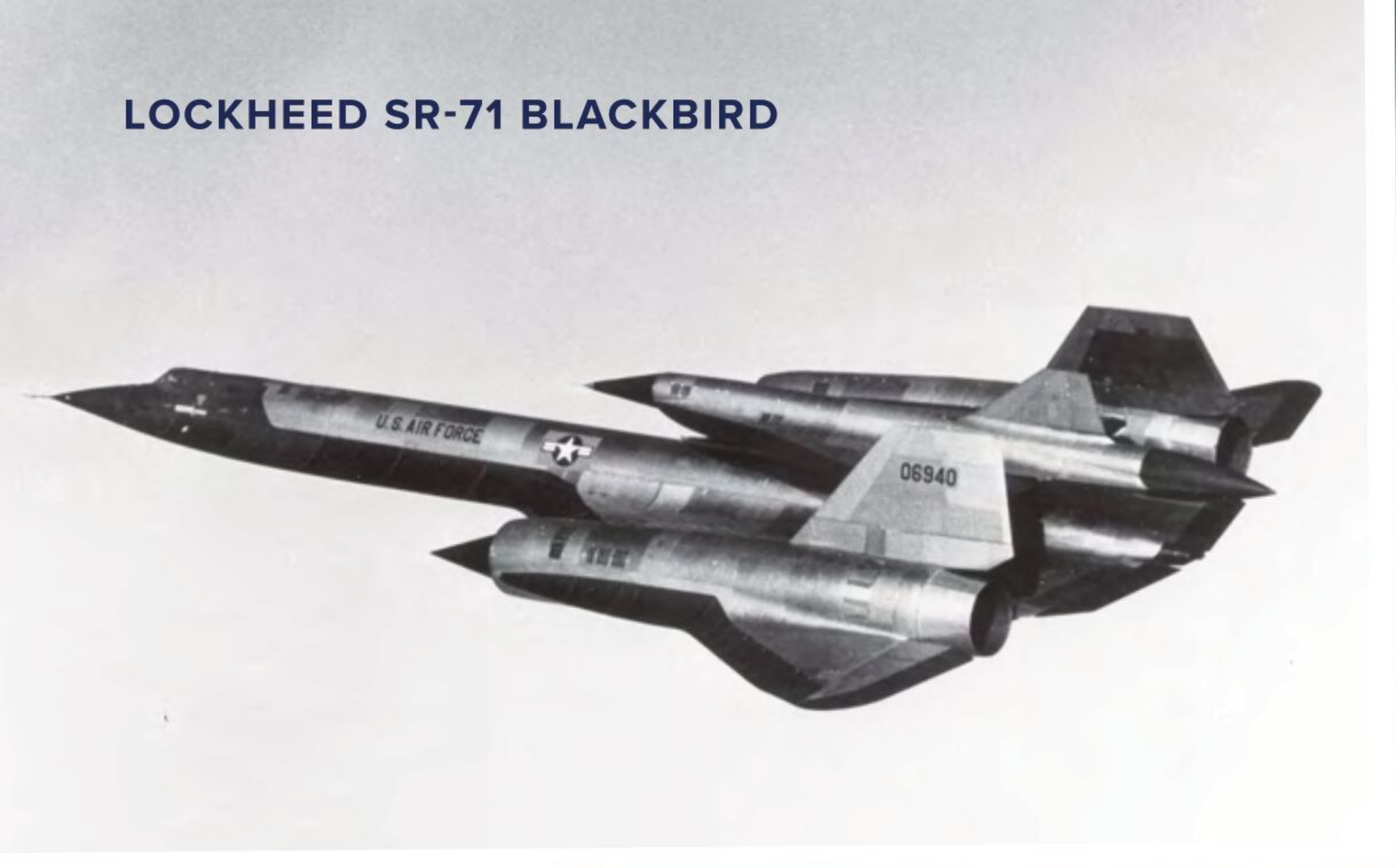
SR-71s were typically aerial refuelled immediately after take-off, followed by repeated refuelling, often every 90 minutes. Three refuellings was standard, and a long-range mission could easily require six or eight. On

RIGHT: **SR-71A 64-17964** taxiing to RAF Mildenhall's runway 11 for a mission in November 1981. The KC-135Q Stratotanker in the background is one of about ten that would have been deployed on TDY to Mildenhall at the time. The 9th Strategic Reconnaissance Wing based at Beale Air Force Base, California, operated one squadron of KC-135Qs which were modified to carry JP-7 aviation fuel and dedicated to the SR-71 aerial refuelling mission.  
Bob Archer





## LOCKHEED SR-71 BLACKBIRD



an operational mission, every tanker was accompanied by an airborne spare.

McCrary said: "You'd light up the afterburner right after that first refuelling and take it to full power for the next hour. That's pretty amazing because no other plane can fly in full afterburner continuously. All other planes have either a three-minute limit, or five-minute limit on that, but you'd be going at full afterburner for an hour, hour and a half."

Despite the Mach 3-plus afterburner-powered cruise, "At that altitude, you don't have any sensation of speed. The only sensation of speed is looking at your gauges and seeing the miles clicking by," said Colonel Joe Kinego, who commanded the air force's only SR-71 squadron at Beale. Above the clouds and without external references, the only indication of an SR-71's tremendous speed was the airspeed indicator and the external heating. At cruise speed, an SR-71 was nine inches longer than it was on the apron because of heat expansion. An SR-71, on the ground with full tanks,

would always leak fuel, but everything would be sealed up by heat expansion at altitude.

The SR-71 had a narrow flight envelope, with stalling speeds close to its maximum speed. Angle-of-attack had to be maintained to within one or two degrees.

Major B. C. Thomas, a pilot, said: "This made over-controlling very dangerous because the SR-71 was delicate and not very manoeuvrable."

During high-speed high-altitude cruise, an SR-71 had a turn radius of about 100 miles. "In order to fly the SR-71 you had to be on track almost 100% of the time, not off course", said Colonel Richard Graham, SR-71 pilot, and a former squadron commander. "You are

hanging on to this vehicle which is on the edge of being out of control," said Lieutenant Colonel Terry Pappas, an SR-71 pilot. "That's why your adrenaline is pumping the entire time you're flying the aircraft. That's why you're so tired at the end of a three-and-a-half-hour flight."

For all its spacecraft-like performance, the pilot of an SR-71 had to fly it like any 1950s era aircraft, with minimal help from on-board systems. It had a fighter-style control stick and instrumentation. To keep it in trim during its tremendous fuel burn, the pilot was constantly switching tanks and transferring fuel. Former Lockheed test pilot Frank Elliott said: "The SR-71 flew very conventionally, very responsive. The systems were very reliable. We very seldom had any problems at all. But you could never relax."

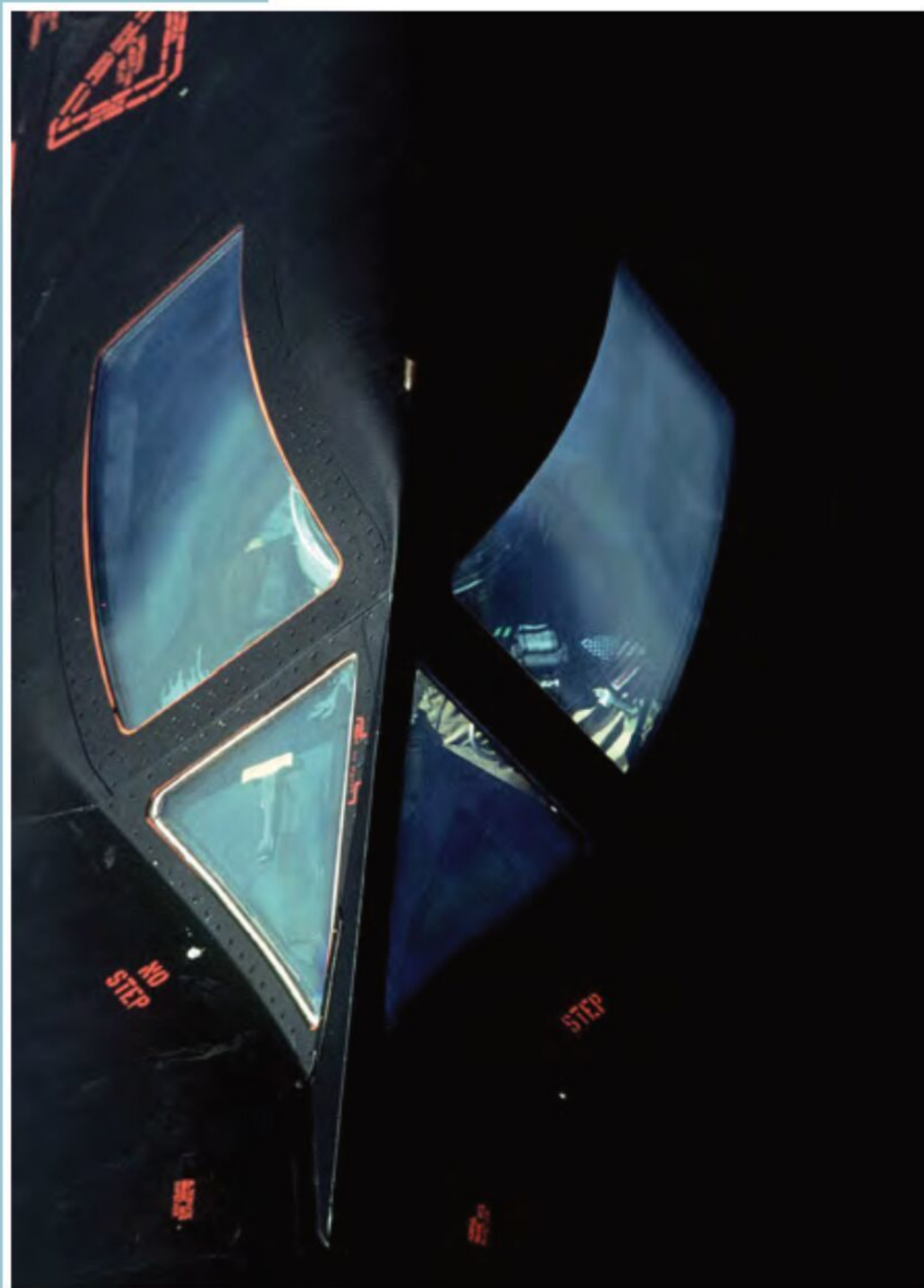
The massive amount of power generated by each J58 engine was made possible by its variable inlet, which reconfigured itself automatically – a major technological innovation – during supersonic cruise to decelerate the air in the engine's intake to subsonic speed. But disruption to the air intake flow – such as might happen if the angle of bank exceeded 45

LEFT: *The D-21 was originally designed to be launched at supersonic speed from the back of an M-21 carrier aircraft, a modified A-12. Two M-21s were produced, Articles 134 and 135, serial numbers 60-6940 (shown) and 60-6941.*  
US Air Force



BELOW: *US Air Force/TSgt Michael Haggerty*





ABOVE: *This image shows the pilot inside the SR-71's small cockpit.*  
US Air Force/TSgt Michael Haggerty

ABOVE RIGHT: *An airman assists an SR-71 Blackbird pilot undergoing training in an altitude chamber as another technician mans the control panel.*  
US Air Force/SSgt Bill Thompson



degrees – would result in a sudden, violent loss of thrust, called an unstart. These emergencies happened infrequently but could push the SR-71 out of its narrow envelope of stability, sometimes with disastrous results.

Landing speed was high and required a nose-high final approach. Landing visibility from the cockpit was limited by the long nose and required using a small window. Fuselage chines blocked the downward view. SR-71 pilots did not fly often. “Throughout the seven years I was in the SR-71 programme I only accumulated 738 flight hours, but that was more than a lot of people,” said Bevacqua. “You’d be lucky if you got two flights a month on the SR-71, maybe three or four when you’re doing the real stuff out in Kadena.” McCrary agreed, “You didn’t fly the SR often, because of the expense. Almost every flight was operational, which was unusual.”

## Crises, Conflicts and Overflights

The SR-71 was the National Command Authority’s directed telescope, able to produce focused intelligence enabling high-level decision-making and diplomacy as well as functioning as an unmistakable indication of US concern and engagement. Nothing said ‘we’re watching’ quite like the sonic boom of an SR-71.

After SR-71s replaced A-12s at Kadena in 1968, they started the Giant Scale programme. They photographed the Hanoi-Haiphong area in North Vietnam and collected SIGINT along the People’s Republic of China border.

The SR-71’s camera and radar aerial mapping capability which covered 100,000 square miles in an hour was used to create the Deployable Data Base System, which enabled bombing attacks. SR-71s were tasked with creating sonic booms above the Hanoi Hilton – where US prisoners of war were kept – at a specific time, signals that a planned rescue mission would not take place. In May 1975, SR-71s flew reconnaissance missions during the *Mayaguez* incident, the capture of a US merchant ship by Cambodia’s Khmer Rouge that led to the last battle of America’s involvement in southeast Asia.

In February 1980, SR-71s overflew Kampuchea, where the Vietnamese had been fighting the Khmer Rouge - SR-71 imagery reassured the leaders of Thailand that they were not facing a cross-border threat. And starting in November 1980, SR-71s checked out reports of US prisoners still being held in southeast Asia.

On the third day of the 1973 Yom Kippur War, October 8, Admiral Thomas Moorer, chairman of the Joint Chiefs of Staff requested SR-71 overflights. That day, President Richard Nixon approved the first of the nine SR-71 missions which were flown between October 1973 and April 1974. The missions were flown from Griffiss Air Force Base, New York, and required up to 10 refuellings for each round trip. Secretary of State Henry Kissinger shared SR-71 photographs with Israel and Egypt to negotiate a ceasefire and withdrawal. When both sides saw that the US would know if

anyone cheated, they agreed. The US continued to provide U-2 overflights of the region for years, confidence building measures that contributed to the eventual signing of a peace treaty.

In 1979, President Jimmy Carter approved SR-71 overflights of Cuba. These confirmed that new fighters supplied by the Soviets were export-version Mikoyan MiG-23 Flogger-Es that were not nuclear-capable.

In March 1979, fighting between North Yemen and South Yemen led Saudi Arabia to request the US overfly the conflict with an SR-71. France blocked an SR-71 overflight request, but Spain allowed KC-135Q tankers to fly in to refuel the mission, which was successfully completed after staging through RAF Mildenhall.

In August 1981, an SR-71 on a routine standoff ISR collection mission along the Korean DMZ was fired upon by a North Korean SA-2. The SAM did not come close, but US protests were met by North Korean denials. The SR-71 tracks were moved further south. In October, SR-71s resumed their usual standoff track with F-4G Phantom Wild Weasels positioned close to the DMZ to suppress any SAM site that might threaten an SR-71. The North Koreans never fired on an SR-71 again.

SR-71 overflights of Lebanon took place between April and November 1983 and repeated in July 1984. On April 15-16, 1986, following the US airstrike on Libya intended as retaliation for a terrorist attack in Berlin, Mildenhall-based SR-71s flew three battle damage assessment missions. Both France and Spain





LEFT: **SR-71A 64-17979** sitting on the end-of-runway ramp at Beale during final pre-flight checks before take-off. Of note is the large, full-colour 9th Strategic Reconnaissance Wing badge on the tail fin and the bright white titles. US Air Force/SSgt Bill Thompson

denied overflight permission, putting a strain on the tankers. Another three-sortie effort by SR-71s in August was carried out in response to Libyan claims of deploying Mikoyan MiG-29 Fulcrum fighters.

While the National Command Authority had considered using SR-71s for ISR during the 1979-1980 Iran Hostage crisis, the most sustained campaign in the region started in July 1987 with four long missions over the Gulf, each involving 11+ aerial refuelling brackets supported by as many as 27 KC-135Q tankers. These missions were flown by Det 1 at Kadena in response to the 'tanker war' when both Iraq and Iran were attacking international shipping. The National Command Authority used

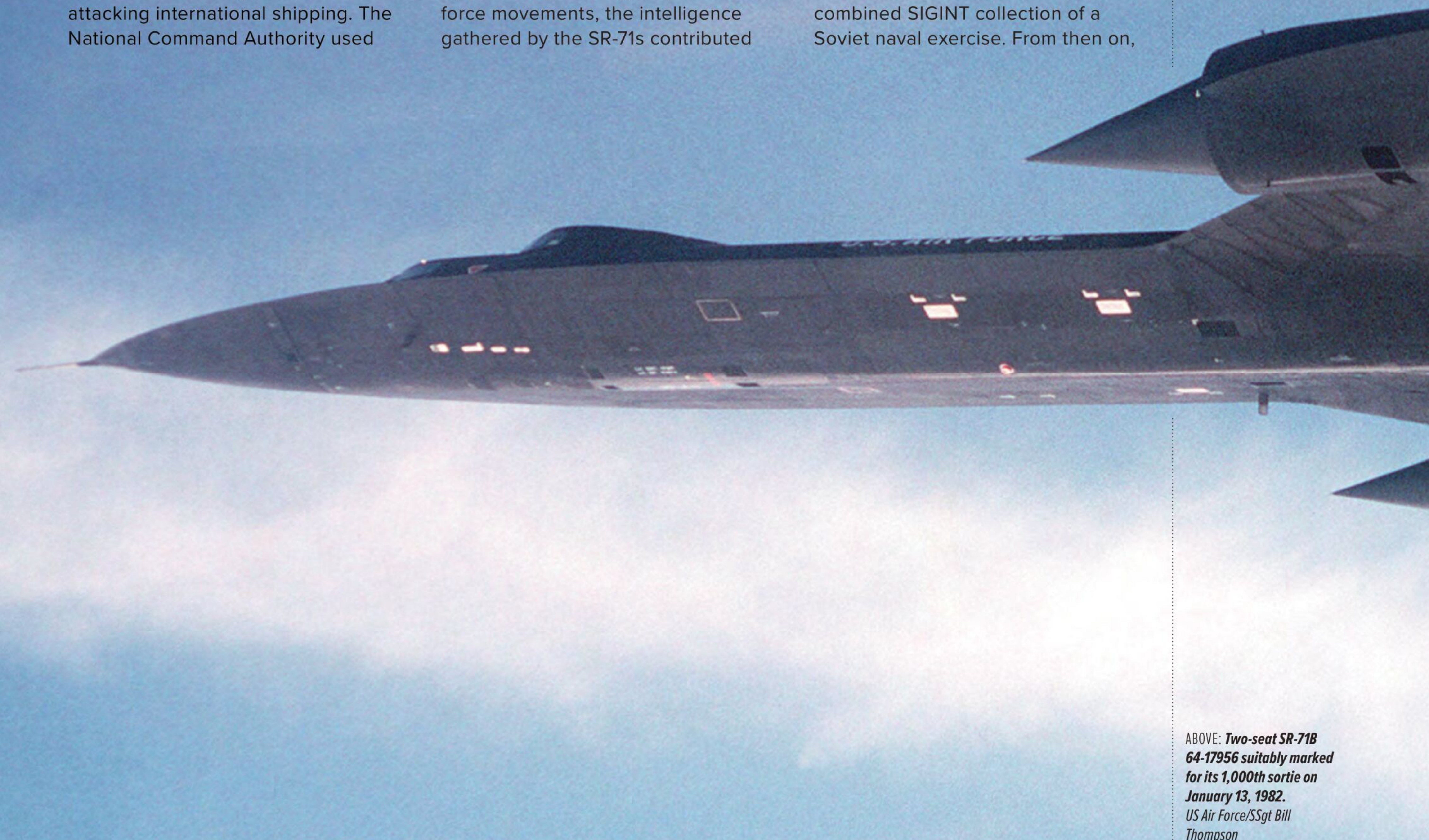
SR-71s to confirm China's delivery of HY-2 Silkworm anti-ship missiles to Iran, intelligence that was used to deploy countermeasures against the threat. Missions were flown in international and friendly airspace until April 1988.

### Around the Peripheries

Most SR-71 operational missions were flown from standoff ranges, designed by the Department of Defense and known as peacetime air reconnaissance operations or PARO, often around the periphery of the Soviet Union, the People's Republic of China, and North Korea. By providing warnings of potential force movements, the intelligence gathered by the SR-71s contributed

to maintaining international stability during the Cold War. Like overflights, standoff missions were often coordinated with RC-135V and RC-135W Rivet Joints and Lockheed EP-3 ARIES aircraft or other ISR platforms. According to SR-71 pilot Major B. C. Thomas, PARO missions: "provided an opportunity to survey our potential enemies and glean information that only we could provide, owing to our reconnaissance capability [sensors], and our stealth, flexibility, speed, and altitude."

Overflight missions of North Vietnam were initially code-named Black Shield and renamed Giant Scale in the latter part of 1968. One such mission combined SIGINT collection of a Soviet naval exercise. From then on,



ABOVE: **Two-seat SR-71B 64-17956** suitably marked for its 1,000th sortie on January 13, 1982. US Air Force/SSgt Bill Thompson



RIGHT: *This image of SR-71A 64-17980 from January 1990 shows the aircraft with a full-colour Det 4 tail badge marking the end of Blackbird operations at RAF Mildenhall which lasted from 1976 to January 1990. Aircraft 64-17967 and 64-17964 departed Mildenhall for Beale Air Force Base on January 18 and January 19, 1990, respectively. Flight times for the last two Atlantic crossings were 5hrs 23m, and 5hrs 21m, respectively.*  
US Air Force/TSgt Michael Haggerty

Kadena-based SR-71s monitored the Soviet military in the Far East. Soviet Air Force Lieutenant Viktor Belenko, encountered SR-71s in international airspace, “scooting up to altitudes the Soviet planes could not reach and circling leisurely above them, or dashing off at speeds the Soviets could not match.” On September 6, 1976 he made world headlines when he defected by flying his MiG-25P Foxbat-A to Hakodate Airport on Japan’s northern prefecture of Hokkaido.

Colonel Richard Graham, SR-71 pilot and a former squadron commander recalled a mission when, “three Russian MiG-25s came to intercept us in the air. However, they could not reach our altitude, and we stayed on course”.

### To The UK

The first SR-71 to land in the UK did so at Farnborough on September 1, 1974. Major James Sullivan, the pilot, and Major Noel Widdifield, the radar systems operator, flew

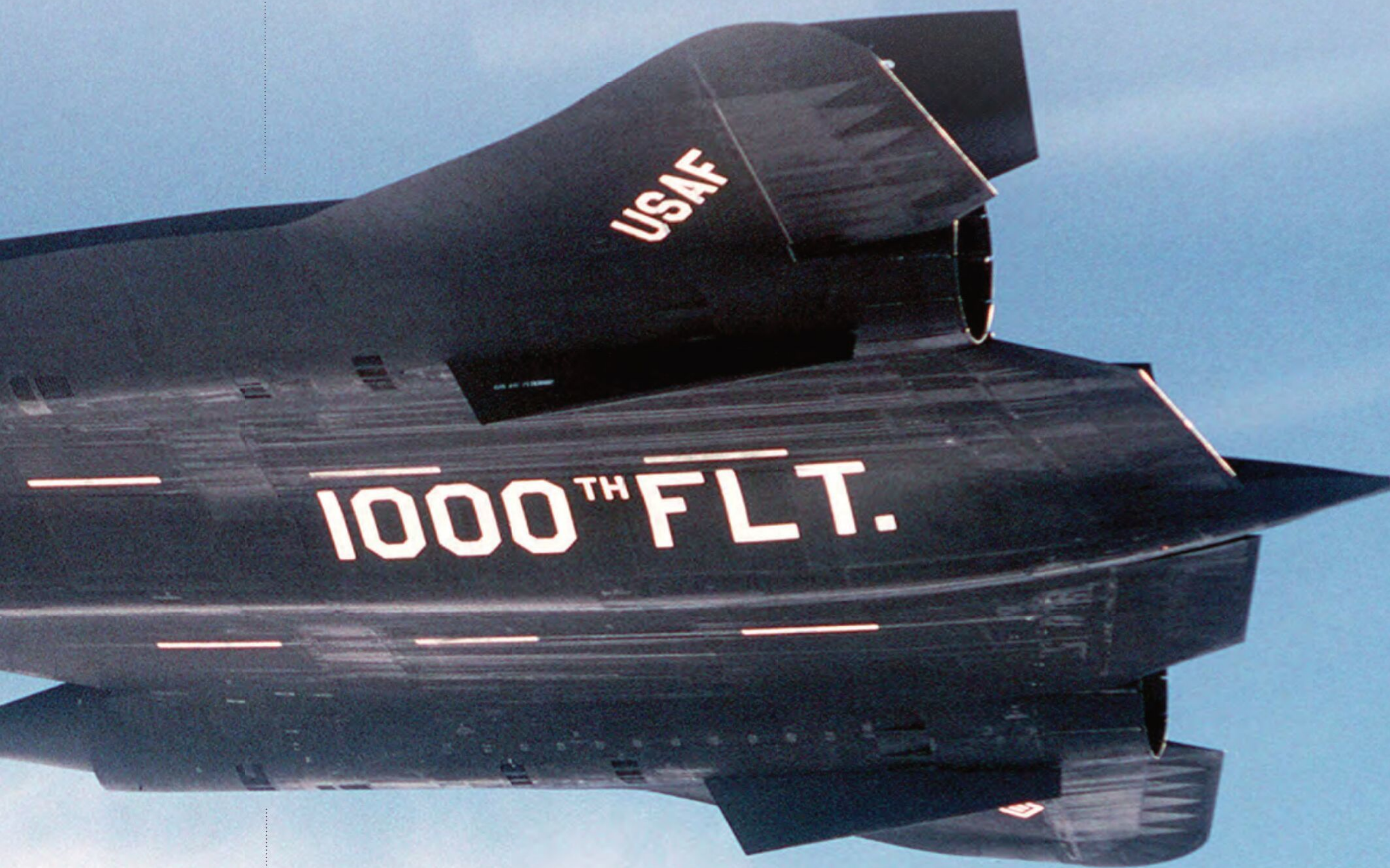


SR-71A 64-17972 from New York to London in 1 hour 54 minutes and 56 seconds. Their extraordinary flight set a transatlantic speed record that still stands to this day. During the flight, Sullivan and Widdifield achieved an average speed of 1,806.96mph.

While its predecessor ISR aircraft had worked closely with the British – despite Prime Minister Anthony Eden

ordering the CIA’s U-2s out of the UK in 1956 – no RAF pilot ever flew an SR-71.

The Soviet military build-up in the 1970s led to an increased demand for intelligence gathered by SR-71s in Europe. Starting in 1977, SR-71s started to use RAF Mildenhall, England as an operating location for temporary deployments. The 9th Strategic







Reconnaissance Wing conducted standoff reconnaissance missions of the Soviet Union's Red Banner Northern Fleet bases from the Suffolk base. SR-71's radar surveillance monitored Soviet submarines, proficient at minimising exposure to reconnaissance satellites, and supplemented other ISR platforms – including NATO submarines – watching exercises. In 1979, the SR-71's presence at Mildenhall became a permanent detachment, like Kadena, with the extensive infrastructure

(especially the photographic processing systems and fuel storage) required to base two SR-71s and their associated tanker support. The Mildenhall operation was designated as the 9th Strategic Reconnaissance Wing's Det 4.

In response to SR-71 operations, Soviet Air Force commanders deployed Mikoyan MiG-31 Foxhound-As and MiG-25PD Foxbat-Es armed with high-performance air-to-air missiles to bases in proximity to known routes flown by the SR-71s

to intercept the Mach 3 beast in international airspace. One experienced Foxhound pilot, Guards Major Mikhail Myagkiy, made 14 intercepts of SR-71s over the course of his career, but only once, on January 31, 1986, did he make visual contact. The SR-71 was streaming contrails at 75,000ft and remained far above the Myagkiy's MiG-25PD.

A few months later, on June 3, 1986, the Soviet Air Force put on a personal air display for the benefit of Major Lionel Boudreaux, flying an SR-71 on a standoff mission in international airspace north of Archangel. While flying at over 70,000ft and streaming contrails, Boudreaux saw six Foxhounds ahead of his position, running across his flight path, directed by Soviet ground control. All six MiG-31s were streaming contrails of their own, making zoom climbs in a line abreast, some 15 miles between each aircraft. The Foxhounds could not reach the SR-71's altitude, but their demonstration of Soviet capability was unmistakable. However, the Soviets did not repeat such a performance on subsequent SR-71 missions.

But the main threat to SR-71s remained in-flight emergencies. On June 29, 1987, over the Baltic, a Mildenhall-based SR-71 flown by Major Duane Noll and Major Tom Veltri suffered an engine explosion. Forced to descend 40,000ft in one minute, first to 25,000 and then to 18,000ft, within reach of Soviet aircraft and at risk of being shot down or forced to land. "We were ... three seconds from our turn point when the right engine exploded while I was counting the seconds down in case the aircraft didn't turn itself, because otherwise we're going to go right over sovereign

LEFT: **Airmen assist Lieutenant Colonel Bob Crowder, from the 9th Strategic Reconnaissance Wing, to put on his high-pressure suit ahead of an aerial refuelling test mission with the then new KC-10A Extender.**  
US Air Force/SSgt Bill Thompson

BELOW LEFT: **Pilots from the 9th Strategic Reconnaissance Wing laid out aboard their transportation vehicle en route to an SR-71.**  
US Air Force/SSgt Bill Thompson

BELOW RIGHT: **A pilot sits in the cockpit of an SR-71 Blackbird prior to flight.**  
US Air Force/SSgt Bill Thompson







ABOVE: US Air Force/TSgt Michael Haggerty

[Soviet] airspace. Then the left engine had to adjust to the loss of the right engine—called an unstart—to ensure the jet remained under control. Without that, the supersonic air comes around the compressors and there would have been insufficient rudder authority to handle the aircraft’s asymmetric tricks and thrust,” said Veltri.

According to Veltri, the engine explosion shut off the aircraft’s generators, caused the cabin to lose pressure, which triggered full inflation of the pilot’s pressure suits, making it hard for them to move in their cockpits and keep the aircraft airborne.

Major Noll declared an emergency and headed toward the Swedish island of Gotland in the hope they could land the jet and Veltri activated its IFF transponder so air traffic control could detect the jet. “This wasn’t standard procedure—it made the jet easily visible to the Soviet Air Force but was probably the best thing I ever did that day,” he said.

Fortunately help was to hand. The Sverige Flygvapnet (Swedish Air Force) – which for years had scrambled its fighter jets when SR-71s appeared – on this occasion provided the crippled aircraft, flying on one engine westbound over the Baltic, with an escort comprising two Saab JA 37 Viggen fighters flown by Major Roger Möller and Major Krister Sjöberg already airborne on a routine training mission. Möller and Sjöberg’s Viggens were running low on fuel so two more Viggens held on quick reaction alert were scrambled as replacement escort jets to the SR-71.

Viggen pilots Colonel Lars-Eric Blad and Lieutenant Bo Ignell then

escorted the Blackbird until it reached Danish airspace, where some F-15 Eagles met and escorted the SR-71 to Naval Air Station Nordholz, where it landed safely.

On November 28, 2018, Colonel Lars-Eric Blad, Major Roger Moller, Major Krister Sjöberg, and Lieutenant Bo Ignell were each presented with an air medal in the company of Noll and Veltri during a ceremony at the United States Embassy in Stockholm. Air medals are awarded based on an act of heroism or meritorious achievement during a flight.

## Shutdown

As the Cold War approached its end, the US Air Force decided to retire the SR-71. There was still much life left in the airframes, but they lacked the datalinks and digital sensors that were increasingly being used for ISR. New-generation reconnaissance satellites offered increased performance. There were already reports of new-technology high-altitude ISR aircraft, manned and unmanned, operating in the black world, that had the potential to replace SR-71 aircraft.

At a time of declining budgets: \$200-300 million per year, the SR-71 fleet was expensive. Its JP-7 fuel alone cost \$18,000 per flight hour. The air force could operate two fighter wings for what it cost to operate SR-71s, an argument that seemed compelling to the fighter pilots who, then as now, set air force priorities.

On March 7, 1990, the air force sent its last SR-71 from storage at Air Force Plant 42 at Palmdale California to the National Air and Space Museum near Washington, adding four new speed records – that still stand – to the many

the aircraft had previously set.

In response to Congressional concerns, the air force returned some SR-71s into service during the mid-1990s, using NASA’s flight test infrastructure for support, but this only provided a limited capability. While there were proposals to upgrade communications and requests for overflights over the former Yugoslavia, no operational missions were flown after 1989. NASA retired its Blackbirds, modified YF-12s and SR-71s, by 1999.

## Blackbird Legacy

In 24 years of operational service flown by 86 air force pilots, none of the 32 SR-71s were lost to hostile action (though 12 crashed), despite having over 1,000 SAMs fired at them during the course of 3,551 operational missions. Within the world’s largest air arm, SR-71 aircrew constituted a small select group that had much of the cachet of being some of the first astronauts.

With one base and two permanent detachments, SR-71 aircrew did not get to fly from bases all over the world. They saw the world only through the narrow windows of their remarkable aircraft. But the list of high-ranking officers and VIPs that received the opportunity to fly in an SR-71 leaves no doubt that the combination of people and aircraft had the proverbial ‘right stuff’. Perhaps the best summary of the aircraft came from air force test pilot Terry Pappas who said: “The SR-71 is the pinnacle. When you walk up and look at it for the first time, it’s kind of hard to believe they built something like that.”





# Skywarriors and Destroyers

**Mark Ayton** provides a short overview of the US Navy EA-3 Skywarrior and the US Air Force RB-66 Destroyer reconnaissance aircraft

**T**he story of the Douglas A-3 Skywarrior and the subsequent B-66 Destroyer aircraft started just two years after World War Two. According to Naval Air Systems Command, Douglas started designing the type in 1948 after the US Navy commissioned studies to determine whether it was possible to overcome weight problems and build a carrier-based jet-powered strategic bomber.

On September 29, 1949, the navy awarded a development contract to the Douglas Aircraft Company which led to the development and production of the A3D Skywarrior.

Douglas' team was led by Ed Heineman who designed a twin-engine bomber with a high-mounted, sweptback wing with negative dihedral, suitable for aircraft carrier operations capable of delivering specific nuclear weapons at a range in excess of 1,000 miles.

## A3D Skywarrior

Prototype Douglas XA3D-1 Skywarrior BuNo 125412 made its maiden flight from Edwards Air Force Base, California, flown by Douglas test pilot George Jansen, on October 28, 1952.

The first A3D-1s were delivered to Heavy Attack Squadron 1 (VAH-1) 'Tigers' based at Naval Air Station Jacksonville, Florida on March 31,

1956. Sister squadron VAH-2 'Royal Rampants' followed in April as the first Skywarrior unit assigned to the US Pacific Fleet and the first to receive A3D-2s, the most numerous naval variant which eventually equipped 12 of 14 Heavy Attack Squadrons.

Unsurprisingly, as the first squadron to transition to the Skywarrior, VAH-1 was first to deploy. The squadron embarked the USS *Forrestal* (CVA 59) as part of Carrier Air Group 1 in January 1957 for a six-month Mediterranean cruise.

According to the November 1991 issue of *Naval Aviation News*, there was always some tension in the Skywarrior's relationship with the aircraft carriers it sailed on. Its fuselage shape and sheer size earned it the appellation 'Whale' and it became a hated nuisance to air bosses, who cursed it as they tried to move planes about crowded flight decks.

Specialised variants followed: the A3D-2Q configured for electronic reconnaissance, the A3D-2P for photo reconnaissance, and the A3D-2T trainer.

The A3D-2Qs equipped Electronic Countermeasures Squadron 1 (VQ-1) based at Iwakuni, Japan and VQ-2 based at Naval Station Rota, Spain.

In September 1962, the A3D-1 and A3D-2 aircraft were redesignated the A-3A and A-3B respectively under the new tri-service designation system.

After the US Navy gave up the strategic bombing role, most of the A-3B bomber-equipped Heavy Bomb Squadrons were disestablished and their aircraft either retired or converted

for a specialised role: 85 as KA-3B aerial refuelling tankers and eventually 39 EKA-3B electronic attack aircraft, 34 of which were former KA-3B tankers.

Specialised A-3s continued to support carrier air wings by embarking small detachments of Skywarrior aircraft with them. As the war in Vietnam rumbled on, the navy continued to embark different variants with a carrier air wing. For example, Carrier Air Wing 9 based at Naval Air Station Lemoore, California made repeat deployments in support of the war, each one with different variants of the Skywarrior embarked. CVW-9 embarked A-3B bombers in 1965, electronic reconnaissance EA-3Bs in 1965-1966, KA-3B tankers 1966-1967, KA-3B tankers and electronic attack EKA-3Bs in 1968 and 1969, electronic reconnaissance EA-3Bs, KA-3B tankers and electronic attack EKA-3Bs in 1970, and EKA-3Bs in 1971.

Throughout the Vietnam War, EA-3Bs flown by VQ-1 and VQ-2 provided electronic intelligence to the US Seventh Fleet and high-level commanders.

## VQ-1 'World Watchers'

Electronic Countermeasures Squadron 1 (VQ-1) was commissioned on June 1, 1955 at Marine Corps Air Facility Iwakuni, Japan and received its first A3D-1Qs in November 1956. When the unit moved to Naval Air Facility Atsugi, Japan in July 1960 the unit was re-named Fleet Air Reconnaissance Squadron 1 (VQ-1).

BELOW: An EA-3B assigned to Fleet Air Reconnaissance Squadron 1 (VQ-1) 'World Watchers' on final approach to Naval Air Facility Atsugi, Japan in 1970. This image shows the canoe-style radome installed on the fuselage underside housing antennas for the aircraft's radar and electronic sensors.  
US Navy







ABOVE: **RB-66B Destroyer 53-0418** assigned to the **363rd Tactical Reconnaissance Wing** at **Ta Son Nhut Air Base, South Vietnam** in 1965. *US Air Force*

Four years later, VQ-1 first deployed EA-3Bs either to aircraft carriers assigned to Combined Task Force 77 or Da Nang Air Base, South Vietnam. They were tasked with the Tactical Airborne Signal Exploitation System role in support of combat operations in Southeast Asia.

In June 1971, VQ-1 moved to Naval Air Station Agana, Guam, and inherited photo reconnaissance-configured RA-3Bs from the previously resident and defunct Heavy Photographic Squadron 61 (VAP-61), for a three-year stint.

Throughout the remaining years of the Cold war, VQ-1 continued to fly electronic reconnaissance missions in support of 7th Fleet operations, and frequently deployed detachments aboard aircraft carriers.

## VQ-2 'Batman'

Electronic Countermeasures Squadron 2 (VQ-2) was established to serve the US Atlantic and 6th Fleets based at Naval Air Station Port Lyautey in Morocco. The first A3D-1Qs Skywarriors were received in 1956 less than two years before its move to Naval Station Rota, Spain in November 1958.

Renamed Fleet Air Reconnaissance Squadron 2 (VQ-2) on January 1, 1960, the unit deployed to Naval Air Station Key West, Florida in the autumn of 1962 to provide SIGINT reconnaissance capability of Soviet and Cuban weapon systems during the Cuban missile crisis. In 1965, VQ-2 deployed a detachment to Da Nang Air Base, South Vietnam; a tour that lasted four years. This was also the year that VQ-2 started to regularly deploy detachments embarked on board aircraft carriers operating in the Atlantic, the Mediterranean and the Indian Ocean. The Rota-based unit was perfectly located to support Operation El Dorado Canyon against Libya in April 1986.

The EA-3B was withdrawn from service on board aircraft carriers in October 1987 and retired from VQ-1 in December. All aircraft were transferred to VQ-2 which operated them until their retirement on September 20, 1991, including participation in Operation Desert Shield, Operation Desert Storm.

The last of 283 Douglas Skywarriors was delivered to the US Navy in January 1961 to fill the slots of the 18th squadron then operating the type. At 70,000lb, the Skywarrior was the largest and heaviest aircraft ever to operate from an aircraft carrier.

## RB-66 Destroyer

In 1952, the US Air Force ordered an initial batch of strategic bomber aircraft based on the US Navy's A3D-1 and did so in advance of its maiden flight.

Unsurprisingly, Air Force requirements were different to the those of the navy. They needed fast aircraft, offering all-weather capability at low-level, and at high altitude, and the ability to fly from austere or short runways. Lastly, the Air Force required two variants: one devoted to strategic bombing and one to reconnaissance, both packed with electronic countermeasure systems to counter enemy radars.

Unlike the AD3 design led by Heineman, starting in early 1952, the design effort for the B-66 was led by John Buckwalter at the Long Beach, California facility.

Navy-specific features were removed: folding wings, arrestor gear, and catapult harnesses. Ejector seats were incorporated to meet aircrew survivability requirements and they required a revised cockpit canopy that accommodated escape hatches - vital for operating at low altitude and fairly high speeds.

The RB-66's flight deck configuration was different to that of the AD3 with the pilot sat at the front, and the navigator and reconnaissance system operator immediately aft.

Several aspects of the airframe's configuration were changed: airframe strengthening, revised wing planform, new ailerons, flaps, emergency air brakes, and wing spoilers.

Systems fitted were a 45-inch APS-27 radar antenna, a K-5 navigation radar, a remotely-controlled tail turret with two 20mm cannons, four cameras mounted in the centre fuselage bay, and provision for aerial refuelling equipment.

The first of five pre-production RB-66A aircraft powered by two Allison J71-A-9 engines (9,570lb) made its maiden flight from Long Beach on June 28, 1954.

Production standard aircraft were designated as RB-66Bs, the first of which made the variant's maiden flight in March 1955, with the first of 145 delivered to the Air Force Flight Test Center at Edwards on February 1, 1956. All were powered by Allison J71-A-11 turbojet engines (10,200lbf) but for the last 17 which had more advanced J71-A-13s, the engine subsequently retrofitted to the other 128 aircraft.

The final RB-66C was a specialised electronic reconnaissance variant, 36 of which were built by Douglas at its Tulsa, Oklahoma plant. Most were initially powered by J71-A-11 engines, later retrofitted with J71-A-13s.

Given the nature of its role, an RB-66C had a crew of seven: pilot, navigator, gunner, and four electronic warfare officers who operated within a pressurised compartment carried within the space originally intended for the bomb bay.

ELINT equipment was housed in wingtip pods with additional systems housed in an extended tail cone installed on the later examples.

The first RB-66C made its maiden flight from Tulsa on October 29, 1955. The first RB-66Cs were delivered to the 363rd Tactical Reconnaissance Wing at Shaw Air Force Base, South Carolina in February 1956.

The Cuban missile crisis in 1962 was the first crisis to which RB-66Cs were tasked to conduct ELINT missions to snoop on Soviet and Cuban weapon systems.

On October 1, 1965, the first RB-66Cs (later designated EB-66Es) assigned to the 41st Tactical Electronic Warfare Squadron were deployed from Shaw Air Force Base, South Carolina to Royal Thai Air Base Takhli, Thailand. In January 1966, more RB-66Cs assigned to the 42nd Tactical Electronic Warfare Squadron arrived at Takhli, Thailand.

The ELINT-capable jets were tasked to locate and identify North Vietnamese radar sites being used to target surface-to-air missiles and anti-aircraft artillery aimed at American aircraft. Most of the 36 RB-66s were eventually deployed to Takhli from where they conducted a significant proportion of America's snooping activities on North Vietnamese forces.

RIGHT: **An EA-3B** assigned to **Fleet Air Reconnaissance Squadron 1 (VQ-1)** seen over the **South China Sea** in 1974. The aircraft is shown with markings for **USS Constellation, VQ-1 Det-54** and **Carrier Air Wing 9**. *US Navy*





# Swedish Snoopy

The Svenska Flygvapnet operated two Sud Aviation SE 210 Caravelle airliners reconfigured for the SIGINT role. **Mark Ayton** charts their service and operation

**B**arkaby is an unassuming suburb just to the north of Stockholm. Until June 30, 1974, it was home to the F 8 Svea Air Corps equipped with Rb68 Bloodhound missiles and two Sud Aviation SE 210 Caravelle III airliners. The two French-built aircraft did not offer intercontinental air service to locations around the world, but a signals intelligence gathering capability for the Försvarets Radio Anstalt (FRA or National Defence Radio Establishment). Designated TP85s, the aircraft were

operated and maintained by the Svenska Flygvapnet (FV or Swedish Air Force). The aircraft (SE-DAG c/n 172 and SE-DAI c/n 210) were purchased from Scandinavian Airlines System (SAS) by the Försvarets Materiel Verk (FMV or Defence Materiel Administration) in April and September 1971, respectively. Only three Caravelle aircraft in the SAS fleet had undergone modernisation featuring new cockpits. The three modernised aircraft were selected by SAS because they had the lowest flight times in the airline's 21-aircraft Caravelle fleet. Two were the aircraft purchased by the FMV at a cost of SEK 8.8 million in a deal that included pilot

training, heavy maintenance, spares, and programme support provided by SAS.

## Aircraft Conversion

The Caravelle aircraft met three essential FRA and FV operating criteria: an aircraft sufficiently large enough to accommodate more operators and the required SIGINT mission systems; an aircraft powered by jet engines that could fly faster, higher and for longer than its predecessors; and an aircraft with a size and weight footprint suitable for Sweden's military air bases of the time. Additionally, the aircraft's stern-mounted engine configuration (as

BELOW: **Fv85172** was moved to the Flygvapenmuseum's site at Malmén on February 17, 2012.  
Flygvapenmuseum





RIGHT: **TP85 Fv85172** captured on take-off during landing gear retraction. This photo clearly shows the cylindrical microwave antenna housing at the aft fuselage underside, various antennas mounted on the centreline of the fuselage top and bottom, and the canoe-style radome under the forward fuselage. Svenska Flygvapnet



opposed to engines hung on underwing pylons) avoided masking of fuselage underside antennas and the resultant bearing limitation within certain sectors around the aircraft. Furthermore, the original airliner design enabled a straightforward temporary configuration for the air transportation of Sweden's leaders.

The two TP85s were given the military serial numbers Fv85172 and Fv85210 based on their designation and construction numbers. Once in service, the aircraft were assigned to the F 8 Barkaby's 6th Transportgruppen and for a few months were tasked with air transportation missions.

Subsequently, each aircraft underwent conversion to a SIGINT configuration under a 1971 contract with AB Svenska Flygverkstäderna (Swedish Aviation Workshops) at Malmö-Bulltofta airport.

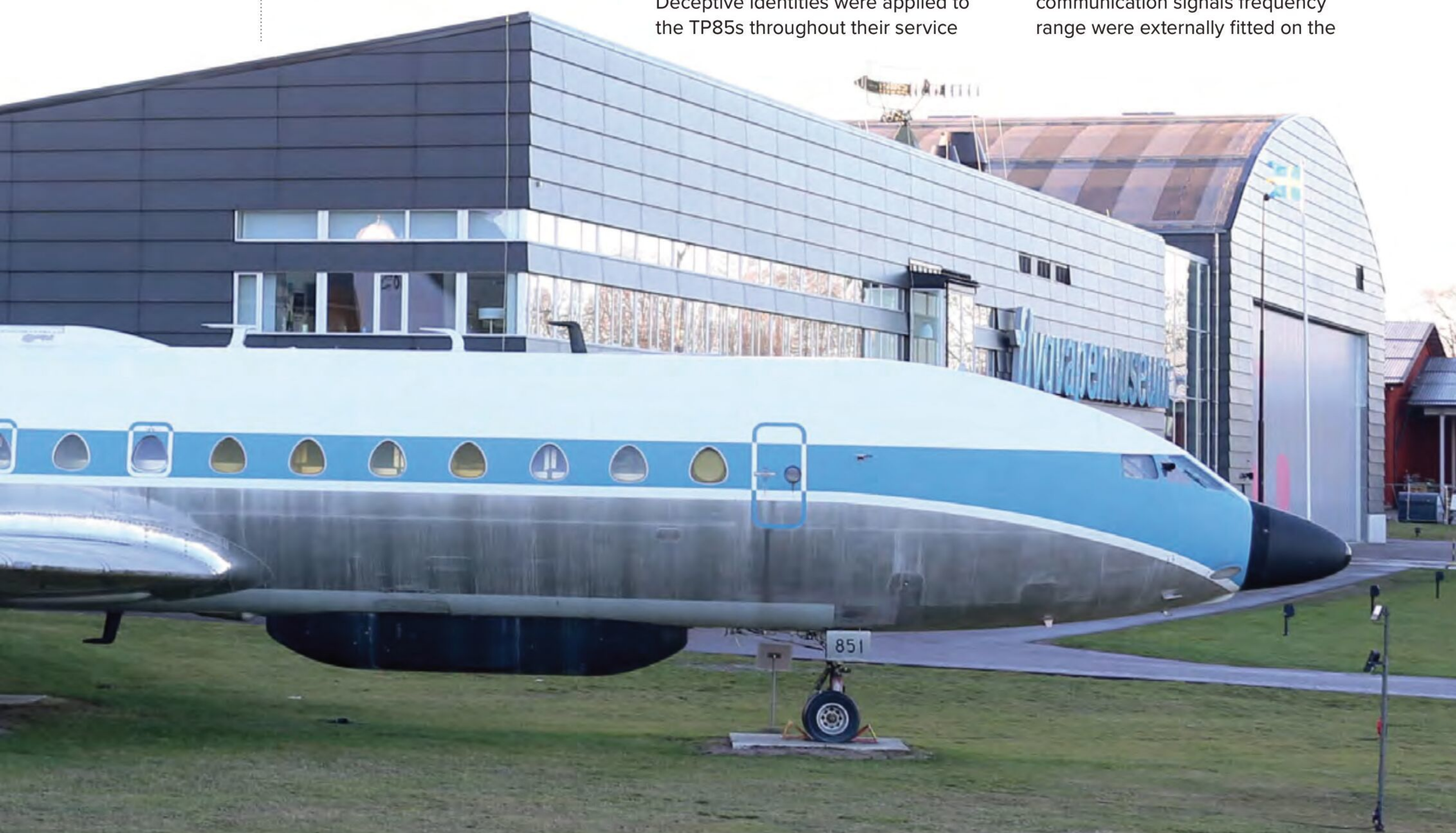
Each aircraft received over 35,000-man hours of work which included installation of an extra generator to each of the two Rolls-Royce Avon RA29 engines to generate sufficient power for the new mission systems, 18 FRA-designed racks specifically designed to hold its SIGINT systems, and painting in a commercial airline style scheme, designed to deceive potential adversaries with a confusing appearance of a military aircraft. Deceptive identities were applied to the TP85s throughout their service

lives. All of the identities used featured components of their military serial numbers, for example, Fv85172 wore codes 17, 81 and 851.

Most of the SIGINT systems were developed, manufactured, and installed by FRA personnel; developed at Lovön near Umea and installed at Malmen.

Paint was one thing, but new hardware integrated for the SIGINT mission was more prominent including a new nose radome modelled on the J 32 Lansen fighter, antennas, and a large canoe-style radome fitted on the fuselage underside housing antennas for the technical SIGINT (TES) system.

Fin-shaped antennas covering the communication signals frequency range were externally fitted on the





fuselage underside and spiral antennas covering the frequency range between microwave and ultra-shortwave were mounted in the forward cabin windows.

A cylindrical-shaped radome housed antennas covering the microwave bandwidth and was fitted on the underside of the aft fuselage. However, this device was not installed on the TP85s until the early 1980s.

One interesting story from 1972 when the aircraft were under conversion in one of the Svenska Flygverkstädernas hangars at Bulltofta was an unexpected disclosure of the TP85. The Malmö-Bulltofta airport was due to close on November 30, 1972. A date well in advance of the TP85 conversion programme being completed. To enable TP85 85210 to leave the facility after November 30 required a permit to be issued by the Malmö city council. During the permit application process, associated documentation about the TP85 at Bulltofta airport and its required departure revealed their existence to the public and the press. The story made the news all over Sweden and beyond.

### Försvarets Radio Anstalt

The FRA was and remains the Swedish government's agency within its Ministry of Defence tasked with the collection of signals intelligence (SIGINT) and to support all authorities and state-owned companies with cyber security. The FRA uses the information it gathers about foreign military ships and aircraft in its geographical area to develop protection and countermeasures for Swedish military aircraft and ships.

In the case of the now retired TP85s, secrecy lay in the intelligence products created by its FRA crew which support the Swedish government's foreign, security and defence policy, and forewarn its armed forces of any attack against the nation.

SIGINT data and information collected during each mission was handled by the FRA's signals processing section which undertook analysis of the intercepted transmissions, communications, codes,



and documentation created by the operators. Post analysis, another section dedicated to compiling the material collected, prepared the necessary reports for the government, security services and the Ministry of Defence, including descriptions, locations, and photos of the most important targets for FV strike aircraft to attack. The target list was rich with those in Soviet territory around the Baltic Sea, but in the event of Soviet occupation, others in Denmark and Finland, and strategic locations in Sweden.

### Flygvapnet Service

Post conversion, 85172 was delivered to F 8 Barkaby in September, followed in late 1972 by 85210. Each aircraft was subsequently delivered to F 3 Malmen for mission system integration and installation by FRA personnel. All work was undertaken in the then new Hangar 85 with support provided by FV technicians assigned to F 3. Fully configured for the SIGINT role, both aircraft remained at F 3 Malmen where they were assigned to the resident Signalspaningsenhet (Signal Reconnaissance Unit) where they replaced the unit's TP52 Canberras. The first TP85 SIGINT mission flown by a TP85 took place from Malmen on March 28, 1974.

On June 30, 1974, F 3 was stood down and F 8 Barkaby was closed. The 6th Transportgruppen, the Signalspaningsenhet, one TP52 Canberra, its TP79 Dakotas (retired in 1984) and its TP82 Varsities (retired in 1977) were transferred to the detachment of F 13 based at Malmen and dubbed F 13M. Each type of SIGINT aircraft was assigned to, and operated by, a Signalspaning Flygenhet (Signal Reconnaissance Flight), one for each type of aircraft. Twenty years later, F 13(M) was transferred to the control of F 16 Uppsala (Upplands Wing), and re-numbered F 16(M).

Despite the classified nature of the intelligence data and information gathered by the TP85s, the aircraft operated from all kinds of civilian and military bases, including the so-called Krigsflygbaser (war bases), located around Sweden as part of the system known as Flygbassystem 90 (Air Base System 90) during exercises.

A standard TP85 SIGINT mission lasted approximately four hours and required a crew of 11: three from the FV, two pilots and a navigator, and eight from the FRA, a battle commander (in charge of signal reconnaissance) and five operators each sat on the left (portside) of the cabin opposite a systems workstation, a sixth operator, and an FRA engineer who had tools

ABOVE: **TP85 Fv85210** captured on camera over the Baltic Sea during its 20-year assignment to F 13(M) at Malmen. Svenska Flygvapnet

BELOW LEFT: **The operator's station nearest the camera has a different configuration of systems likely used for more advanced analysis.** Flygvapenmuseum

BELOW RIGHT: **The third most aft of the six operator's station was used by the battle commander who was in charge of signal reconnaissance.** Flygvapenmuseum





and a workbench at the forward part of the cabin at their disposal for running repairs.

Under FRA classification, SIGINT was divided between Tekniska Elektroniska Signaler (TES or technical electronic signal) and Kommunikation Spaning (KOS or communication reconnaissance).

Four TES operators (Operators A to D) used receivers and analysis systems to identify the type of signal, its source platform, and analysis of the signal to determine a function and its capacity. Operators A, B and D recorded signals, pulses and pulse trains on analogue video cassette recorders and oscilloscopes. Of the four, Operator C used more advanced systems to analyse signals and pulses beyond the recording capability of the onboard tape-recording system, such that a subsequent analysis would be near impossible because of distortion.

One KOS operator (Operator E) was responsible for monitoring telephony, voice communication, telegraphy, and transmissions via data links, satellites, and fibre. Operator E was also a linguist.

Each TP85 was fitted with a secure safe which was used to stow all notes and recordings held on board in the event that the aircraft had to land at an airfield with a lower level of security than Malmen and other military bases. If the jet recovered to such an airfield, the FRA mission crew used a telephone connection located at the parking stand to send encrypted intelligence data gathered on the mission.

Interestingly, TP85 Fv85210's cabin could be re-configured for passenger transportation. This involved the removal of the operator seats and installation of up to 30 seats previously used by SAS, placed in two rows on the cabin's port side. Whoever the passengers were, security onboard remained paramount such that the mission systems were hidden from view by installing heavy metal screens, and later much lighter

curtains.

According to former TP85 pilots, while gathering SIGINT, the aircraft was usually flown at an altitude of 33,000ft at 325kts airspeed during the initial phase of the mission when the fuel payload was greater. As the fuel payload burned down, the aircraft would climb to 41,000ft to provide greater reach of its antenna arrays and sensors.

Missions were flown around Sweden, sometimes over the North Sea, but most regularly over the Baltic Sea to snoop on Soviet and subsequently Russian systems. A TP85 was regularly deployed to another base in Sweden to operate autonomously from its base at Malmen to practice wartime scenarios.

The TP85s were regularly intercepted by fighter aircraft operated by all of Sweden's neighbouring nations (Finnish Hawks and MiG-21s and Danish F-16s) and, when flying over the Baltic Sea, those operated by both the Soviet and subsequently Russian Air Forces (including MiG-23s, Su-15s and Su-27s). Of note, Soviet and subsequently Russian Air Force pilots flew their MiG and Sukhoi fighters very close to the Caravelle, just like their modern-day counterparts do alongside NATO and allied aircraft over the Baltic and Black Seas.

Interestingly, despite being friendly neighbours, Finnish Air Force Saab J 35 Draken fighters shadowed the TP85 along the Finnish-Swedish border at low-level.

## Maintenance, Readiness, Retirement

Aircraft maintenance was undertaken in Hangar 85 at Malmen, notably the 100-hour check, while five-yearly heavy maintenance was done by French company Sogerma at Bordeaux-Mérignac. This arrangement was put into place once SAS was no longer able to support the requirement. All mission systems were removed prior flying the aircraft to Bordeaux-Mérignac,

a lengthy process which had to be reversed upon arrival back at Malmen after the maintenance had been carried out.

Each period of heavy maintenance with Sogerma started in October which required careful planning for the other aircraft to ensure its availability throughout.

Throughout the 1970s and 1980s, the Signalspaningsenhet's fleet of SIGINT aircraft was maintained at a high state of readiness. One aircraft was held at one hour during normal operational hours. During periods of extensive Soviet military activity in the Baltic region, the FV required two SIGINT aircraft to be airborne concurrently, all to snoop on Soviet weapon systems.

Despite its age and the challenges with a lack of spares faced by the maintenance department, daily availability remained high until the two aircraft were retired in late 1998. Fv85172 flew its final mission on September 30, 1998 and on November 19, Fv85210 flew the type's final Air Force mission. But it remained in reserve status until the end of the year. Both jets were then decommissioned.

Fv85172 was transferred to the Flygvapenmuseum (Swedish Air Force Museum) but remained at the adjoining Malmen Air Base until February 17, 2012 when it was finally moved to the museum's site.

Fv85210 was flown to Stockholm-Arlanda Airport on January 28, 1999 completing the final European flight of an SE 210 Caravelle before its handover to the Le Caravelle Club.

After the end of the Cold war and the Soviet Union, the primary task of Sweden's FRA remains pretty much the same: to gather signals intelligence. Today's S102B Korpen aircraft no longer fly FRA missions to monitor for war preparations by Russia, but instead to conduct signal reconnaissance, which according to its website is "aimed at foreign conditions to support the Swedish government's foreign, security and defence policy."

BELOW: An early photo of TP85 Fv85172 in its original air transportation role before conversion for SIGINT. Note the FC code on the engine nacelle denoting the aircraft's assignment to the Malmen-based Försökscentralen or experimental centre. Svenska Flygvapnet





# Pour Le Président

**Mark Ayton** details the Armée de l'Air's DC-8 SARIGuE and SARIGuE NG strategic SIGINT aircraft

**A**s a nuclear-armed nation and for many other reasons, French governments and intelligence agencies depend upon sovereign-gathered strategic intelligence. Between 1977 and 2004, France relied upon heavily modified Douglas DC-8 narrow-body airliners for gathering strategic SIGINT. The type was an ideal aircraft that offered sufficient range to

perform relatively long flights without aerial refuelling.

Operated as the *Système Aéroporté de Recueil des Informations de Guerre Electronique* (Airborne Electronic Warfare Information Collection System) or simply SARIGuE, DC-8-33 F-RAFE (c/n 45570) officially entered Armée de l'Air service on July 15, 1976. It was delivered to Escadron Électronique 00.051 'Aubrac' at Base

Aerienne 217 Brétigny-sur-Orge southwest of Paris and declared operational on June 1, 1977. Just over six months later, on December 12, the squadron moved to Base Aerienne 217 Evreux-Fauville to the west of Paris.

DC-8-33 45570 was rolled-out at Long Beach, California on January 12, 1956 and served with TAI and UTA registered as F-BIUZ. Years later,





BELOW: *Armée de l'Air DC-8 SARIGuE F-RAFE just a few days after its retirement to the Air and Space Museum at Le Bourget on July 25, 2001.*  
Rémi Dallot

the aircraft was purchased by the Armée de l'Air and transferred to the Centre d'Essais en Vol (CEV or Flight Test Centre) registered F-ZARK on December 17, 1973.

An aircraft's true identity is worth hiding when it is tasked with snooping on potential foes from locations around the world and the Armée de l'Air's DC-8-33 F-RAFE was no exception. Using a deceptive tactic, throughout its entire SIGINT service life F-RAFE was operated in an airliner-style livery, a discrete cover to its spying mission.

### SARIGuE Conversion

In 1973, the aircraft entered a major classified modification programme to configure the aircraft for the SIGINT role, which lasted over three years. Modification was undertaken by UTA under great secrecy at Le Bourget north of Paris.

Among its many roles associated to SIGINT, the aircraft's intended applications were wiretapping, interception and classification of electromagnetic spectrum signals from radios, radars, new weapon systems, and photography of targets. Intelligence gathered by the aircraft was used by the French authorities to build and maintain a database of Warsaw Pact and Soviet weapon

systems.

SIGINT is divided into electronic intelligence (ELINT), the geolocation and gathering of radar emissions, and communications intelligence (COMINT), listening to radio communications.

All modifications made to 45570 by UTA had to be validated by the Douglas engineering team based at Long Beach and overseen by several French organisations that included the Centre d'Essais en Vol (Flight Test Centre) and the Direction Générale de l'Armement (Directorate General of Armaments).

Work undertaken included:

- Installation of a 30ft long composite ventral radome under the fuselage housing antennas used for transmissions above 1 GHz.
- Fairings installed on the wing tips believed to house the Thomson-CSF ASTAC electromagnetic intelligence collection system. ASTAC located, classified, and analysed hostile emitters transmissions between 125 and 1,000 MHz, and monitored up to 20 targets of interest concurrently.

- A COMINT suite comprising VHF/UHF radios operating from 20 to 500 MHz
- An ELINT suite capable of intercepting radar emissions between 30 and 125 MHz; and intercepting and geo-locating radars operating between 125 and 18,000 MHz
- A single blade antenna under the nose and a second atop the forward fuselage.
- One vertical and two oblique Omera 36 cameras for horizon-to-horizon coverage from 30,000ft. The cameras were operated by a photographer sat at the aft of the mission cabin on the left.





## "According to French media stories, details of the impending mission was only revealed to the SARIGuE crew just hours before take-off, and sometimes afterwards."

Post conversion, on July 15, 1976, F-RAFE was delivered to the DC-8-equipped Escadron de Transport 2/60 'Esterel' based at Roissy-Charles-de-Gaulle Airport. SARIGUE aircrew were trained on the DC-8 by Escadron de Transport 2/60 before they transferred with F-RAFE to Escadron Électronique 51 'Aubrac' in 1977.

During its service life, the Armée de l'Air contracted UTA Industries at Le Bourget to replace F-RAFE's original JT4A engines with JT3D-3Ds, a modification that re-configured the aircraft to DC-8-53 standard. Its first flight powered by the new engines took place on April 3, 1980.

DC-8-33 F-RAFE was retired to the Air and Space Museum at Le Bourget on July 25, 2001.

### SARIGuE Operations

Flying a mission within the European theatre required a typical crew comprising two pilots, one or two radio-navigators, a flight engineer, and up to 16 specialist mission system

operators including linguists.

According to French media stories, details of the impending mission was only revealed to the SARIGuE crew just hours before take-off, and sometimes afterwards. In the latter scenario, an envelope containing the mission plan was carried on board by the aircraft commander (pilot) and unsealed once in flight.

Many missions were flown near to the borders of potential enemy states. This increased the risk of the DC-8 being targeted by interceptors or surface-to-air missiles and a DC-8 was a large target for shoot down, so the Centre d'Essais en Vol validated an in-flight evacuation procedure. Each member of the crew was issued with a parachute and a survival kit.

During its 24 years of operational service, the SARIGuE operated throughout Europe (the Baltic Sea, Berlin air corridors, and along the borders of Czechoslovakia and the GDR, the Balkans 1992-1997 and during the spring of 1999, in Operation Allied Force), Africa, the Middle East (Al Hasa Air Base, Saudi Arabia 1990-1991) and the Indian Ocean region. During Operation Allied Force, the Armée de l'Air's C-160G Gabriels and DC-8 SARIGuE flew 43 SIGINT missions.

### SARIGuE NG

At the time of its retirement, the original DC-8 SARIGuE was an old jet with parts obsolescence and maintenance challenges. The French government needed a more capable replacement which led to the launch of the SARIGuE NG (Nouvelle Génération) programme in 1993 by the then Minister of Defence, Pierre Joxe.

Project management of the SARIGuE NG programme was undertaken by Thales SA (Thomson-CSF at the time) and subcontractor Air France Industries.

In 1995, DC-8-72 F-RAFD, a former ET 3/60 'Esterel' aircraft entered a major modification programme with Thomson-CSF and Air France Industrie (by 1995 UTA Industries was part of Air France).

Renovation and structural modification works were completed at a Clermont-Ferrand facility run by Atelier Industriel de l'Aéronautique (AIA). AIA completely rebuilt and





BELOW: On display in February 2010, DC-8 SARIGuE F-RAFD looking a little weathered after nine years of being exposed to the elements at the Air and Space Museum at Le Bourget. AirTeamImages/Alex Filippopoulos

strengthened the upper and lower outboard wing sections to bear the large wing-tip mounted fairings used to house sensors and antennas.

AIA also installed a 30ft long, 5ft diameter semi-cylindrical ventral radome installed on the forward under fuselage, as per the original SARIGuE. Radome installation required structural reinforcement to be fitted in the shape of a near 40ft long machined sheet.

In total, AIA fitted 10 tons of equipment that included 75 miles of cables, 4,000 connectors, 365ft of microwave coaxial links and nearly 440lb of additional rivets for the structural reinforcements.

Re-configuration of the former passenger cabin involved installation of 16 operator workstations all linked by a new data bus. Sensors were linked to the mission system by the data bus which enabled data to be extracted, correlated, and presented to the operators.

The aircraft was equipped with new computer architecture to support the data bus and the upgraded flight deck which featured a new inertial navigation system, radios, and an on-board intercom system.

The SARIGuE mission systems were individually tested by the various divisions of Thales, and then combined for full system bench functional testing by Thales Systèmes Aéroportés at Elancourt near Paris. A

major programme milestone, before the SARIGuE system was integrated on the aircraft.

After 200,000 hours of work, factory acceptance testing was carried out by the DGA's Centre d'électronique de l'armement (Electronic Armament Centre) based at Bruz near Rennes.

The aircraft was then given the test registration F-ZVMT and flown to Istres for a multi-month flight test campaign with the CEV. Next, the aircraft transferred to the Air France Industries facility at Le Bourget where a joint team, including personnel from Thomson-CSF, spent a further 800,000 hours fitting new Snecma CFM-56-2 engines and just under 10 tons of SIGINT equipment developed by Thales.

Two antenna farms each comprising four blade antennas for the COMINT role were installed atop the forward fuselage. And a second farm of ELINT sensors used for radar monitoring were housed in the ventral radome.

Flight testing of the SARIGuE mission systems comprised two phases, industrial and military acceptance. Each phase was conducted by teams of CEV test personnel from Brétigny-sur-Orge and Base Aérienne 125 Cazaux, integrated with the SARIGuE NG programme team from the Centre d'Expertise Aérienne Militaire (Air Warfare Centre) at Base Aérienne 118 Mont-de-Marsan.

Configured to the new military DC-8-

72 standard, SARIGuE NG F-RAFD (c/n 46043) was officially handed over to the Armée de l'Air in 2000. The jet entered service with EE 01.051 on April 12, 2001 and operated alongside its predecessor for just a few months that year.

The SARIGuE NG's crew comprised two pilots, a mechanical engineer and twenty-four specialist operators including linguists, photo interpreters, and signal analysts to generate products based on COMINT (voice communication), ELINT (radar signals) and IMINT (imagery) gathered by the mission systems.

Unlike its predecessor, F-RAFD served for just three years. Escadron Électronique 00.051 'Aubrac' was disbanded on September 15, 2004, followed by the final flight of F-RAFD to Base Aérienne 279 Châteaudun two days later. An official ceremony marking the withdrawal of the DC-8 from ET 3/60 Esterel and EE 0/51 Aubrac took place at Base Aérienne 110 Creil on November 24, 2004. F-RAFD was dismantled at Châteaudun in 2006.

As for the reasons for the SARIGuE NG's retirement, the then minister of defence, Michèle Alliot-Marie cited high operating costs. French media reports at the time cited that in addition to a 50% cost overrun on an upgrade by the then Thales, the weight of the new upgrade had exceeded safety limits.





# Gabriel

**Mark Ayton** details the Armée de l'Air's Transall C-160G Gabriel tactical SIGINT aircraft

Signal interception and analysis of transmissions by Warsaw Pact military weapon systems operating in the Baltic region, Czechoslovakia, and the German Democratic Republic (GDR) were the main functions of the Armée de l'Air's original Gabriel system.

Its name is the acronym for Groupe Aérien de Brouillage, de Recherche et d'Identification Electronique which awkwardly translates to Aerial Group of Jamming, Research and Electronic Identification.

All kinds of weapon systems were targeted and included different types of radars (aircraft, air defence, surface-to-air missile, surveillance), datalinks, types of aircraft and their inter-plane and air-to-ground radio communications. Conversations were intercepted, collected, translated, and analysed in real-time.

Building and maintaining a potential adversary's electronic order of battle was enabled by the Gabriel's ability to gather frequencies, call signs, procedures and geolocation information from the GDR and Czechoslovakian weapon systems. This was an ongoing process, given the regular Soviet troop

rotations and associated changes of frequencies and call signs, which ensured the EOB remained valid, foiled deceptive transmissions, disseminated false information, and created fake potential targets.

But such signals intelligence also enabled the Gabriel to provide an understanding of Czechoslovakian and GDR tactics, an estimation of the respective levels of aircrew and controller training, and a make-up of the two air forces.

Stories about Cold War-era Gabriel operations state that the squadron flew at least one mission per day with another aircraft held on standby ready to launch within one hour.

Of course, not every weapon system intercepted was always a legacy type, from time-to-time new aircraft, armament or operator were identified opening a requirement to determine all kinds of performance parameters.

Unlike Allied ground-based monitoring stations along the border with Czechoslovakia and the GDR, the Gabriel aircraft like all SIGINT aircraft were able to snoop on much broader areas of territory to capture additional information. This was serious

information that helped the Armée de l'Air develop plans for striking targets inside Warsaw Pact territory. At the most abhorrent level, these plans involved tactical nuclear strikes by dedicated Mirage IV-series bombers assigned to the Forces Aériennes Stratégiques (Strategic Air Forces).

## Transall Gabriel

Toward the end of the Cold War, the N2501 Gabriel platforms operated by EE 01.54 were not only fitted with near obsolete systems, but the aircraft were also near the end of their service lives. By 1987, EE 1/54 had four aircraft remaining. N2501 No.66 undertook the type's final flight in service with both EE 1/54 and Armée de l'Air on October 26, 1989.

In 1984 the Ministère de la Défense launched a programme to procure two aircraft configured for the SIGINT mission. One option considered by the French authorities was acquisition of a pair of American EC-130H aircraft for the role. Though France has procured many American weapon systems through the decades, the EC-130H was not one of them. Instead, Paris went for a home-grown option, perhaps

BELOW: *C-160G Gabriel F216/GS in the type's original three-tone paint scheme during a flight from Base Aérienne 128 Metz-Frescaty assigned to Escadron Électronique 01.054.*  
Armée de l'Air





RIGHT: *Note the antennas located atop and beneath the wing tip pod containing the Thomson-CSF ASTAC electromagnetic intelligence collection system, and the retractable radome containing the Thomson-CSF EPICÉA communications intelligence suite.*  
Armée de l'Air



offering a mechanical terroir, comprising a modification programme involving two C-160NGs re-configured to C-160G Gabriel standard. An announcement was made in March 1986. The contract was awarded to the Société Gironde d'Entretien et de Réparation de Matériel Aéronautique, dubbed SOGERMA.

C-160NGs F216 and F221 underwent the conversion programme and remain in service today as Gabriel aircraft marked as Transall C-160 F216 and F221.

When any baseline aircraft undergoes modification to configure it for a dedicated role its external mould line and appearance can change somewhat, the C-160G is no exception and features:

- A square canoe integrated on the forward fuselage underside housing a retractable radome containing the Thomson-CSF EPICÉA communications intelligence suite that detects and monitors enemy transmissions. The radome extends downward from the belly of the fuselage in flight. The system is able to intercept transmissions within a

500-mile radius of the aircraft when flying at altitudes between 23,000 and 33,000ft.

- Two pods at the wing tips containing the Thomson-CSF ASTAC electromagnetic intelligence collection system, which locates, classifies, and analyses hostile emitters, and monitors up to 20 targets of interest concurrently. Each pod has five blade antennas attached. An initial assessment of data is undertaken on board the C-160G with ASTAC. The information is then downlinked to the Organisation Système d'Intégration du Renseignement et des Informations SIGINT (OSIRIS or Intelligence and SIGINT Information System Integration Organizer) ground station where operators conduct further exploitation. A battlespace picture of the potential adversary's air force is then created by a system designed to integrate SIGINT and other information known as IRIS (Intégration du Renseignement et des

Informations SIGINT or Integration of Intelligence and Information). This was the sequence at least when IRIS was co-located with EE 01/54 at Base Aérienne 128 Metz-Frescaty.

- An array of very-high, ultra-high, and standard high-frequency radio antenna on top of the fuselage atop of the forward fuselage.
- Other antennas on the underside of the forward fuselage underside.
- A sponson fitted to the fuselage on each side aft of the original paratrooper door. The sponson houses a single Omera 51 panoramic camera used for wide-angle visual imagery collection from the all-important safety of a high altitude above most missile engagement zones.
- An aerial refuelling probe to enable long-duration missions.
- To enable secure carriage of the internal SIGINT suite, the original aft cargo ramp is permanently fixed shut.

A C-160 Gabriel flight deck crew comprises a pilot, co-pilot, a radio navigator, and a flight engineer, while the mission crew is made up of a SIGINT team leader, three COMINT operators, three ELINT operators, a systems engineer, and an HF operator.

The first C-160G aircraft arrived at Metz on January 3, 1989. The first mission along the Berlin air corridors was flown on March 21, a tasking that lasted until November when the Berlin Wall fell. The type was declared operational with EEA 00.054 on July 2.

Flying SIGINT missions along the Berlin air corridors was specifically what the C-160G Gabriel was designed for - snooping on the then USSR. Since the fall of the Berlin Wall, the type's tasking has been adapted to meet the needs of the French state in the face of the significant geopolitical upheavals of the past 30 years. Gabriel is an essential

RIGHT: *A SIGINT operator keys in a command using a keypad of the Thomson-CSF ASTAC electromagnetic intelligence collection system.*  
SIRPA Air/Lt Lise Moricet and Sgt Malaury Buis





## TRANSALL C-160G GABRIEL

weapon system within the Armée de l'Air's arsenal and makes the service one of the few in the world to operate such a capable SIGINT system.

### Squadron History

Formed at Lahr Air Base, Germany on January 1, 1964, Escadrille Électronique 00.054 was initially equipped with three Gabriel V-configured Nord 2501 aircraft. The squadron moved to Metz-Frescaty on July 1, 1966, and eventually operated nine Gabriel V and Gabriel VI-configured Nord 2501 aircraft.

On September 1, 2006, Escadron Électronique 01.054 (Electronic Squadron 01.054) became an independent unit and was redesignated Escadron Électronique Aéroporté 01.054 (Airborne Electronic Squadron 01.054).

On January 9, 2009, the unit changed its number plate again, this time to Escadron Électronique Aéroporté 00.054 (Airborne Electronic Squadron 00.054), its current designation.

Subsequent to Metz-Frescaty's closure in 2012, the squadron moved to Base Aérienne 128 Evreux-Fauville during the summer of 2011. At the time of its move, EEA 01.054 was supported by two other units: Groupe des Télécommunications 10.801 (a Telecommunications Group) and Centre de Détection et de Contrôle Mobile 90.540 (a mobile detection and

control centre).

Though the two Gabriel aircraft are operated by the Armée de l'Air, their crews are tasked by and serve the Direction du Renseignement Militaire (DRM or Directorate of Military Intelligence) and the Direction Générale de la Sécurité Extérieure (DGSE or Directorate General of External Security), the two foremost components of the French intelligence community.

The DRM was formed in April 1992 with two headquarters: one for administration in the chief of general staff's Paris office and one for the technical and operations directorate at Base Aérienne 110 Creil to the north of the capital. Intelligence captured by the Gabriel aircraft is processed and analysed by the Centre d'Information sur les Rayonnements Electro Magnétique (Electromagnetic Transmissions Information Centre).

According to French media reports, the Gabriels are sometimes flown by aircrews assigned to the DGSE's special missions unit, Groupe Aérien Mixte 56 'Vaucluse' (Mixed Air Group) based at Evreux-Fauville.

### Combat Operations

In 1992, one Gabriel (and a DC-8 SARIGuE) was deployed to Al Hasa Air Base in Saudi Arabia under Operation

Daguet, the French component of the US-led Operation Desert Shield in 1990 and 1991. According to French media reports, aircrews of the two aircraft liaised with the then Groupement des Contrôles Radioélectriques's (GCR or Electromagnetic Control Group) Djibouti surveillance station, commanded by the Centre d'Exploitation du Renseignement Militaire (Military Intelligence Exploitation Center). Today the former GCR is the Direction Générale de la Sécurité Extérieure (General Directorate of External Security).

A Gabriel returned to Saudi Arabia in the third quarter of 1992 to support enforcement of the Iraq southern no fly zone against Saddam Hussein's regime.

In 1995, the Armée de l'Air used the Gabriels to conduct snoop missions of Yugoslav forces in support of the United Nations mission in Bosnia and Herzegovina.

America's war in Afghanistan ultimately led to Allied nations including France participating in Operation Enduring Freedom. Consequently, the Armée de l'Air entered the fight including use of the Gabriel to intercept al-Qaeda and Taliban mobile phone transmissions. Aircraft were deployed to Dushanbe, Tajikistan in 2001 to support coalition operations in Afghanistan.

The Gabriel was regularly

BELOW: *Various antennas fitted to Gabriel F221 are shown in this nose-on shot captured during a promotional photo shoot near a sunny beach in France.*

*SIRPA Air/Lt Lise Moricet and Sgt Malauray Buis*





RIGHT: *The configuration of the Transall C-160G Gabriel features an array of antennas atop the forward fuselage, an aerial refuelling probe and other antennas fitted to the fuselage underside.*  
Armée de l'Air



deployed in the last decade: Opération Harmattan in 2011 (Libya), Opérations Serval (Mali) and Barkhane (Sahel) since 2013 and Opération Chammal (Iraq and Syria) in late 2014.

Libya 2011: Gabriel aircraft were deployed to a base on a Mediterranean island, most likely Base Aérienne 126 Solenzara, Corsica or Souda Bay, Crete. According to reports in the French media, Gabriels were snooping around Libya as much as six months before the first Armée de l'Air strikes conducted under Opération Harmattan. Throughout the operations conducted before the start of Harmattan's strikes against Gaddafi, the Gabriel crews' primary task was to create a comprehensive order of battle listing all components of the Libyan air defence system, surface-to-air missiles and radars, and their locations around Tripoli

and Benghazi.

Sahel 2013: According to French media reports, while supporting Operation Barkhane in the Sahel region of Africa, Gabriel aircraft provided support to French military convoys which helped protect personnel and vehicles from the threat of IEDs. The mission crew was able to provide warnings of insurgent activity close to the convoy's route based on their interception and real-time translation of insurgent cell phone transmissions.

Operations in southwest Asia continued through the more recent conflict against ISIS in Iraq and Syria. One Gabriel was reportedly deployed to an air base in Jordan from where it flew missions to intercept communications from the ISIS organisation between 2015 and 2018, though French authorities have never acknowledged the deployment. ISIS fighters reportedly nicknamed the

Gabriel aircraft as 'the fat cow'.

Black Sea 2020: Despite its prowess on combat operations in southwest Asia and Africa, the Gabriel also conducts peacetime missions. On one such operation over the Black Sea on December 7, 2020 to snoop on Russian military activity and illegal trafficking, a Gabriel was intercepted by a Russian Air Force Su-30 Flanker. According to the Armée de l'Air, the Russian intercept was conducted "in strict compliance with international rules for the use of airspace." That day proved fruitful for the Russian fighter jock, he also got to intercept a US Air Force KC-135 tanker and its RC-135 Rivet Joint receiver.

Generally, the C-160Gs typically fly ten-plus hour missions.

## Gaby to Falcon

Now in its 32nd year of operation, the C-160G Gabriel is getting old and somewhat obsolete when compared with the complexity of current and future battlespaces. Highly-capable weapon systems in operation are such that new surveillance systems allowing decisions to be made quickly are required.

A replacement is being developed in the shape of three Falcon 8X business jets equipped with the Universal Electronic Warfare Capability (CUGE) mission system. Manufacturer Thales claims that CUGE will allow the simultaneous detection and analysis of radio and radar signals, using its multi-polarisation antennas supported by artificial intelligence. In accordance with the French Military Programming Act for 2019-2025, the three Falcon 8X-based systems will replace the two Transall C-160 Gabriel aircraft from 2025.

BELOW: *C-160G Gabriel F221/GS in the type's current single-tone grey paint scheme. The side codes GS and GT used by Escadron Électronique 01.054 appear to be swapped between aircraft F216 and F221.*  
Armée de l'Air/Jean-Luc Brunet





# Business-based SIGINT

**Mark Ayton** details the Svenska Flygvapnet's Gulfstream IV SP-based S102B Korpen

**P**rior to the final SIGINT mission flown by Swedish Airforce TP85 Caravelle Fv85210 on November 19, 1998, a new type of jet was already in service for them. That jet was the superlative Gulfstream IV SP-based S102B Korpen and it was conducting signal reconnaissance for Försvarets Radio Anstalt (FRA or National Defence Radio Establishment) supporting the Swedish government's foreign, security and defence policy.

The Swedish Airforce, or Svenska Flygvapnet, continues to operate two S102Bs, Fv102002 'Huginn' and Fv102003 'Muninn' each named after a raven owned by the Norse God Odin.

The type entered service with 73 SIGINT Squadron based at Malmén Air Base in the autumn of 1997 and gained full mission capability during 1998. Both aircraft are managed by the Transport and Special Flights Unit, part of F 7 Skaraborg Wing based at Såtenäs Air Base.

Operated with a crew of six comprising a pilot, co-pilot and four system operators, S102Bs are equipped for intercepting and recording both communication and electronic signals, COMINT and ELINT respectively, reportedly using an American SIGINT system built by Northrop Grumman called the Wideband Tactical Surveillance System. The aircraft reportedly gathers COMINT information from transmissions in the 2MHz to 20GHz frequency range.

In comparison to its TP85 predecessor, and other western SIGINT aircraft such as the RC-135 Rivet Joint and the C-160G Gabriel, the S102B offers good endurance, higher airspeed (over 485 knots) and altitude performance, which enables the aircraft to reach its tasked surveillance area faster, and when on station provide greater mission flexibility for intercepting technical signals transmitted by radars, navigation equipment and weapon systems. A level of performance despite an additional three tons of mission system payload compared to a baseline Gulfstream IV SP business jet.

Despite its Gulfstream IV SP business jet roots, the S102B is highly-modified. The SIGINT configuration features a large fairing fitted on either side of the forward fuselage, a canoe-style radome on the forward fuselage underside and a small blister on the nose. All three types of assembly house antennas or sensors. Like all SIGINT aircraft, the S102B features an array of blade and hook antennas installed on the lower surfaces of the centre and aft fuselage, and wings.

The Korpen system includes high bandwidth, 2Mb/sec data links used to downlink large volumes of data directly to the FRA's operations centres and Svenska Marinen (Royal Swedish Navy) ships and vessels.

What's notable about Sweden's changing defence posture is its government's willingness to participate

in international military operations in a non-kinetic way. In the spring of 2018 and 2019, an S102B deployed to RAF Akrotiri, Cyprus in support of efforts by the western alliance to defeat ISIS in Syria. When operating from Malmén the two aircraft predominantly operate over the Baltic Sea gathering COMINT and ELINT of Russian weapon systems operating from/to and in Kaliningrad. This enables the FRA to keep its intelligence databases up to date for use by the Swedish government, its intelligence agencies and armed forces.

Operating from Cyprus, the Korpen was able to fly orbits in international air space to snoop the latest Russian weapon systems operating in Syria (and those operated by the Assad regime) under combat conditions. Given Russia's deployment of Su-35 Flanker fighters, S-400 surface-to-air missiles and Gravestone multi-mode engagement radars, the Korpen was perfectly placed to gather a swathe of new information on Putin's weapons of war, so highly valuable to the Swedish military machine. Information that allowed the Scandinavian nation to improve and optimise its own weapon systems as a means of countering potential new threats.

According to the Swedish government's bill 'Totalförsvaret 2021–2025' (Total Defence 2021-2025) published in October 2020, both S102B aircraft will be retained in service, with no planned replacement until after 2025.

BELOW: **S102B**  
*Fv102003/023 parked on the flight line at Malmén Air Base.*  
Försvarmakten





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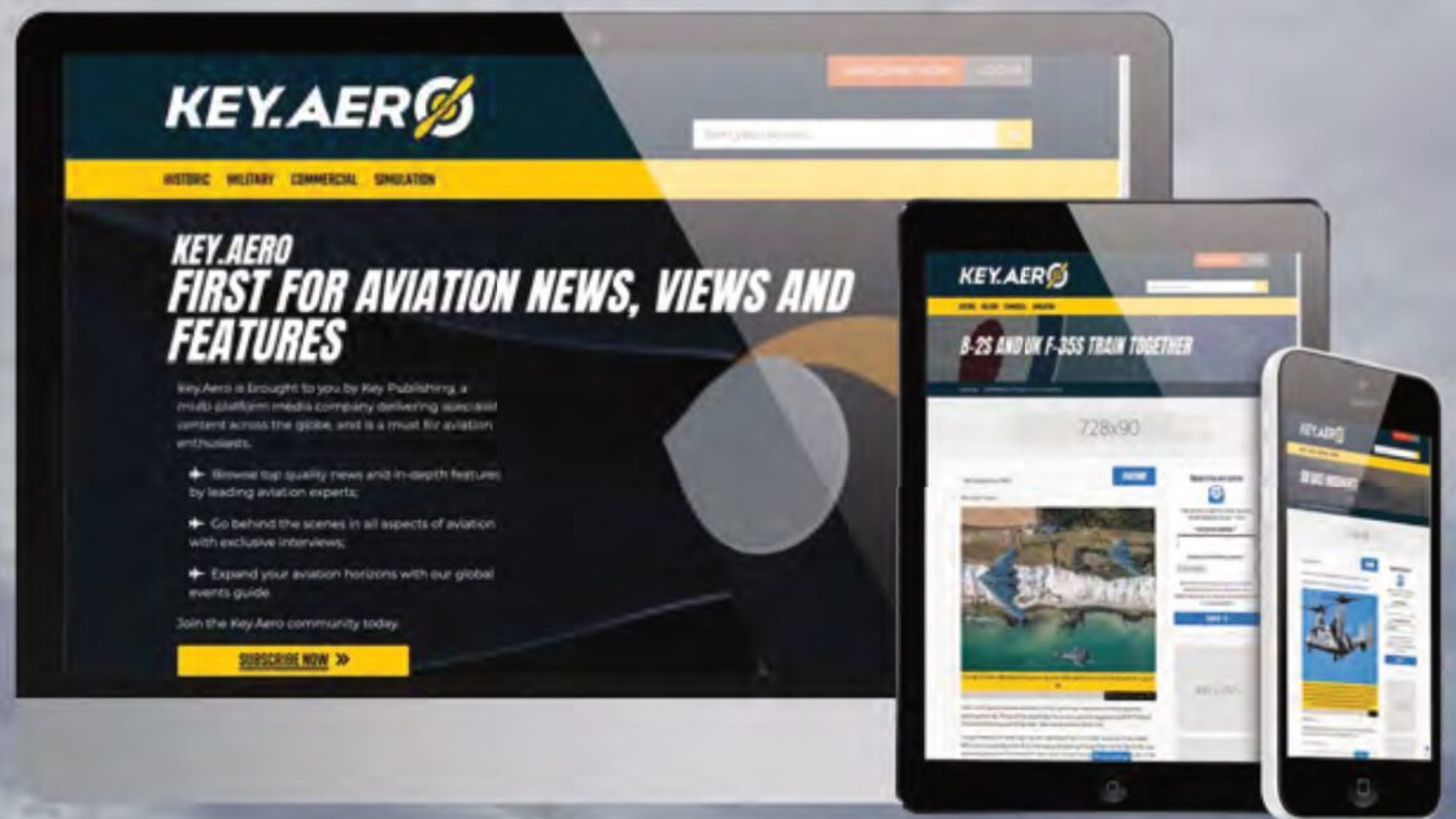
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