Abstract

The SR-71 is one for the world's most well known spy planes. However, little is generally known about it's development and what all it accomplished. While a lot of the details behind the Blackbird are still secret, there are many facts that have been revealed. This paper is an attempt to show what went into the development of the SR-71, from it's predecessors, the A-12 and the YF-12A to the work that went into the J-58 engines that provide the thrust needed to achieve the Mach 3 speeds that the SR-71 regularly attained.

When someone talks about fast vehicles, or airplanes, one of the first things that comes to my mind is Lockheed's SR-71, the Blackbird. It's one of the most distinctive airplanes, and has set speed records that have lasted for nearly 20 years.

The SR-71 was the successor of the A-12, which was approved in 1957. At that time, the CIA and Lockheed were working on designing a new spy plane that would attain speeds between Mach 3 and 4, with a cruising altitude of between 80,000 and 100,000 feet, using state of the art technology. Lockheed's main competition for the development of the spy plane was General Dynamics. While the designs General Dynamics put forth would produce planes that would go higher and faster, some even much faster, Lockheed was awarded the contract on 29 August 1959.

September of 1960 marks the beginnings of the AF-12, known in its early stages as the YF-12A, a long range, high speed interceptor, another predecessor of the Blackbird. In October, the USAF gave the OK for work to commence. The last of the then-current order of A-12's was to be modified into a prototype.

The SR-71 itself was finally given the go=ahead on 18 February 1963, with an order of six, and an understanding that on 1 July 1963, a contract would be made for 25 more.

Development continued not only on the shell of what was to become the SR-71, but also on the engines that were to power it. In order to attain speeds of Mach 3, new alloys were needed in the engines due to the high temperatures and stress factors. The engines also had to be able to provide the thrust to move 150,00 pounds of aircraft. Pratt and Whitney's J-75 was capable of Mach 2 speed, but was too heavy for performing at sustained supersonic speeds. The engine that was eventually used was the J-58, whose design traces back to the J-91 jet engine which had been created for the XB-70, but which had been cancelled.

The J-91, along with the J-89, were the primary candidates. However, in late 1955, four more were under consideration. Wright improved upon the J-67 and called it the TJ32C4. Pratt and Whitney had their J-91, and an improved J-75, while General Electric had the TF-31 (X-84), as well as at least two improvements on the J-79, both with improved thrust. By February of 1956, only three were left in contention. Allison, the original designer of the J-58, Pratt and Whitney with their J-91, and GE's X-275, one fot he improvements on the J-79. The J-91 was chosen and transformed for Navy use, while the Air Force, having spent quite a bit already, monitored its development.

New alloys were developed for the engine. They were quite strong, considering they had a thickness of only 0.030 inches on the aft part of the power plant. Many problems had to be overcome, including welding the pieces together, and making all new components out of the alloy, as nothing from the former models could be used. Other problems included a lack of suitable testing facilities, as well as the fact that no plane could house the J-58 as it was being developed.

The fuel used for the J-58 was changed from JP-5 to JP-7, which has a high flash-point, requiring tetraethylborane to ignite it. The chemical ignition system was developed by the Navy because of problems with the J-65 having blow outs, causing the loss of numerous planes. It was also used to prevent the addition of more parts that could be prone to failure under the high temperature and stress levels. The oil used in the J-58 is virtually solid at 86 degrees Fahrenheit, and takes one hour to raise it 10 degrees. Instead of grease, a silicon-based instrument transducer lubricant was used. Special plastics and hydraulic fluids were also developed for the operation of the J-58.

When construction got underway on the SR-71's themselves at Lockheed's Skunk Works site, several difficulties were encountered there as well. The titanium that was used turned out to be brittle, due to poor quality control, and 95% of it was unusable. The titanium also interacted with other elements, such as chlorine, fluorine and cadmium, causing further setbacks and delays. Special tools had to be developed, at a cost of over one million dollars, that would cut and drill through the titanium. A chemist, Mel George, helped to develop a coating which reduced the head and lowered the radar cross section of the SR-71 to numbers that even the B-1B stealth bomber has not beat.

The A-12's were ready almost one year before the engines were, so the J-75 was used for test flights. In October of 1962, the J-58's were ready, and a changeover began. There was not immediately a total switch to the J-58's, but rather a move to using one of each engine, with the J-58 being on the left. This was to reduce loss of aircraft until the J-58's were deemed ready. This came on 15 January 1963, with the first flight of an A-12 using two J-58's.

In October of 1964, the first SR-71A, builder's number 2001, Air Force serial 61-7950, was ready to leave Burbank, home of Skunk Works, for Palmdale, the final assembly site. It was transported early on the morning of 29 October. It's first flight was on 22 December 1964. The plane flew for one hour, at a speed of over 1000 MPH.

The Air Force, on 7 January 1966, took delivery of a SR-71B trainer, with builder number 2007 and AF serial 61-9756. The plane was transferred to Beale AFB in Marysville, California, which was to become the home base of the SR-71's. Other major host sites for the Blackbird include: Edwards AFB, the 9th SRW at Kadena Air Base in Okinawa, and the 9th SRW at Mildenhall Royal Air Base in the UK. The first SR-71A to be mission capable was ready on 4 April 1966. It was the 10th built, with builder number 2009, and AF serial 61-7958. When all the Blackbirds were completed, two squadrons were made, each with 8 SR-71A's and a trainer, while the remainder were being modified, or in for maintenance.

The first operational mission for the SR-71 occurred on 31 May 1967. The area scheduled for surveillance was clear, however, the plane had to take off in the rain, something that had not yet occurred in practice. The flight lasted 3 hours, 39 minutes with a speed of Mach 3.10 at 80,000 feet over North Viet Nam.

Flying the SR-71 was highly demanding, a full-time, high-intensity mission, compared to flying the F-111 and RF-4. The pilots had to be highly qualified, and there are fewer Blackbird pilots than astronauts. To qualify, a pilot had to be between 25 and 40 years of age, qualified in high performance aircraft, emotionally stable, and highly motivated. Of the original 16 nominees, 11 of the passed to become the first group of pilots for the SR-71.

The SR-71's time line extends from 22 December 1964 to 6 March 1990, when a record-breaking final flight occurred. During this period, none of them were ever shot down by enemy fire, something no other aircraft can claim. Nineteen of the Blackbirds were either lost of written off. Eleven of those were SR-71's, two were YF-12's and the remaining six were A-12's. Only four accidents occurred at Mach 3. Of the 15 A-12's, seven single place ones are still intact. The only trainer, and one of the M-21's used to launch the D-21 drone, which were similar in appearance, but smaller than the Blackbird, also remain. Among it's major achievements are 53,490 total flight hours, 17,300 missions, 3,551 of which were over North Korea, North Viet Nam, the Middle East, South Africa, Cuba, Nicaragua, Libya and the Falkland Islands. 11,675 of the SR-71's flight hours were above Mach 3. 11,008 hours of support operational missions were flown, and 25,862 hours of flight refueling were also flown, mostly by the KC-135Q's. The Blackbird also holds numerous world records for altitude and speed attained, as well as shortest times between New York and London, and London and Los Angeles.

During Desert Storm, after the retirement of the SR-71, the Department of Defense asked Lockheed about making one of the SR-71's at Storage Site 2 mission capable. Lockheed replied that given the right operating circumstances, they could have one ready in fourteen days after the go-ahead. A few weeks later, the DoD replied with another question, this one being how long it would take to prepare a second SR-71. Lockheed's reply was thirty days, due to the efficiency in which the major electronic equipment in the planes was disassembled. Surprisingly, the DoD, after another long delay, came back and did not give the go-ahead, as they felt that recalling the plane would make the Secretary of Defense look bad for having retired it. Therefore, they had to rely on other planes, such as the RF-4C Phantom to perform the reconnaissance.

NASA has three of the Blackbirds in service for research at Edwards AFB. In 1994, a proposal was under review to return them to service. One of the proposed uses was as a launch platform for outer space vehicles.

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