

## Stealth Pioneer Shares the Story of ‘Skunk Works’

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The Naval Postgraduate School turned a spotlight on a now declassified deep corner of the “dark side” with a special keynote lecture by Stealth pioneer Alan Brown as part of the university’s Centennial Salute to Aeronautics and Astronautics during Air and Space Week

The dapper gentleman with a British accent and cartoon-skunk tie probably wasn’t what the audience expected for the founding chief engineer of America’s secret Stealth program, but the fast-paced, information-packed talk quickly put any doubts to rest.

The tie – and matching wristwatch – bore the logo of Lockheed’s famous “Skunk Works,” the unofficial name for the company’s Advanced Development Projects, where Brown was deputy program manager for the pioneer low-observable “Have Blue” research aircraft and then program manager and chief engineer for the F-117A Stealth Fighter jet through production of the first aircraft. In 1982, he was elevated to Director of Low Observable Technology, a real life incarnation of James Bond’s technology genius *Q*.

Brown reviewed the history and engineering specifications of the nation’s first radar-invisible aircraft, noting that the thrust and origin of the program came from the need for U.S. bombers to be able penetrate the defensive radar systems of the Soviet Union undetected.

“The philosophy and guiding light of the early spy plane program – which was completely ‘in the black’ up to 1971, even to DARPA [the Defense Advanced Research Projects Agency] – was to get [an aircraft with] a low radar cross-section combined with high speed and altitude,” he explained. “The original U-2 spy planes weren’t at all stealthy and were quickly followed in the mid ‘60s with a definite attempt to reduce the radar cross-section in a new high-speed, high-altitude design. This resulted in the SR-71, on which we secretly worked under CIA auspices.

“In 1971, DARPA realized our planes weren’t able to penetrate Soviet defenses and that something drastic needed to be done, such as coming up with an essentially invisible [to radar] aircraft. During this period, we got a no-money-exchanged contract with DARPA to design and build the pioneer experimental stealth test bed aircraft, called ‘Have Blue.’ The goal was to prove that a real, manned, jet-powered aircraft with tactical operational and weapons delivery capabilities could have a very low radar cross-section. And we did.”

“The big challenge was to be both stealthy – as radar invisible as possible – and aerodynamically viable, because there’s a big tradeoff between operational survivability and aerodynamic performance,” Brown explained. “If you made the plane stable, you couldn’t fly it invisible [to radar] -- you couldn’t get the center of gravity far enough forward to for sure have a low radar cross-section.

“The solution was to consciously sacrifice aerodynamic performance and speed -- stealth planes of that era were subsonic -- for low radar visibility, resulting in the now-famous dark and angular craft that look like they’re straight out of an episode of ‘Star Wars.’ We ended up actually designing it to be unstable but under the absolute, redundant control of the flight control system.

“The keys to our success in this, as in any major design and building project, are to listen carefully to the customer and figure out what they really need and want, which isn’t always clear at the outset, even to

them; start from the ground up with a clean sheet of paper, as you can't add low-radar-cross-section material to a conventional plane as their curved edges produce 90 degree angles regardless of radar location; and go beyond what's in the contract -- always deliver more than is expected."

The former "Q" of the U.S. Stealth program then revealed what he meant by "success": "When we were done, the F-117 Stealth fighter looked the size of an insect or a bird [on enemy radar]."

"This was also probably the last military aircraft to be designed completely using pencil and paper," Brown recalled with a hearty laugh. "Looking back from the perspective of today's computer world, I'm not sure how we did it -- but we did."

Born in Britain, Brown began his career as an engineering apprentice at Blackburn Aircraft in 1945 and graduated from the College of Aeronautics at Cranfield with a master's degree seven years later. After working at Bristol Aeroplane, he moved in 1956 to the United States where he did research and lectured at the University of Southern California before moving to Lockheed in 1960. During his 32 years with the company, he also earned a master's degree from Stanford University, and after retirement received an honorary doctorate of science from his former alma mater, Cranfield University.

Brown retired from Lockheed in 1992 as Director of Engineering at corporate headquarters. He is a fellow of the American Institute of Aeronautics and Astronautics (AIAA), a fellow of the Royal Aeronautical Society, a member of the National Academy of Engineering, and a 1990 recipient of AIAA's Aircraft Design Award.

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