

AIAA and ASME **ZOOM** Meeting  
AIAA San Fernando Pacific High School STEM Essay Awards  
**Thursday, May 12, 2022 at 0600 PM to 0730 PM PDT**  
**Development of the F-117 Flight Control System**  
**Mr. Robert Loschke**



Lockheed Martin (LM) Skunk Works was awarded a Defense Advanced Research Projects Agency (DARPA) contract for Have Blue, the stealth demonstrator that would lead to the F-117A Nighthawk in April 1976. Have Blue took its first flight in December 1977 and LM was awarded the F-117 contract in November 1978. The F-117 took its first flight in June 1981 and the first F-117A operational aircraft was delivered in October 1983. LM delivered 59 production F-117A aircraft and was first used in combat in 1989.



The F-117 aircraft was designed as a precision bomber at night but had to meet the maneuvering and flying qualities of a Fighter/Attack aircraft. The aircraft design included two LO gridded inlets, two large internal weapons bays, two GE F404 non-afterburning turbofan engines, an Auxiliary Power Unit (APU) for self-starting and power backup, mission avionics, and fuel tanks. The F-117 has a length of 65 feet, wingspan of ~43 feet, and height of ~12.5 feet. The F-117 has a maximum takeoff weight of 52,500 lb. and flies with a high subsonic speed.

Bob Loschke was the lead Engineer for the flight control systems of the Have Blue stealth technology demonstrator, the world's first Very Low Observable aircraft and on the F-117A, the world's first operational Stealth aircraft. The F-117 has a quadruple redundant fly-by-wire flight control system (FCS) which is critical to fly this inherently unstable aircraft. The unusual F-117 aircraft has FCS design challenges including the combination of aerodynamic instabilities, cross axis coupling and directionally destabilizing exhaust nozzle effects. The F-117 radar cross section (RCS) and infrared (IR) low observable (LO) signature considerations drove the aircraft design to have highly swept wings, swept canted fins, and high aspect ratio engine exhaust nozzles. The FCS also had the additional challenge of a desired center of gravity being relatively far aft to allow for zero elevon deflection to minimize RCS and cruise trim drag.

Bob recently spoke at the F117 Experience at the Palm Springs Air Museum to celebrate the museum's commitment to restore F-117 aircraft #833 in the Jim Houston Pavilion.



*Bob Loschke received two degrees from the University of Oklahoma in 1961; a Bachelor of Science (B. S.) in Aeronautical Engineering and a B. S. in Electrical Engineering. After joining Lockheed in 1961, he continued his formal education through Lockheed's work Study program and received a Master of Science Degree in Control System Engineering from UCLA in 1967.*

*During his 37 years career at Lockheed, Bob contributed in the design, development, and testing of a variety of aircraft: Land based and carrier based, subsonic and supersonic, single engine and multi-engine, manned and unmanned.*

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Click the following link to attend this exciting ZOOM Meeting.

<https://aiaa.zoom.us/j/91816632945?pwd=NkNJQndJUk1lYU0yU1VyL2ZvdDRMQT09>

**Meeting ID: 918 1663 2945**

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