

# Design and Development of the Blackbird: Challenges and Lessons Learned

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The Lockheed Blackbirds hold a unique place in the development of aeronautics. In their day, the A-12, YF-12, M-21, D-21, and SR-71 variants outperformed all other jet airplanes in terms of altitude and speed. Now retired, they remain the only production aircraft capable of sustained Mach 3 cruise and operational altitudes above 80,000 feet. In this paper the author describes the design evolution of the Blackbird from Lockheed's early Archangel studies for the Central Intelligence Agency through Senior Crown, production of the Air Force's SR-71. He describes the construction and materials challenges faced by Lockheed, the Blackbird's performance characteristics and capabilities, and the National Aeronautics and Space Administration's role in using the aircraft as a flying laboratory to collect data on materials, structures, loads, heating, aerodynamics, and performance for high-speed aircraft.

## Nomenclature

AFCS	=	Automatic Flight Control System
AOA	=	angle of attack
ASARS	=	Advanced Synthetic Aperture Radar
C	=	Centigrade
CAPRE	=	Capability Reconnaissance
c.g.	=	center of gravity
CIA	=	Central Intelligence Agency
F	=	Fahrenheit
FATOLA	=	Flexible Aircraft Takeoff and Landing Analysis
FCO	=	Fire Control Officer
FRC	=	Flight Research Center
$g$	=	acceleration due to the force of gravity
HTLL	=	High Temperature Loads Laboratory
IR	=	infrared
KEAS	=	knots equivalent air speed
LCO	=	Launch Control Officer
MOU	=	memorandum of understanding
NASA	=	National Aeronautics and Space Administration
OBC	=	Optical Bar Camera
RCS	=	radar cross-section
RSO	=	Reconnaissance Systems Operator
SST	=	Supersonic Transport
TEB	=	triethylborane

## I. Introduction

THE Lockheed Blackbirds hold a unique place in the development of aeronautics. In their day, they outperformed all other jet airplanes in terms of altitude and speed. Now retired, the Blackbirds remain the only production aircraft capable of sustained Mach 3 cruise and cruising altitudes above 80,000 feet.

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