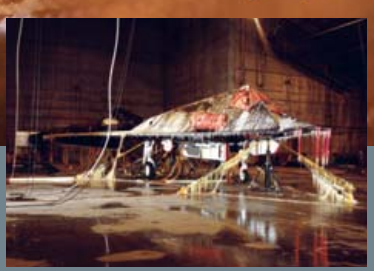
LOCKHEED F-117 NIGHTHAWK STEALTH FIGHTER



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AIR VANGUARD 16

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CONTENTS

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INTRODUCTION

Although universally known as "the Stealth Fighter," Lockheed's F-117 was an attack aircraft. Designed within the legendary Skunk Works primarily by electronic engineers, radically new solutions had to be developed to enable the aircraft to evade radar detection and interception. The enormity of the challenge is neatly conceptualized by the radar equation, which basically states that "radar detection range is proportional to the fourth root of the targets' radar cross section (RCS)." In other words, to reduce the detection range of an aircraft by a factor of ten, it is necessary to reduce its RCS by a factor of 10,000 or 40 dBs. Having successfully vaulted such a monumental hurdle, when the F-117 was deployed in combat, together with its weapons delivery system it achieved a consistent – almost eye-watering – level of success, the like of which had never before been attained by any other previous combat aircraft. Indeed, so deadly accurate was this weapons platform, it enabled US Air Force (USAF) planners to confidently utilize the aircraft against some of the world's most highly defended targets to perform a "surgical strike" – destroying the target without other areas incurring collateral damage.

Perhaps not surprisingly, the F-117 and its forerunners were developed in the "Black World" and flight-tested at the hot, highly classified desert test site known as Area 51. When, finally, the basic shape of the much speculated F-19 stealth fighter was revealed to the public by Assistant Defense Secretary J. Daniel Howard during a Pentagon press conference on November 10, 1988, the grainy photograph depicted a black, stubby, angular aircraft, whose shape was more akin to a lifting body or something that Darth Vader might have flown in a sequence from *Star Wars*. It certainly bore no resemblance whatsoever to the curves and blended body of what was supposedly an accurate representation of the aircraft available for model enthusiasts to purchase in the form of a plastic construction kit. The security clearance necessary to access information relating to the Have Blue proof of concept (or demonstrator) vehicles and the follow-on Senior Trend program (the equally classified code name for the F-117) was categorized as top secret/sensitive compartmented information (TS/SCI), and it was spectacularly successful in keeping both programs under wraps. When Lockheed test pilot Dave Ferguson first saw the highly faceted, unconventional, "slab-sided" aircraft, he asked Dick Cantrell how airframe ice encrustation might affect the aircraft's aerodynamics. The program's chief aerodynamicist dryly replied, "Probably improve it."

When Ben Rich became president of the Skunk Works on January 17, 1975, Lockheed faced financial losses amounting to $2 billion. Selling the U-2R concept to the USAF, together with his strident support of Have Blue and the F-117 program, undoubtedly played a major role in turning around the company's fortunes. (Lockheed Martin)

The less-than-spectacular combat debut of the F-117 during Operation *Just Cause* – the US invasion and subsequent ousting of General Manuel Noriega from Panama – was more than compensated for just 15 months later, on January 17, 1991. On this date, during the opening phase of Operation *Desert Storm* (the expulsion of Saddam Hussein's occupying forces from Kuwait), the first laser-guided bombs dropped from F-117s slammed into their targets with devastating accuracy. Some of the infrared footage of these strikes, recorded in each aircraft for subsequent analysis by pilots and intelligence specialists, was made available to the media, and became a source of fascinating viewing during news bulletins throughout the world. The 43-day campaign proved beyond a shadow of a doubt the effectiveness of stealth technology as applied to the F-117 when, despite flying hundreds of sorties against the most heavily defended targets in Iraq, not a single one of these ungainly looking aircraft was shot down or even hit.

DESIGN AND DEVELOPMENT

Air battles fought by the United States during the Vietnam War, together with losses suffered by Israel during the so-called Yom Kippur War of 1973, were responsible for the Defense Advanced Research Projects Agency (DARPA) initiating conceptual studies into developing a manned aircraft with a sufficiently low RCS to defeat modern air-defense systems. Consequently, in 1974 Ken Perko of the Tactical Technology Office (TTO) at DARPA requested submissions from Northrop, McDonnell Douglas, General Dynamics, Fairchild, and Grumman, under the code name *Project Harvey* (derived from an old movie starring James Stewart and "featuring" an invisible ten-foot rabbit named Harvey), addressing two considerations. Firstly, what were the signature thresholds that an aircraft would need to achieve to become essentially undetectable at an operationally useful range? Secondly, did the relevant companies possess the capabilities to design and produce an aircraft with the necessary low signatures?

Fairchild and Grumman declined the invitation to participate, while General Dynamics emphasized the continued need for electronic countermeasures. However, the submissions from McDonnell Douglas and Northrop demonstrated both a grasp of the problem and a degree of technical capability for developing an aircraft with a reduced signature. Consequently, both companies were awarded contracts worth approximately $100,000 each during the closing months of 1974 to conduct further studies. Radar experts from the Hughes Aircraft Company were also involved, their role being to identify and verify appropriate RCS thresholds. At this early stage the studies were only classified as "Confidential."

Bill Elsner was the primary USAF technical expert on the program, and by the beginning of 1975 McDonnell Douglas had identified likely RCS thresholds that could produce an operational advantage. In the spring, these were confirmed by Hughes and were established by DARPA as goals for the program. DARPA then challenged the participants to find ways of achieving them.

Lockheed had not been one of the five original companies approached by DARPA, simply because it had not produced a fighter for nearly ten years. This, however, was about to change. Whilst networking his contacts at the Pentagon and Wright-Patterson Air Force Base (AFB), Ed Martin, Lockheed California Company's Director for Science and Engineering, was made aware of the study. He flagged this to Ben Rich, who at this time was deputy to the Skunk Works' legendary president Clarence L. "Kelly" Johnson. The two men then briefed Johnson, who in turn obtained a letter from the Central Intelligence Agency (CIA), granting the Skunk Works permission to discuss with DARPA the low observable (LO) characteristics of their earlier A-12 and D-21 drone program.

Rich and Martin presented this data to Ken Perko and Doctor George Heilmeier, the head of DARPA, and formally requested entry into the competition. However, Heilmeier explained that two $100,000 contracts had already been awarded and there was no more cash available. Drawing upon his negotiation skills, Rich convinced the DARPA boss to allow Lockheed into the competition without a government contract – a move that ultimately paid a handsome dividend. The Skunk Works team were then given access to technical reports already provided to the other participants, and the first step that would culminate in a revolutionary aircraft was taken.

Within the Skunk Works team, Denys Overholser recalls his boss, Dick Scherrer, asking him one day, "How do we shape something to make it invisible to radar?" Overholser's reply was, "Well, it's simple, you just make

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F-117 PROFILES

1: The Have Blue prototype HB1001 (known in-house as Blue 1) had a unique camouflage pattern applied at Burbank before being disassembled and flown via C-5 Galaxy to the test site at Area 51.

2: The second Have Blue aircraft, HB1002, first flew on July 20, 1978. It was flown primarily to enable various air- and ground-based radars to gather RCS data. It completed 52 sorties before crashing on July 11, 1979.

3: The F-117 prototype aircraft 780 sported an unusual camouflage pattern for its first ten test flights, before being painted light gray for over a year.

4: When aircraft 781 completed its flight-test career, it was bead-blasted of all its classified, radar-absorbent coatings, and generally stripped out inside, before undergoing a functional check flight (as depicted here). It was then delivered to the US Air Force Museum, where it received a coat of standard black paint before being put on display.

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4