

# A History of NASIC

NATIONAL AIR AND SPACE INTELLIGENCE CENTER

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

## The \$10 Million PORTAL CIRC Record

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Did you know that the Foreign Technology Division played a pivotal role in the development of stealth technology? In the early 1970's, who would have thought that the translation of an obscure Russian technical paper on the diffraction of electromagnetic radiation off geometric configurations would lead to the development of the F-117A aircraft and save the Air Force an estimated \$10 million in research and development costs?

In 1971, the Foreign Technology Division's translations branch completed a translation of the 1962 book, "UR Method of Edge Waves in the Physical Theory of Diffraction" by Pyotr Ufimtsev, chief scientist at the Moscow Institute of Radio Engineering. Shortly thereafter, the translation was read by Denys Overholser, a mathematician and radar specialist at Lockheed Martin's Skunk Works division. He recognized how to apply Ufimtsev's theories to calculate the radar cross section of an aircraft, eventually leading to the development of an aircraft with a radar cross section the size of an insect, the F-117A.

*Excerpts from Ben Rich's book, Skunk Works: A Personal Memoir of My Years at Lockheed*

On an April afternoon in 1975, a thirty-six year old Skunk Works mathematician and radar specialist named Denys Overholser presented Ben Rich with "the Rosetta Stone breakthrough for stealth technology." Overholser had discovered this nugget deep inside a long, dense technical paper on radar written by one of Russia's leading experts and published in Moscow nine years earlier. That paper, called "Method of Edge Waves in the Physical Theory of Diffraction," had been recently translated by the Air Force Foreign Technology Division (which later became the National Air & Space Intelligence Center) from the original Russian language. The author was Pyotr Ufimtsev, chief scientist at the Moscow Institute of Radio Engineering.

Ufimtsev had revisited a century-old set of formulas derived by Scottish physicist James Clerk Maxwell and later refined by the German electromagnetics expert Arnold Johannes Sommerfeld. These

calculations predicted the manner in which a given geometric configuration would reflect electromagnetic radiation. Ufimtsev had taken this early work a step further, showing how to accurately calculate radar cross sections across the surface of the wing and at the edge of the wing and put together these two calculations for an accurate total. Ufimtsev had shown the Skunk Works engineers how to create computer software to accurately calculate the radar cross section of a given configuration, as long as it's in two dimensions.

Overholser thought he would need six months to create his computer software based on Ufimtsev's formula. Ben Rich gave him three months. Overholser and his old mentor, Bill Schroeder, who had come out of retirement in his eighties to help him, delivered the goods in five weeks.

Around this time, the Defense Department's Advanced Research Projects Agency (DARPA) invited Northrop, McDonnell Douglas, and three other companies to compete on building a stealthy airplane, with each company getting a million dollars to come up with a proof of concept design. Lockheed Martin was not one of the other companies. Unknown to DARPA, Lockheed Martin had been working with the CIA since the 1960s building the SR-71 Blackbird, a highly classified program, which was actually the world's first operational stealth aircraft. When the CIA agreed to declassify the project results, DARPA allowed Lockheed Martin to enter the competition, based on a one dollar pro forma government contract, instead of the one million dollars the other companies received. This aircraft, the Hopeless Diamond, would win the competition. Lockheed Martin would go on to build two experimental airplanes based on the Hopeless Diamond design. The program was designated under the code name Have Blue. Out of that program emerged the Air Force's F-117A aircraft. Dr. Ufimtsev came to teach electromagnetic theory at UCLA in 1990. Until his arrival here he had remained blissfully unaware of his enormous impact on America's stealth airplane development, but clearly wasn't surprised by the news. "Senior Soviet designers were absolutely uninterested in my theories," he wryly observed.



*Foreign Technology Division played a pivotal role in the development of the F-117A aircraft.*