Looking straight up

The Rockwell XFV-12A pursued both vertical lift, supersonic conventional flight

By Erik Simonsen

During the early 1970s, the notion of having a supersonic, highly maneuverable fighter that could take off and land vertically from a carrier deck was a naval planner's dream. Hoping to make that a reality, in November 1971 the U.S. Navy initiated the Vertical Fighter Attack-X program and invited contractors to submit proposals. Rockwell International, a Boeing predecessor company, submitted an entry featuring a Thrust Augmenter Wing (TAW) concept and was awarded a $47 million contract in May 1972 for two demonstrators.

As Rockwell received its TAW concept contract, the Navy, under the leadership of Adm. Elmo Zumwalt, Chief of Naval Operations, planned to build a new, smaller class of 12,500-ton Sea-Control ships to base the new lightweight vertical or short takeoff and landing (V/STOL) fighters on.

For its V/STOL fighter (designated XFV-12A), Rockwell utilized the forward fuselage/cockpit and the nose/main landing gear from a McDonnell Douglas A-4 Skyhawk fighter, and the inlets, wing box/main fuel tank from a McDonnell Douglas F-4 Phantom fighter to expedite assembly and reduce cost. In all, 35 percent of the XFV-12's structure would originate from existing aircraft.

The TAW system was designed to flow ducted air into a full-span ejector flap system in the wings and in the canards. With the rear exhaust nozzle closed, engine thrust was augmented by drawing air in from the top of the fuselage and into flaps (movable panels) that carried exhaust gases to augmenter exit nozzles. This would also result in a cooler exhaust footprint on the carrier deck. Once flight was achieved, the nozzles would be rotated to transition the aircraft to conventional flight mode. Additionally, the mixing of primary and ambient air above the wings would provide increased vertical lift, thus easing the transition. The aerodynamic effect would be similar to the blown-flap technique of the North American RA-5C Vigilante (see Page 8 of the September 2008 *Boeing Frontiers*). The afterburner would only be used for conventional supersonic flight.

At the aircraft's Aug. 26, 1977, rollout at Rockwell's Columbus, Ohio, Division, the public saw an aircraft with a sleek futuristic design. After substantial ground testing it was determined that powered tethered tests were needed to validate the TAW system. In November 1977 the XFV-12A was transported via the Aero Spacelines Super Guppy aircraft to the NASA Impact Dynamics Research Facility, formerly known as the Lunar Landing Research Facility, at Langley, Va. Flying the XFV-12A to Langley was considered but rejected—a decision later regretted. Certainly, testing and demonstrating the aircraft in conventional flight mode at Columbus and flying it to Langley would have been a substantial step toward building confidence in the design.

Tethered beneath the huge gantry where Apollo astronauts once trained for simulated lunar gravity, the XFV-12A underwent six months of powered V/STOL testing. Although the aircraft exhibited excellent handling characteristics with the ducting system, sufficient thrust was not developed for vertical lift. The TAW system achieved a thrust-to-weight ratio of 1.35; however, 1.45 was required using 21,800 pounds of engine thrust.

"Unfortunately, computational fluid dynamics was not available at the time. That may have predicted the corner flow for the ejectors and isolated the vertical thrust anomalies," Bob Gulcher, divi-

Shortly after its rollout on Aug. 26, 1977, the futuristic XFV-12A is shown near the runway at Rockwell's Columbus Division. BOEING ARCHIVES PHOTO

sion chief engineer for the XFV-12A, recently said. "Had we shifted away from vertical lift, I believe the aircraft would have made an excellent short take-off and vertical land (STOVL) fighter."

Unfortunately for the XFV-12A, naval strategy had begun to shift by the mid-1970s toward re-emphasis on larger Nimitz-class aircraft carriers basing larger, multirole fighter/attack aircraft. What's more, funding inconsistencies plagued the program—in fact, the second demonstrator was eliminated—and in 1981 the XFV-12A program was terminated.

LET'S GET CONVENTIONAL

Although original plans called for a conventional first flight, the XFV-12A program remained firmly focused on solving the V/STOL problems. Flying conventionally and demonstrating extreme maneuverability utilizing direct lift, direct side force control thrust and a large speed brake—coupled with supersonic dash speeds—might have struck the right chord with the Navy.

Indeed, the British-designed V/STOL Harrier made its first flight in conventional mode on Dec. 28, 1967; V/STOL testing followed later. Today, Harriers of the Royal Air Force and Royal Navy—and the Boeing AV-8B Harrier II flown by the U.S. Marine Corps—achieve maximum efficiency in short takeoff mode. This lesson learned, today's strategy favors short takeoff for multimission, flexible-base fighters.

Rockwell's work on the XFV-12A led to the creation of a demonstrator aircraft that incorporated envelope-pushing technologies. Although the Navy ultimately scrapped this program in part because of strategic shifts, Rockwell's achievements helped pave the way for other advanced-flight achievements. ■

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Tale of the tape: **XFV-12A**

CREW: 1

LENGTH: 43 feet 11 inches (13.4 meters)

WINGSPAN: 28 feet 6 inches (8.72 meters)

HEIGHT: 9 feet 5 inches (2.9 meters)

EMPTY WEIGHT: 13,800 pounds (5,897 kilograms)

VTOL GROSS WEIGHT: 19,500 pounds (8,618 kilograms)

STOL GROSS WEIGHT: 24,250 pounds (10,866 kilograms)

POWERPLANT: One Pratt & Whitney F401-PW-400 afterburning turbofan

THRUST WITH AFTERBURNER: 30,000 pounds

LIFT THRUST: 21,800 pounds (plus augmentation)

SPEED: 1,534+ mph (2,470+ km/h)

RANGE: Operational radius 575 miles (925.37 kilometers)

SERVICE CEILING: 40,000 feet (12,192 meters)

ARMAMENT: One 20 mm M61 Vulcan cannon; two AIM-7 Sparrow (fuselage hardpoints) and two AIM-9L missiles, or four AIM-9 Sidewinder (outboard wing) missiles