Latest jet fighter has wings on backward

By Steve Thorpe
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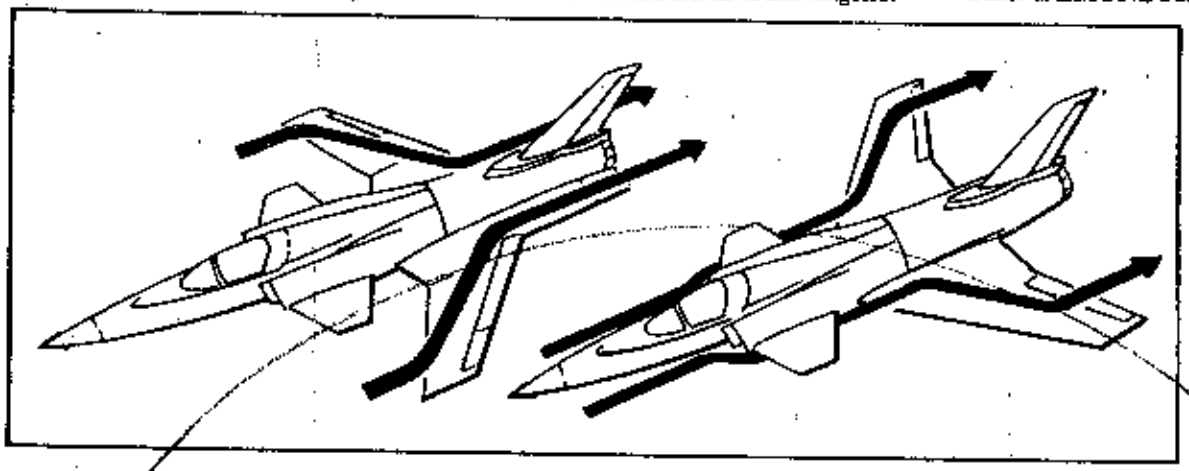
You know the plane is a fighter immediately. Needlelike nose. Huge, gaping exhaust. Swept-forward wings.

Swept-forward wings?

The new craft with its wings on backward is the X-29 jet, now under development by Grumman Corp. of Bethpage, N.Y. It's designed to test new ideas and technologies for the next generation of fighter planes and looks like nothing anyone has seen outside of science fiction films.

The first American experimental fighter to be flown in more than a decade, the craft can maneuver more freely and fly farther on the same amount of fuel than a plane with conventional wings.



Airflow on the X-29 wings (left) moves in toward the fuselage instead of out. As on conventional wings, this keeps the ailerons, at the rear edge of the wings, positioned in smooth air.

THE FORWARD sweep of its wings forces air to move inward toward the fuselage, instead of outward toward the wingtips. This keeps the aileron control surfaces, at the trailing edge of the wing, out of tumbling, disturbed air. The feature allows better control during tight maneuvering.

The unusual wings also make the aircraft so inherently unstable that computers must check control surfaces 40 times a second to keep it from disintegrating during flight.

Why intentionally make an aircraft unstable? An unstable plane can leave a straight line and execute violent maneuvers much more quickly than existing craft.

For decades, design efforts were directed at fast, faster and fastest. A fighter pilot would intercept his quarry and then stand off and fire a missile. Sounds great. Often it didn't work.

IN VIETNAM, fighter pilots found that just being fast wasn't good enough. For one thing, the afterburner that made an aircraft so swift also burned incredible amounts of fuel. The amount of time a pilot could spend at top speed was limited. Many fights turned into twisting, turning battles that looked more like World War I than *Star Wars*. The dogfight was still very much alive.

Enter the swept-forward wing. The X-29 made its maiden flight Dec. 14 at Edwards Air Force Base, Calif.

"Very nice airplane," said Charles Sewell, chief test pilot for Grumman Aerospace, as he brought the X-29 in for a landing at the desert air base 60 miles north of Los Angeles. "Only complaint is I don't have enough fuel to stay up longer."

Despite all the recent publicity, the swept-forward wing is not a new design. During World War II, German scientists built such a plane, which they called the JU 287 bomber. Seventeen test flights were made before its capture by Allied forces in 1944.

THE PROBLEM with that plane — a drawback that continued to vex designers for decades — was that it displayed a tendency toward what engineers call "structural divergence." In laymen's terms, the wings came off.

That can offset all the advantages quite effectively.

However, with the recent development of "composite" materials, the problem is on its way to being solved. The X-29 has wing covers made of plastic composites stronger than steel and lighter than aluminum. These covers have allowed the swept-forward wing to leave the drawing board and take to the air.

Grumman Corp. put up $40 million of its own money after winning an Air Force contract for $90 million in 1981 to prove the forward-swept wings not only will work, but are superior to conventional wings.

THE DEMONSTRATOR program has three objectives. The first is to prove the feasibility of a supersonic, forward-swept wing. The second is to show that an aircraft with such a wing can offer increased performance. The third is to pass all the program data along to government.

Because of the complexity of the next generation of aircraft, many different disciplines must come together to produce a prototype. The aerodynamic engineer designing the wing knows little about the computer expert whose programs keep that wing from coming off. The metallurgist working on alloys for one part of the aircraft may know little of the new composites used in the wing covers. The design process has, of necessity, become much more of a team effort.

The X-29 is a bit like Frankenstein's monster. To keep costs low, many "off-the-shelf" parts were used. The nose section and cockpit are from a Northrop F-5 fighter. The landing gear is from a General Dynamics F-16. The engine is the same one used for the McDonnell Douglas F-18.

"We went that way to contain costs," said Glenn Spacht, a Grumman deputy director of development in charge of the X-29 project. "Otherwise, it would be like owning a Lamborghini. Off-the-shelf parts make it more like owning a Chevrolet."

IN AN ERA when the costs of new weapons systems often are targeted for criticism, the savings are an

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important feature of the project.

Another advanced feature of the X-29, aside from its strange wing, is the "fly-by-wire" control system. The controls operated by the pilot transmit signals to several analog (simultaneous) computers, which in turn order controls to operate the flaps, rudders, ailerons and other aerodynamic surfaces. The same type of system is used in the F-16 fighter and the Space Shuttle. Just as on the Shuttle, these computers "vote," the decision being made by the majority.

Other aircraft use direct linkages to flight controls by hydraulic systems or cables.

The X-29 was built for the Defense Advanced Research Projects Agency, a research office for the Defense Department. Grumman will make four test flights before turning the craft over to the agency for further testing.

TWO PROTOTYPE aircraft were built. The second plane is still at the Grumman facilities at Calberton, N.Y. In its current configuration, the X-29 will never go into production. It will continue as a test bed for new fighter plane technologies.

The use of computer modeling and analysis reduced the need for wind-tunnel testing by 10 percent compared to other new aircraft. A radio-controlled scale model was used to verify the computer findings. Only then was a human pilot allowed to fly the aircraft.

After last month's maiden flight, the test pilot, Sewell, a 54-year-old retired Marine Corps lieutenant colonel, told National Aeronautics and Space Administration ground controllers that the X-29 handled better in the air than the training simulator on the ground. The controllers said the flight was excellent.