



WORLD'S MOST FAMOUS STEALTH AIRCRAFT

News / Manufacturer



TASS is reviewing world's most famous stealth aircraft while Japan is about to become the fourth country in the world possessing one.

Japan had plans for March 2016 to complete trials of its new-generation aircraft, the Advanced Technology Demonstrator X, developed with the use of the stealth technology. The Land of the Rising Sun will become the fourth country in the world to develop stealth aircraft. Before that, only Russia, China and the United States could boast combat aviation systems based on low radar signature technology.

Stealth technology is a major required parameter for fifth-generation aircraft.

The stealth technology reduces radar and infrared detection and the effect is achieved through special coating, the specific shape of the aircraft's body and materials of its airframe.

The radio waves emitted, for example, by the transmitter of an air defense missile system are reflected from the aircraft's surface and received by a radar system, thus making the plane radar detectable.

Radar signature is characterized by the radar cross-section (RCS). This is a formal parameter

measured in units of area and is a quantitative gauge of an object's ability to reflect an electromagnetic wave. The smaller the area, the more difficult it is to detect an aircraft and hit it with a missile (at least the range of its detection is reduced).

The RCS of old bombers can be as large as 100 square meters while this parameter ranges from 3 to 12 sq. m. for modern fighter jets and just 0.3-0.4 sq. m. for stealth aircraft.

The RCS of complex objects can't be calculated under formulas and is measured by experiment at practice ranges or in an echo-free chamber. Its value strongly depends on the direction of radar energy and is represented by a range for one and the same plane: normally, the best RCS results are registered when an aircraft is exposed to radar waves from the front hemisphere. Therefore, there can be no exact RCS indicators while measured values for existing fifth-generation aircraft are classified.

Western analytical resources normally understate the RCS data for their stealth aircraft.

World's most famous modern stealth aircraft

- US B-2 Spirit stealth bomber
- US F-117 "Wobblin' Goblin" stealth attack aircraft
- US F-22 Raptor fighter jet
- US F-35 Lightning fighter jet
- Russian T-50 stealth fighter jet
- Chinese J-20 Mighty Dragon fighter jet
- Japanese X-2 "Spirit of the Heart" fighter jet

US B-2 Spirit stealth bomber

The B-2A Spirit heavy low-signature strategic bomber is the most expensive plane in the US Air Force's fleet.

According to data for 1998, a B-2 bomber cost \$1.16 billion. The entire program was estimated at almost \$45 billion.

The B-2 bomber performed its first public flight in 1989. Overall, 21 B-2 bombers were built. Almost all of them were named after US states.

The B-2 bomber has an unusual external look and is sometimes compared with an aliens' space vehicle. In its time, the plane's external appearance generated a lot of rumors that the bomber had been built using the technologies developed from the study of UFO debris in the so-called Area 51.

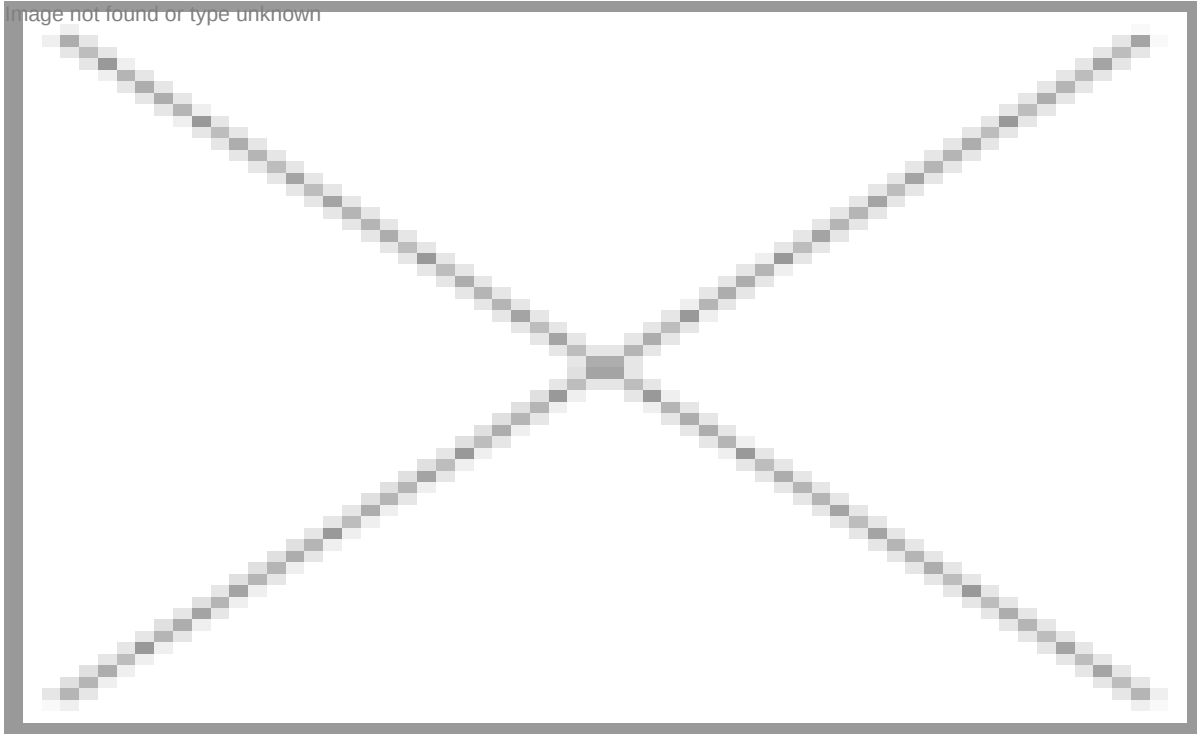
The plane can carry 16 nuclear or eight 907-kg precision-guided bombs with laser guidance or 80 227-kg conventional bombs and deliver them from the Whiteman Air Force base in the state of Missouri actually to any part of the world as the bomber has a flying range of 11,000 km (6,835 miles).

The B-2 Spirit bomber is maximally automated and has a crew of two pilots. The bomber has substantial endurance and can make a safe landing in side wind of 40 m/s. According to data of foreign publications, the bomber's RCS is estimated in the interval of 0.0014 - 0.1 sq. m. Other data suggest that the bomber has more modest indicators: from 0.05 to 0.5 sq. m. in the frontal projection.

The cost of maintenance is the B-2 Spirit's major drawback. The plane can be housed only in a

special hangar with an artificial micro-climate. Otherwise, ultraviolet radiation will damage the plane's radar-absorbing coating.

The B-2 is invisible for outdated radars while modern anti-aircraft missile systems can detect and effectively destroy it. According to unconfirmed data, a B-2 bomber was shot down or received serious damage to its combat systems from an anti-aircraft missile complex during NATO's military operation in the former Yugoslavia.



US F-117 "Wobblin' Goblin" stealth attack aircraft

The **Lockheed F-117 Night Hawk** nicknamed as "Wabblin' Goblin" is a US single-seat subsonic stealth attack plane produced by Lockheed Martin. The aircraft was designed for stealthily penetrating an enemy's air defense system and attacking strategically important ground facilities.

The F-117 performed its first flight on June 18, 1981. Overall, 64 F-117 planes were produced. The last serial plane was delivered to the US Air Force in 1990. Over \$6 billion was spent on the F-117 attack aircraft development and production. In 2008, these attack aircraft were fully withdrawn from operational use both for financial reasons and due to the acceptance of the F-22 Raptor fighter jet for service.

The F-117's RCS ranged between 0.01 and 0.0025 sq. m., depending on the angle of observation, according to the data of foreign publications.

The F-117's reduced visibility was achieved through the specific angular shape of the aircraft's body built under the "reflector plane" concept and the use of composite and radar-absorbing materials and special coating.

As a result, the F-117 looked quite futuristic and could rival Hollywood mega stars by popularity in computer games and movies.

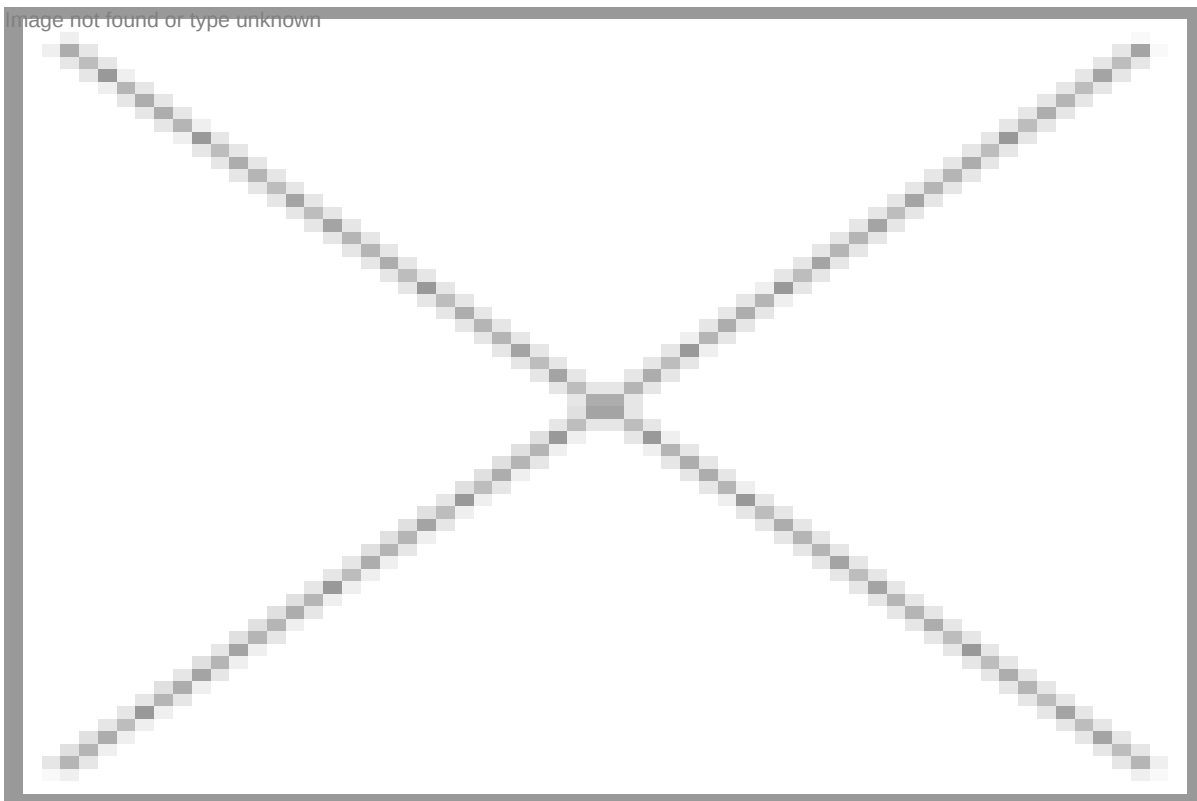
However, the designers breached all possible aerodynamics rules to reduce the aircraft's visibility and the plane was developed with poor flight characteristics, for which US pilots nicknamed it as

‘Wobblin’ Goblin.”

As a result, the US Air Force lost six out of 64 F-117A aircraft in flight incidents or almost 10% of their total number. Only the most experienced US pilots were entrusted to fly F-117 planes. However, despite this, they regularly crashed all the same.

The F-117 aircraft took part in five wars: the US intrusion into Panama (1989), the war in the Persian Gulf (1991), Operation Desert Fox (1998), NATO’s war against the former Yugoslavia (1999) and the Iraq war (2003).

At least one F-117 aircraft was lost in a sortie in the former Yugoslavia: the stealth plane was shot down by the Yugoslav air defense forces from the outdated Soviet anti-aircraft missile system S-125 Neva.



US F-22 Raptor fighter jet

The **US F-22A Raptor** is the first and the sole fifth-generation aircraft so far that has been accepted for service.

The F-22 Raptor production started in 2001. At present, several F-22 aircraft are taking part in the operation of the US-led coalition in Iraq to deliver strikes against militants of the Islamic State terrorist organization.

As of today, the Raptor is the world’s most expensive fighter jet. According to open data, the cost of each F-22 aircraft ordered by the US Air Force exceeds \$300 million, taking into account the expenses on its development and other factors.

Nevertheless, the F-22A boasts the possibility of a supersonic flight with a turned-off afterburner, powerful airborne avionics and again, low visibility.

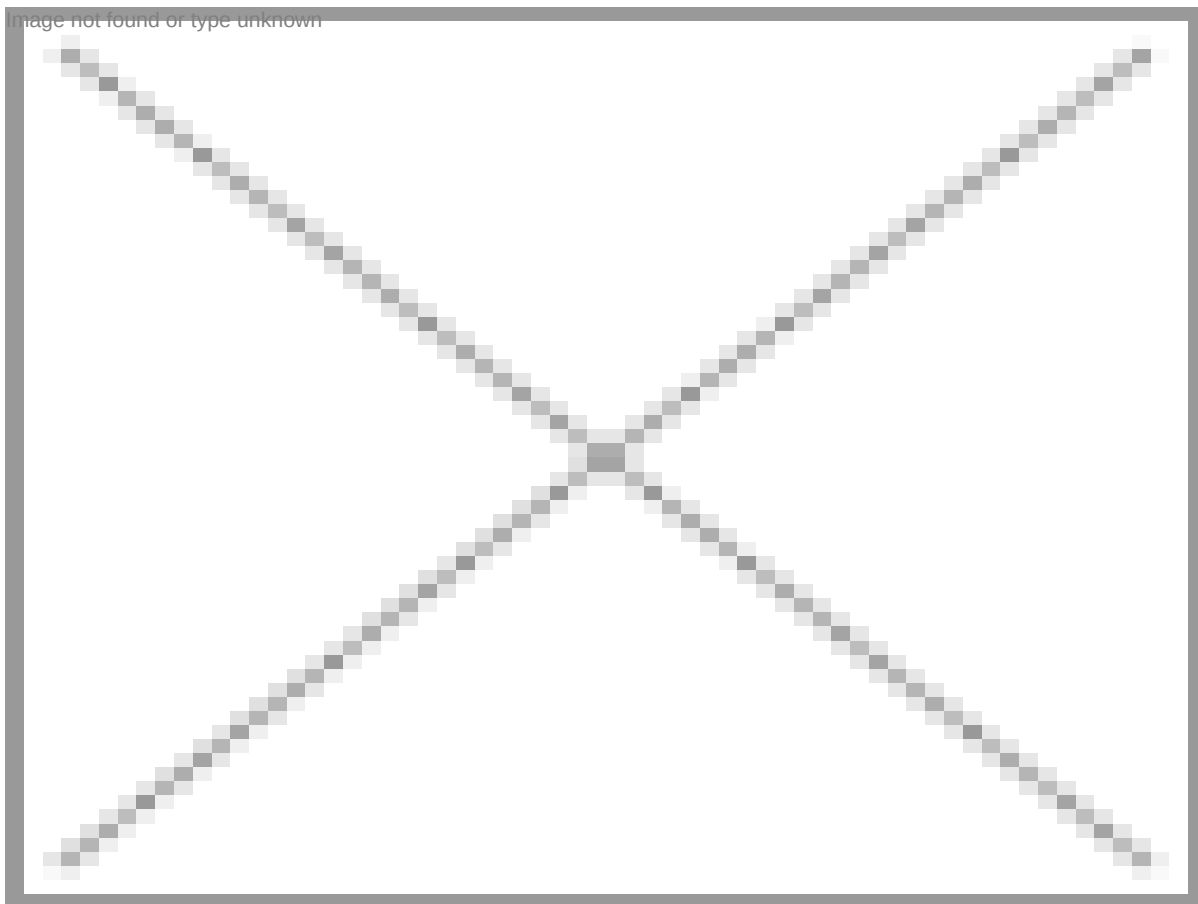
However, the F-22 is inferior even to many Russian fourth-generation fighter aircraft by its maneuverability.

The F-22's thrust vector changes only in one plane (up and down) whereas the most advanced Russian aircraft have the thrust vector that can change in all planes and, what's more, independently from each other on the right and left engines.

There are no exact data on the F-22's RCS: it varies from 0.3 to 0.0001 sq. m., according to various sources. The data of Russian specialists suggest that the F-22A's RCS ranges between 0.5 and 0.1 sq. m. while the radar Irbis mounted on the Sukhoi Su-35S fighter jet can detect the Raptor at a distance of no less than 95 km.

The highly costly Raptor also has some problems in its operation. In particular, the fighter jet's anti-radar coating could be easily washed out by the rain. This fault was eventually eliminated but the plane's price increased even more.

The pilot's oxygen supply system is another serious drawback of the F-22 aircraft. Pilot Jeffrey Haney lost control of his fighter jet over suffocation and crashed in 2010. After that, all F-22A fighter jets were prohibited from 2011 to climb above 7,600 meters. It was believed that at this altitude the pilot would be able to descend to 5,400 meters upon the first signs of suffocation to take off the oxygen mask and breathe in the air in the cockpit. It turned out that the problem was caused by a design defect: carbon dioxide from the engines' work could get into the pilot's breathing system. Attempts were made to resolve the problem with the help of additional charcoal filters. But the drawback has not been completely removed up to date.



US F-35 Lightning fighter jet

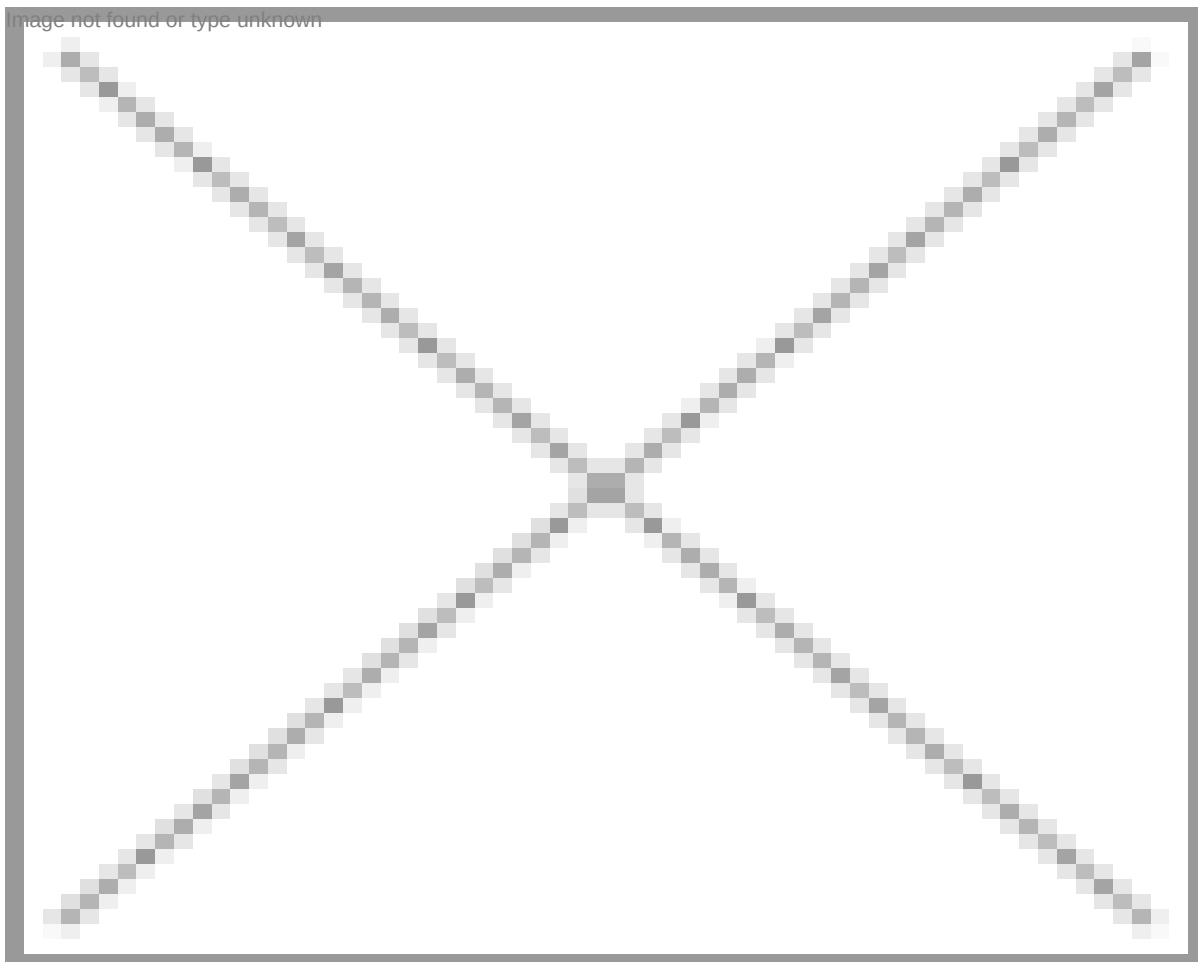
The US **F-35 Lightning II** was perceived as a multi-purpose aircraft for the US Armed Forces and NATO allies capable of replacing the F-16 fighter jet, the A-10 attack aircraft, the McDonnell Douglas AV-8B Harrier II vertical take-off and landing assault plane and the McDonnell Douglas F/A 18 Hornet shipborne fighter-bomber. Huge funds were spent on developing this fifth-generation fighter-bomber (expenditures exceeded \$56 billion while the cost of one plane amounted to \$108 million) but all the same the developers failed to bring the warplane to perfection.

Analysts note that the systems of enemy radar suppression mounted on the F-35 aircraft cannot accomplish their task in full. As a result, this may require the development of a separate plane designed to suppress the enemy radar systems to ensure F-35 fighter jets' invisibility.

Therefore, experts throw into question the expediency of the Pentagon's multi-billion-dollar expenditures on the F-35 aircraft development.

Some US media sources also note that the F-35 largely fails to meet the requirements set to fifth-generation aircraft: the "Lightning" is distinguished by the low thrust/weight, survivability and maneuverability characteristics and can't perform supersonic flights without an afterburner.

The fighter jet can be easily detected by radar systems operating in super-high frequencies while its RCS has turned out to be larger than was stated in its performance characteristics. Nonetheless, according to the existing tradition, foreign publications estimate the F-35's RCS at 0.001 sq. m., depending on the angle of observation. In the estimates of many specialists, including Western experts, the F-35 is considerably inferior to the F-22 by its RCS characteristics.



Russia's T-50 stealth aircraft

Russian specialists have incorporated some stealth elements in such aircraft as the Sukhoi **Su-34 fighter-bomber**, the Mikoyan **MiG-35 light frontline fighter** aircraft and the **Su-35S heavy fighter jet**.

However, the stealth technology will be fully implemented in the **PAK FA T-50 heavy multi-purpose fighter jet** and the **PAK DA long-range strategic bomber**.

The T-50 (the Promising Aviation Complex of Frontline Aviation abbreviated as PAK FA in Russian) is Russia's response to the US F-22 fifth-generation fighter jet.

The T-50 aircraft is the quintessence of all advanced technologies in Russia's aircraft-building. Little is known about its characteristics and the larger part of information is kept in secret so far.

It is known that the PAK FA incorporates a whole range of carbon fiber reinforced polymers for the first time ever. They are twice as lighter as aluminum of comparable strength and titanium and four or five times lighter than steel. The new materials make up 70% of the fighter jet's coating, which has allowed developers to reduce its design weight: the T-50 weighs four times less than an aircraft made of traditional materials.

The Sukhoi Design Bureau notes "the aircraft's unprecedentedly low radar, optical and infrared visibility," although domestic specialists have quite restrained estimates of the jet's RCS at 0.3-0.4 sq. m. Meanwhile, some Western analysts make more optimistic estimates about the Russian T-50 aircraft and consider its RCS to be three times less at about 0.1 sq. m.

The real data of the PAK FA's RCS are classified.

The T-50 is distinguished by a high level of its intellectualization. The aircraft's radar with an active phased antenna array produced by the Tikhomirov design bureau can detect targets at a distance of over 400 km (248.5 miles) and simultaneously track up to 60 and hit 16 targets. The minimum RCS of tracked targets is 0.01 sq. m.

The engines are placed wide apart, which has allowed the developers to increase thrust vectoring during maneuvers and make a spacious weapons compartment capable of carrying heavy weaponry that can't be placed on the F-35 Lightning II due to its size.

The PAK FA is distinguished by its splendid maneuverability and controllability in the vertical and horizontal planes both in supersonic and low-speed flights.

Currently, engines of the first stage are mounted on the T-50 aircraft, which enable it to maintain a supersonic speed in a non-afterburning mode. After the fighter jet receives its organic engine of the second stage, its performance characteristics will improve considerably.

The T-50 performed its first flight on January 29, 2010. The serial deliveries of PAK FA fighter jets to the Russian Armed Forces are expected to begin in 2017 and the troops are planned to receive 55 fifth-generation fighter aircraft before 2020.

Chinese J-20 Mighty Dragon fighter jet

The Chinese **Chengdu J-20 “Mighty Dragon”** is a fighter jet referred to the fourth generation under China’s classification and the fifth generation under the Western category system. The aircraft performed its test flight in 2011. The J-20 fighter jet is expected to become operational in 2017-2019.

Some media sources have reported that the Russian-made AL-31FN engines are mounted on the J-20 and the Chinese Army has purchased decommissioned engines of this type in large numbers.

Most of J-20 performance characteristics are kept in secret. The fighter jet features a large number of elements similar to or fully copied from the Russian-made Mikoyan MiG 1.44 technology demonstrator plane and the US F-22 and F-35 fifth-generation fighter aircraft.

The aircraft has the canard configuration: it features a pair of ventral fins and the closely spaced engines (similar to the MiG 1.44), while the canopy and the nose are identical to the same elements on the F-22 aircraft.

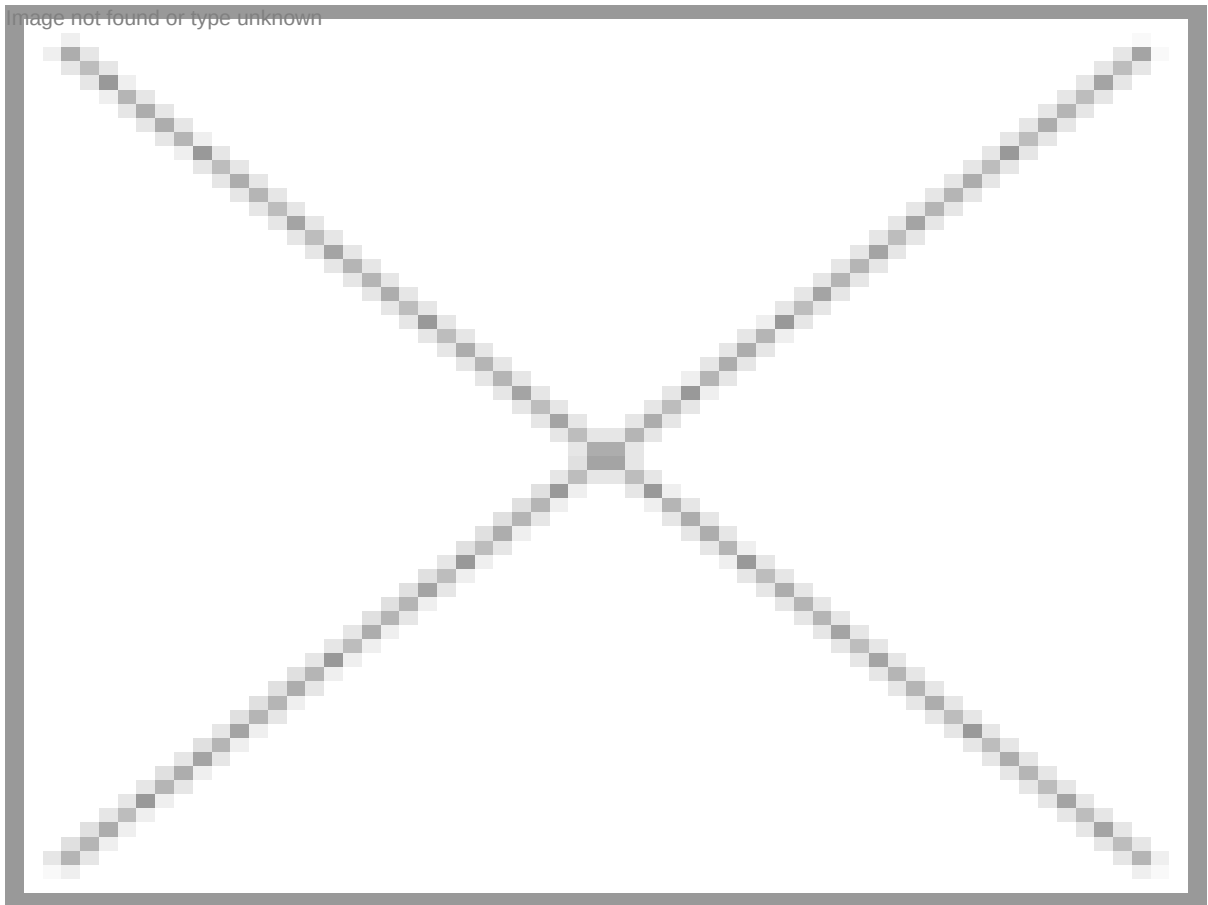
The air inlets are arranged similar to the air intakes on the F-22 plane. The J-20 has an all-moving vertical stabilizer and the geometry similar to the F-35 fighter jet’s fin.



Japanese X-2 "Spirit of the Heart" fighter jet

The **Mitsubishi X-2 (ATD-X) Shinshin** ("Spirit of the Heart") is the prototype of Japan's fifth-generation stealth fighter jet. The aircraft was designed by the Japanese Defense Ministry's Technical Research and Development Institute and built by the corporation that had produced the famous Zero fighter jets during World War Two. The fighter jet has received the poetic name Shinshin, which means the Spirit of the Heart. The ATD-X is close to the Swedish Saab Gripen multi-purpose fighter jet by its size and to the US F-22 Raptor by its shape. The vertical fin size and slope, the shape of the wing extension and air inlets are identical to the elements on the US fifth-generation fighter jet. The cost of the X-2 aircraft may be as high as about \$324 million.

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