GENERATIONS APART

Fifth generation is the latest cohort for fighters, but the sixth generation may look more like the fourth with one important ingredient missing

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Fighter aircraft have flown for more than 100 years and in that time their evolution, from fabric-covered biplanes with machine guns timed to fire between the propellers to radar-absorbing platforms launching hypersonic missiles, has been defined into a series of generations.

GENERATION ZERO: JET ENGINES ARRIVE

At the end of World War Two, the jet-powered fighter arrived in the form of the Messerschmitt Me 262 Schwalbe, which means Swallow, and the United Kingdom's Gloster Meteor. The former intercepted Allied forces' bombers and the latter, the Fieseler Fi 103, V-1 flying bomb, known by the British as the Doodlebug. Post-World War Two, jet-powered fighters included in this zero generation are the Lockheed F-80 Shooting Star and the Republic F-84 Thunderjet.

Dayton, Ohio: Messerschmitt Me 262A at the National Museum of the United States Air Force US Air Force photo

FIRST GENERATION: JET FIGHTERS FIGHT

In the post-World War Two period, jet engine technology was adopted in the US, UK, other European countries and the Soviet Union. Deemed the first generation, these jet-powered fighters included the Messerschmitt Me 262 Schwalbe and the Gloster Meteor, but it is the fighters of the war over Korea that are firmly part of this cohort. The Republic F-84 Thunderjet is among them, as it saw a great deal of action over Korea. Also featured in the first generation are the North American F-86 Sabre and the North American F-100 Super Sabre. While the Soviet-backed forces flew the Mikoyan Gurevich MiG-9 and the Yakovlev Design Bureau Yak-15 in the Korean conflict.

A North American F-100F Super Sabre that is held in the collection of the National Museum of the United States Air Force in Dayton, Ohio US Air Force photo

SECOND GENERATION: AIR-TO-AIR MISSILES MAKE THE DIFFERENCE

While the zero and first generations overlap and stretch to 1955, the second generation covers just five years. This period is marked by the first guided air-to-air missiles and interceptors. In the US, the Century Series of fighters, so called because all the aircraft designations were 100 and above, included the Convair F-102A, Convair F-106A Delta Dart, McDonnell F-101 Voodoo and the Republic F-105A/B and North American F-107A fighter bombers. The F-100 Super Sabre, the first Western supersonic fighter, was also included in this series.

The Century Series requirements were for bomber interceptors capable of a speed of Mach 1.3, a maximum altitude of 60,000 feet and a combat radius of 375 nautical miles. They also had to be able to fire 2.75-inch rockets and MX-904 Falcon missiles. The Soviets had the Mikoyan Gurevich MiG-15, the supersonic MiG-17, the MiG-19 and MiG-21.

The Mikoyan Gurevich design bureau produced more than 9,000 MiG-21s in as many as 32 versions for the Soviet Air Force. While it came after 1960, Virginia-based defense database GlobalSecurity.org includes the MiG-23 in this second generation.

THIRD GENERATION: MULTI-ROLE ARRIVES

Extending over the 1960s, it was the decade of the faster, more capable platform and the emergence of the multi-role, third-generation fighter-bomber and tactical bomber.

The North American F-107A was a fighter-bomber, while the Mikoyan Gurevich MiG-23 had a ground attack capability. According to Virginia-based defense database GlobalSecurity.org, third-generation aircraft provided more capability, "especially if they [had] gone through extensive modifications since they were built," and it includes the MiG-21 and MiG-23 in this generation. They are also featured in the second generation. The third-generation Soviet fighters incorporated the MiG-25, which had a speed of Mach 3, and the Sukhoi Design Bureau Su-24 tactical bomber.

The United States had the McDonnell Douglas F-4 Phantom, which started active service in 1963, and the Ling-Temco-Vought A-7 Corsair II, which

The third generation McDonnell Douglas F-4 Phantom II flies over USAF Holloman Air Force Base United States Air Force

became operational in 1968. Western European aircraft designated as third generation included the Dassault Mirage III, Dassault Mirage 5 and Panavia Tornado. The Mirage 5 entered service with the French Air Force in 1969, while the Tornado did not begin its active life until 1979; nonetheless it is included in the third generation.

FOURTH GENERATION: MULTI-ROLE COMES OF AGE

The third-generation F-15 Eagle firing an AIM-7 Sparrow medium-range air-to-air missile during a Combat Archer air-to-air weapons system evaluation program mission
United States Air Force. Master Sgt. Michael Ammons

Spanning 20 years, the fourth generation covers 1970 to 1990 and saw the continuation of the multi-role trend for fighters equipped with more advanced avionics and missiles.

Maneuverability also came to the fore, with the Lockheed Martin F-16 Fighting Falcon being a notable example. The McDonnell Douglas F-15 Eagle was designed as an all-weather, maneuverable, tactical fighter designed to penetrate enemy defense and achieve air supremacy. The Grumman F-14 Tomcat was intended to engage Soviet high-altitude bombers from beyond visual range and the Tomcat would use its long-range AIM-54 Phoenix air-to-air missiles to engage multiple hostiles more than 90 miles away. Both the F-14 and F-15 entered service in the early 1970s. The F-16, designed for air-to-air combat and surface attack, was operational at the end of the 1970s.

The McDonnell Douglas F/A-18 Hornet also arrived at the end of the 1970s and is primarily an aircraft carrier-based fighter. Its roles have been an all-weather attack aircraft used primarily as a fighter escort and for fleet air defense. For attack it is used for force projection, interdiction, and close and deep air support.

The Soviet Union's Sukhoi Su-27 and Mikoyan Gurevich MiG-29 both entered service in the 1980s. The Su-27 has a fly-by-wire control system for its high maneuverability and it can carry ten missiles. According to the Federation of American Scientists, the Su-27 is akin to the F-14 and F-15, while the MiG-29 is compared to the F-15, but also the F-16 and F/A-18. The MiG-29 has a helmet-mounted system that allows a missile to follow the line of sight of the pilot, a capability which the US military did not have at the time. Russia also has its United Aircraft Corporation MiG-35, which the manufacturer describes as generation "4++". Defense database GlobalSecurity.org director John Pike describes such terms as, "marketing".

For Europe, the Dassault Mirage 2000 is included as a fourth-generation fighter. It started life in the French Air Force in 1984. An air defense fighter, its top speed is more than Mach 2.2. While the Eurofighter Typhoon entered service in 1994, it could also be included as a fourth-generation fighter as it is highly maneuevrable, has advanced avionics and has been compared to the F/A-18.

FIFTH GENERATION: CONNECTED AND STEALTHY

The fifth-generation era lasts from 1990 until 2010. It is defined by advanced avionics systems providing high situational awareness for the pilot and stealth capabilities. The Lockheed Martin F-117 Nighthawk could be included in this generation, even though it was flying in the 1980s.

According to GlobalSecurity.org, the Lockheed Martin F-22 Raptor and F-35 Lightning II were the first fifth-generation fighters. The Raptor is America's first fifth-generation fighter and is an air dominance, multi-role asset. The USAF Operational Test and Evaluation Center completed trials in 2004 and the aircraft went into full production in 2005. The Lockheed Martin F-35 Lightning II is in full production and has entered service with the US Marine Corps, the US Navy, the USAF and a number of foreign air forces. This multirole aircraft is designed to replace the Lockheed Martin F-16 Fighting Falcon, Fairchild Republic A-10 Thunderbolt II, Boeing F/A-18 Hornet, McDonnell Douglas AV-8B Harriers, Hawker Siddeley Harrier GR.7 and BAE Systems Sea Harrier.

In the Russian Federation, the fifth-generation fighter was supposed to be the Sukhoi Su-57, but it had a troubled development and the first operational Su-57 crashed in December 2019 during a test flight just before delivery. China has its Chengdu J-20, of which the Center for Strategic & International Studies stated on its China Power Project website: "The J-20 is believed to be equipped with subsystems and field signature reduction technology that collectively meet the internationally-accepted classification of a 'fifth-generation' aircraft." GlobalSecurity.org's director John Pike explained that the Chinese only talk about four generations because they began with what the West and Russia term the second generation.

On May 12, 2005, Lt Col James Hecker flew over Fort Monroe before delivering the first operational Lockheed Martin F-22A Raptor to the 27th Fighter Squadron at Langley Air Force Base in Virginia
United States Air Force. Tech Sgt Ben Bloker

SIXTH GENERATION: THE FUTURE

The sixth generation is likely to be an unmanned aircraft system, possibly like an attritable loyal wingman design, according to GlobalSecurity.org director, John Pike. This would mean an intelligent drone that fights alongside a piloted aircraft; but whose loss is not deemed significant. The costs of the fifth-generation fighter, in particular the Lockheed Martin F-35 Lightning II, mean that a cheaper expendable platform with stealth characteristics is preferred. In Pike's view, the cheaper platform will be more akin to the fourth-generation fighters, but with one key difference: no pilot. This stealthy sixth-generation unpiloted Lockheed Martin F-16 Fighting Falcon or Boeing F/A-18 Hornet like-platform would go up against the latest surface-to-air missile systems to clear the way for the piloted fifth-generation fighters.

The US military has started working on what it refers to as the Next Generation Air Dominance fighter, but whether it will be piloted, autonomous or optionally-manned is not known. In Europe, there are two next generation programs being developed: the United Kingdom's Tempest and the Franco-German-Spanish Future Combat Air System. A difference with these programs is that they do not discount the prospect of the next generation capability being more than one aircraft. All these programs expect their resulting platform or platforms to enter service in the 2030s.

These broad generation definitions, which have been further detailed with additional information, originated with Virginia-based GlobalSecurity.org, a defense and security online database. The database is accessible by subscription and includes information about all fighter generations. Its director, John Pike, contributed his predictions about what the sixth cohort might look like.