



Foreign

By John A. Tirpak, Senior Editor



Call them generation four-and-a-half—not fifth generation, but getting closer.

Fighters Get **Better**

Check Six: The Air Force has long enjoyed unquestioned dominance in fighters, but new foreign aircraft entering production are faster, longer ranged, have better avionics, and even exhibit a degree of stealth.

FOREIGN air forces will be shrinking during the next two decades, but the aircraft they deploy will be more sophisticated than those they currently possess. They will pose a greater potential danger to US airpower than has been the case since the end of the Cold War, in the view of intelligence experts and industry analysts.

Within 25 years, notes one internal Air Force briefing paper, most of the world's air forces will decline in size by 20 to 30 percent. Savings reaped from the retirement of the older aircraft types and reductions in force structure will generally be applied to buying newer, more capable platforms.

USAF analysts expect to see during this period a sharp global rise in the number of fourth-generation fighters. These aircraft, comparable to Air Force F-15s and F-16s and Navy F-18s, are highly maneuverable and have advanced radars and Beyond-Visual-Range missiles. Already, some 2,500 such fighters—MiG-29s, Mirage 2000s, Tornados, and the like—can be found in active service in about 40 countries, according to the Air Force. A like num-



Two of the most lethal fighters now for sale are the French Rafale (here) and multinational Eurofighter Typhoon (below). Both are superior to the F-15 in many respects and could end up in unfriendly hands.

ber of US-built fighters are in service in about 25 countries.

Swarms

These numbers have become important because US defense strategy calls for the Air Force to fight its wars in the enemy's airspace. It takes time to deploy fighters in large numbers, and the initial squadrons sent to a crisis zone may be outnumbered in the air by a factor of 20. Facing such swarms, and flying against a new generation of advanced, double-digit surface-to-air missiles, Air Force fighters will have to be not merely superior but *far* superior to prevail in the early days of a future conflict.

Even more worrisome than generation four fighters are the aircraft coming just behind. These "fourth-and-a-half" generation aircraft, a quartet of new foreign fighter designs now entering production, are considered significantly more powerful than most of the top aircraft in the US inventory.

The four are Eurofighter's Typhoon, Dassault's Rafale, SAAB's Gripen, and Sukhoi's Su-35/37. They feature, in a limited but real way, some of the characteristics of the Air Force's—and the world's—only fifth-generation fighter, the F-22 Raptor. These traits are supersonic cruise without afterburner, sensor fusion, extreme maneuverability, and stealth. They will have longer range, better situational awareness for the pilot,



and the ability to engage multiple targets at once, along with more capable and jam-resistant weapons.

"Advances in sensor technologies ... provide the enemy with a 'first-look' advantage over US pilots," said the Air Force paper, which referred to airmen flying in current-generation F-15s, F-16s, and F-18s. "Advances in fire control provide the enemy with a 'first-shot' and launch-and-leave capability. Enemy first-look and first-shot capabilities will put US pilots at a deadly disadvantage."

Intelligence analysts stressed that new missiles equipping emerging threat fighters pose just as deadly a

problem, as they can equip older, less advanced aircraft. In large numbers, they could pose a serious problem to US aircraft.

"Many countries will focus on modifying and upgrading versions of proven airframes to accommodate [a] newer generation of air-launched weapons," the Air Force said. These advanced missiles "will be characterized by increased range through ramjet propulsion, more sophisticated motors, helmet-mounted cuing systems, improved seekers, ... and improved counter-countermeasures." Newer missiles, like the Advanced Medium-Range Air-to-Air Missile, will have active-radar seekers, which will allow the pilot to fire, turn around, and run without giving any further guidance to the missile.

Air Force officers say the F-22

will be the only "true" fifth-generation fighter to enter active service during the next 20 years. It was designed to defeat Soviet-built Su-27 and MiG-29 fighters, which began entering service in the 1980s. Outside of the United States, only Russia and China have said they are at work on development of a true fifth-generation fighter. They are not likely to enter service any time soon.

Fighters of the East

Meanwhile, the greatest challenge to USAF in the first quarter of the 21st century probably will come from Russian-built fighter aircraft, chiefly due to their large numbers. The ma-

jority of those fighters won't even be in Russia but rather in the air forces of other nations seeking an inexpensive way to provide some counter to US airpower.

Russia has had great success marketing its front-line fighters—the Su-27 Flanker and its derivatives—to neighboring countries, most notably China and India. Although the transfers so far have been mainly of Russia's most basic Flanker, which is equivalent in capability to the Air Force F-15A of 20 years ago, both countries have struck deals for more-advanced variants that in many key aspects exceed the capabilities of the 1990s-vintage F-15C in service today.

Within a decade, reported a highly placed Pentagon intelligence analyst, "There may be more Flankers in service outside Russia than Russia will be able to put in the air itself." And Su-27 variants sold abroad may be more sophisticated than the ones Russia can afford for its own use, he added.

Russia is selling Flankers for about \$20 million to \$30 million apiece; that is less than half the cost of a new F-15 fighter. Third-party avionics enhancements add up to \$8 million to the cost of each Russian aircraft.

Both China and India will produce Flanker variants under license, and both will enhance the aircraft with some indigenous and imported avionics. India's avionics enhancements will come primarily from France and



Photo by Katsuhiko Tokunaga

The JAS-39 Gripen is Sweden's 21st century fighter. Small and agile, it's easy to fix in the field, has advanced avionics, some stealth, and multirole capability. South Africa will be the first export customer.

Israel, which are providing the head-up display and electronic warfare suite, respectively.

China already has deployed several squadrons of Su-27s. Beijing plans to acquire an additional 200, at least. Two years ago, China ordered 40 Su-30s—a ground attack variant of the Flanker similar in concept to the F-15E. Total cost: some \$1.8 billion. In July, as an adjunct to a new 10-year "friendship pact" between Moscow and Beijing, China placed a new order for about 40 more Su-30s, at a cost of \$2 billion. Russian press reports said the Sukhoi

factory workers would be on overtime fulfilling the deal as quickly as possible.

The parts for these aircraft will be made in Russia, but the aircraft will be assembled in China. Russia will hold back some key elements of the technology, and so the Chinese aircraft at least will have to return to Russia for periodic overhauls. China is not allowed to re-export any of the aircraft that it builds.

India has a similar deal to build the Su-30 under license.

Eagle Equal

According to Air Force intelligence analysts, the Flanker family is equal to the F-15C in maneuverability, radar detection range, and visibility on radar. The Flanker is larger than the F-15 and enjoys an advantage in range because of its internal fuel-carrying capacity. These estimates of the Flanker's capabilities are based on intelligence, statements by Sukhoi representatives, and the firsthand experiences of US, European, and Japanese pilots who have been allowed to fly the aircraft.

All told, there are about 600 air superiority Flankers in service, about 400 of them in Russia. Vietnam operates 12 and has 24 more on order. Belarus, Kazakhstan, and Uzbekistan each have at least a squadron's worth, and Ukraine has about 70. Ethiopia has a handful of secondhand models, and there are unconfirmed reports of transfers to



Russia's effort to sell the Su-27 Flanker and its variants is a success. Hundreds are in service, and India and China are producing their own under license. Performance of the Su-27—this one is Chinese—is on par with the F-15.

Fighter Generations

Photo by Ted W. Van Geffen



MiG-21 Fishbed

Generation 2

Range-only radar
IR missiles



F-4 Phantom II

Generation 3

Pulse radar
All-aspect, depressed-angle BVR
missiles

Photo by Gert Kromhout

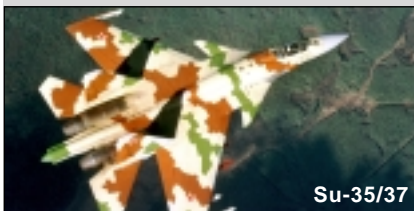


Mirage 2000

Generation 4

Pulse-Doppler radar
High maneuverability
All-aspect, lookdown/shootdown
missiles

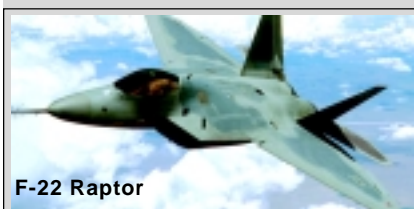
Photo by Katsuhiko Tokunaga



Su-35/37

Generation 4.5

Limited supercruise/maneuverability
Limited sensor fusion
Some stealth



F-22 Raptor

Generation 5

Full integrated avionics
All-aspect stealth
Robust supercruise/maneuverability

Angola and Syria. Yemen is said to be in final negotiations to buy about 24 airplanes.

Russia has decided to build its air force for the next 20 years around the Flanker and its variants and is aggressively marketing the Su-27 family to help defray its own costs. Sales of the aircraft include several types of weapons. The most advanced of these is the AA-12, Russia's answer to the US AIM-120 AMRAAM. India may actually deploy the AA-12 in advance of the Russian air force.

Other potential near-term customers include Iraq and Iran, although a number of Asian Pacific nations have shown high interest. Malaysia is still considered a prospect; Indonesia had placed an order but canceled it, for the moment at least.

Outside of India, Russia, and China, pilot training in the Flanker is "spotty," one industry analyst observed. However, he said, "You can't discount the fact that it [the Flanker] is a world-class airplane. ... A great airplane can make a good pilot out of an average pilot and a great pilot out of a good pilot."

The top version of the Flanker is known variously as Su-35 or Su-37 (Russia has been cagey about the designation). Features include thrust-vectoring nozzles, canards for greater agility, and a more sophisticated sensor and electronic warfare suite. It is capable of extraordinary maneuvers, which include a virtual midair stop,

quick recovery from extreme attitudes, and other tricks that would be hard to deal with in close-in combat. It has an avionics suite to match, employing Russia's best and longest-range missiles. It would likely be able to detect and shoot the F-15 before the F-15 could spot the Su-37 and attack.

Russian Stealth?

The aviation press has buzzed for years with reports about a follow-on to the Flanker, which the Russians have been touting as a direct challenger to the F-22. In this respect, they unveiled two interesting aircraft in the 1990s—the MiG Project 1.44 and the Sukhoi S-37 Berkut.

Russia revealed the MiG 1.44 three years ago. It features thrust-vectoring engine nozzles, but little else about it is very revolutionary. Though advertised as a stealthy aircraft, its appearance suggests low observability wasn't much of a design concern. The company has experienced huge financial problems, particularly with the selection of rival Sukhoi's Flanker series as the centerpiece of the Russian air force, and the 1.44 is considered, at best, a technology demonstrator.

The S-37, a large aircraft with forward-swept wings, has performed interesting flight routines. Its design is considered to be more advanced than that of the 1.44. It appears that low observability was a



Russia's hottest current fighter design is the S-37 Berkut. It's a technology demonstrator—with some stealth, forward-swept wings for extreme agility, and presumed state-of-the-art avionics—moving toward an F-22 challenger.

goal; the engines are concealed somewhat by an overhanging leading-edge extension, and there are opportunities for radar-absorbing materials to be used. There have been rumors that the S-37 will soon be designated the Su-47.

Still, a true, fielded Russian counterpart to the F-22 could be as much as 20 years away, said a top Pentagon official. Even if a program were to be launched immediately, it would still take “about seven years” to construct such an airplane, he said, followed by “12 to 15 years to test and bring it to IOC [Initial Operational Capability].” There’s no indication that the required cash is available. The program “is pretty chaotic,” he added.

China is working on an airplane reminiscent of the F-22 and French Rafale, called the X-X-J or F-12, but



China’s multirole F-10, derived from the canceled Israeli–US Lavi project, is roughly comparable to the F-16 Block 30. China plans to build hundreds to replace its aging inventory of 1950s–70s Russian–designed fighters.



Not much has leaked out about China’s X-X-J, said to be a true fifth-generation fighter on a par with the F-22. It may appear when the F-22 reaches middle age, around 2025. Given China’s growing economic power, maybe sooner.

analysts said it is too soon to even guess when it will fly, let alone enter service. “All our previous estimates of how fast they can develop something have been too generous,” an industry analyst said.

Still, the Chinese are poised to begin production of a significant new airplane, called the F-10. This fighter, which strongly resembles the aborted Israeli–American Lavi project of the 1980s, is expected to replace large quantities of 1960s– and 1970s–vintage MiG-19s and MiG-21s in Chinese service.

The F-10 will be indigenously produced and may even be offered for export once production gears up. It is “an open secret” one analyst said, that Israel has assisted China in the development of the F-10 and that it is in fact based on the canceled Lavi. The airplane will be comparable to the Air Force F-16 Block 30 and should be in service by 2005. Experts think China plans to build about 500 F-10s in its initial version.

Russia is also offering a substantial upgrade to its MiG-29 Fulcrum, which has been exported to over 25

countries. The MiG-29 SMT features a more powerful radar and a deepened “spine” to carry more internal fuel. Fire control is also updated, as are the avionics and displays.

The F-15 was considered superior to the earlier versions of MiG-29s, enjoying an advantage in radar detection and range, if at par in maneuverability and radar cross section. The SMT upgrade will close that gap and make the improved Fulcrum the match of the F-15, the Air Force said. Hundreds of Fulcrums are in service worldwide, particularly in India, Iran, Iraq, North Korea, and the former Soviet states, but it is not yet clear how many Fulcrum operators will sign up for the upgrade.

Older fighter types such as the MiG-21 will also pose a threat in the near future. Upgrades are being offered by Russia and Israel to equip the MiG-21—a second-generation fighter—with modern fire control and Beyond-Visual-Range missiles with active-radar seekers.

“Inferior aircraft armed with superior missiles may be able to defeat US aircraft carrying current generation missiles,” the Air Force said in its briefing paper.

Fighters of the West

The Eurofighter Typhoon, which is expected to see operational service in a few years, will easily outstrip the capabilities of the Su-37, as well as the F-15, and in fact is con-

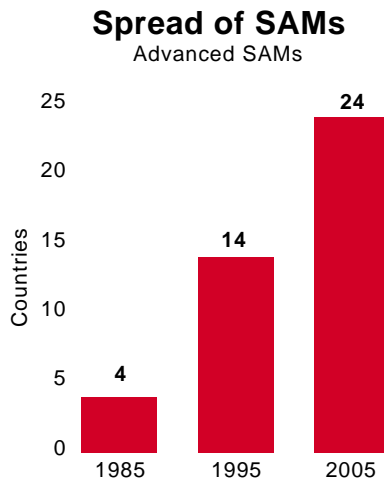
sidered second only to the F-22 in capability. The Air Force regards it as a potential future threat, however, because the English–German–Italian–Spanish consortium building the Typhoon plans to market the airplane widely.

“You never know how politics will change or who could end up with a squadron of very high-performance fighters,” an industry analyst noted.

During the Gulf War, for example, coalition allies had to take care not to accidentally shoot down French Mirage F-1s. The Mirage was a target because Iraq was operating F-1s purchased from France. To prevent fratricide, the French F-1s were always included in a coalition strike package and “never sent out alone,” an Air Force officer involved with planning Gulf War missions reported.

Countries participating in Typhoon ruled out the use of an American engine or radar because they did not want to be bound by US export controls. The Typhoon was designed to carry the AMRAAM, but concerns over its releasability to potential Typhoon customers has spurred the consortium to choose the European-built, ramjet-powered Meteor missile as a near-term replacement for AMRAAM.

Typhoon is more maneuverable and has better radar detection capability than the F-15 and is harder to detect on radar, though it is not considered “stealthy.” Steps have



Source: USAF



been taken to conceal the engine fan blades—a big radar reflector—and coat the air intakes and some leading edges with radar absorbent material. The fighter has canards and digital flight and engine controls and takes advantage of most aerospace state-of-the-art advances through the mid-1990s, when the design was frozen.

The aircraft will have the ability



to operate on shorter runways, and a ground attack capability is being developed for it as well. However, Typhoon was envisioned as an air superiority airplane.

So far, the consortium has lined up no orders outside of the participating nations, a situation that may have a lot to do with Eurofighter’s staggering cost of over \$100 million per copy. A total of 710 Typhoons are on order, to be delivered through 2014, with Germany and the UK the largest operators.

New Customers

Greece has shown keen interest in buying the type, and South Korea is considering it alongside the F-15 in its current competition to choose a new front-line fighter. The US recently told Korea it would not approve integration of South Korea’s substantial inventory of US-made weapons, such as AMRAAM, with the Typhoon or French Rafale if Korea selected one of those aircraft over the F-15.

Saudi Arabia, which bought a large inventory of British Tornado and Hawk aircraft when it was rebuffed from buying top-of-the-line US equipment in the mid-1980s, has requested information on the Typhoon as well. Singapore, the Netherlands,



New, superfast, and extremely agile missiles pose an increased threat. The already potent Typhoon will give up its AMRAAMs for the Meteor, a ramjet-powered, long-range missile with high speed and resistance to countermeasures.

and Australia are also reportedly considering Typhoon.

When France set out to design the Rafale, it originally meant to be a partner with the European nations that wound up building the Typhoon. It withdrew from the Eurofighter project and decided to pursue its own aircraft, partly because it wanted a larger leadership role in the program and partly because it wanted less potential interference with sales. France also saw a good chance of export success because of its track record selling Mirage fighters to nonaligned nations.

The Rafale, built by Dassault, is deemed to be comparable to the Eurofighter in many respects; both have a canard/delta-wing configuration. The Rafale is smaller than the Typhoon and carries less payload but is thought to have equally good avionics and radar and to be somewhat stealthier. It has better range than the Eurofighter but is not quite as agile. Its range of munitions is expansive and they are equal to munitions in USAF. Its radar system can track six targets simultaneously and automatically assign priority. Equal in range and agility to the F-15, it is superior in its radar detection range and stealthiness.

So far, France is the only customer for Rafale and plans to acquire 140 for its air force and about 60 navalized versions for its aircraft carriers through 2012–15. However, US intelligence analysts believe that



Photo by Gert Kromhout

France, which supplied fighters to many nonaligned nations during the Cold War, has positioned itself to help Iraq rearm once sanctions are lifted. It is expected to sell Mirage 2000s, like this one, or the more powerful Rafale.

France has positioned itself to sell Rafale to Iraq, as one said, “as soon as the sanctions are lifted.” The price of one Rafale exceeds \$60 million, not including munitions.

The Swedish Gripen is also a canard/delta configuration. It employs excellent avionics, a degree of low observability, and has performance roughly on par with the F-15, although it is far smaller and lighter. In keeping with Sweden’s strategic plan of operating its aircraft from austere, dispersed airfields, it has been designed for ease of maintenance in the field by draftees with

only a few months’ training. Its small internal fuel supply limits its range, but it can be fitted with sizable external tanks.

Weapons for the Gripen include an impressive array of dogfight missiles and air-to-ground munitions, including anti-ship missiles. These are also available for export.

Sweden has ordered about 200 Gripens, of which about 80 are already in service, with the rest to be delivered through 2007. In a marketing partnership with BAE Systems of the UK, SAAB has logged a single export sale of 28 airplanes to South Africa that will be delivered starting in 2007. Other interested countries include Poland, Hungary, the Czech Republic, Brazil, and the Philippines.

“Overall,” the USAF briefing paper said, “proliferation of both current and developmental advanced airborne weapon systems increases the threat to US airborne operations worldwide,” affecting the ability of the US “to achieve and maintain air superiority.”

Analysts agreed, though, that the Air Force’s rigorous and realistic training gives it the edge against aircraft that are at or near parity with the F-15. “We operate [ours] better,” said one intelligence expert. “That’s the source of our advantage right now.” However, it’s perishable. “If another country could afford to train and fly as we do,” he added, “our edge would be eroded.” ■

Lockheed Martin photo by Kevin Robertson



The only true fifth-generation fighter is the F-22, designed to counter the aircraft now rolling off foreign assembly lines. As new foreign types enter service, USAF faces a window of vulnerability as it slowly trades F-15s for F-22s.