

CLASHING OVER FIGHTERS: WINNERS AND LOSERS

The future market for combat aircraft is likely to be dominated by the US, Russia, and a new player – China. These appear to be the only three countries capable of making the hugely demanding financial and technological leap from the fourth to the fifth generation of combat aircraft. While the competitive position of European players will probably be weakened in the longer term, China is catching up with US and Russian manufacturers. This will also create shifts in the balance of political and military power.



China gains ground: A prototype of the J-20 fifth-generation fighter. Chengdu, China, 5 January 2011.

It was no coincidence that the public presentation of China's fifth-generation fighter prototype coincided with the visit of US Defense Secretary Robert Gates to Beijing earlier this year. This makes China the third country after the US and Russia to reach this development stage. In terms of technology, the Chinese aerospace industry has not yet drawn level with Russian, let alone the US competition, but it is rapidly gaining ground.

The US F-22 is currently the only fully developed and operational fifth-generation combat aircraft. However, the US will be joined within the foreseeable future first by Russia and then by China. US manufacturers, in turn, are already testing a second type of the latest generation. Since the leap from the fourth to the fifth generation is more demanding by orders of magnitude than

the already huge financial and development effort involved in developing combat aircraft, other countries are unlikely to keep pace with the main three powers involved. This will bring changes for the arms industry and the actors involved, not to mention shifts in political and military power.

The high cost of added value

Fighters are jet aircraft developed primarily for air-to-air or air-to-ground combat. They are among the potentially most destabilizing weapons platforms and are not only important defensive weapons, but also permit fast, effective, and long-range attacks. These capabilities can be greatly enhanced by refuelling tankers, electronic warfare systems, and precision-guided munitions. Furthermore, combat aircraft serve as delivery platforms for nuclear weapons with all nuclear powers apart from the UK.

Over the years, combat aircraft have become more and more expensive. The current unit price for modern types varies between US\$40 and US\$100 million. Procurement programmes, which often include expensive contracts for armaments, training, spare parts, maintenance, service, and infrastructure, therefore account for the greatest share of arms expenditures in many countries and create huge burdens on defence budgets. In order to extend the service life of fighter jets after 15 to 20 years, costly upgrade packages are required. The expensive and time-intensive procurement and maintenance of combat aircraft may influence defence policy and doctrine over decades.

This influence is even stronger in the case of proprietary development of combat aircraft. Even though aircraft industries are privately owned in certain states, no military aircraft development programme would be possible without the financial and political support of the respective government. The US began development of the second fighter of a fifth-generation type, the Joint Strike Fighter (JSF) F-35, in the early 1990s. Delivery to the first squadrons is not expected until the middle of this decade. The prospective development and production costs of US\$382 billion for 2'443 units and the expected unit sales price of more than US\$100 million are also extraordinary. In view of this effort, it is doubtful whether many producer and buyer nations will be able to make the transition from the fourth to the fifth generation of combat aircraft.

Combat aircraft in production and development (as of 2010/2011)		
Producing Country	Aircraft type	Status
China	FC-1 (in Pakistan JF-17), J-10, J-11	In production
	J-20	In development/flight testing
France	Rafale	In production
India	Tejas Light Combat Aircraft	In production
Japan	F-2	In production
Pakistan	JF-17 (in China FC-1)	In production
Russia	Su-30MK, Su-34, Su-35, MiG-29SMT	In production
	MiG-35, Su T-50 or PAK-FA	In development/flight testing
Sweden	JAS-39 Gripen	In production
US	F-15E, F-16C/D (and IN), F/A-18E/F,	In production
	F-22	
	F-15SE, F-35	In development/flight testing
Germany/Italy/ Spain/UK	Typhoon (Eurofighter)	In production

■ Fifth-generation combat aircraft

Sources: Jane's Defence Weekly; SIPRI Fact Sheet

Currently, the market is dominated by fourth-generation fighters and their further developments, known as the 4+ and 4++ generations. Fourth-generation types feature pulse-Doppler radar (which is able not only to localise targets, but also to determine their velocity), high manoeuvrability, and look-down/shoot-down missiles. The 4+ and 4++ generations include additional capabilities: high agility, sensor fusion, and reduced signatures; and an active phased-array radar (a radar system with an electronically guided beam), partial stealth capability, and, to some extent, supercruise capability (the ability to fly continuously at supersonic speeds without use of afterburner), respectively.

A fifth-generation fighter aircraft features all-aspect stealth with internal weapons, extreme agility, full-sensor fusion, integrated avionics (the entire suite of electronic communications, navigation, display, and control instruments), and some or full supercruise. These properties reduce the aircraft's vulnerability. Furthermore, the synthesis of data in the cockpit gives the pilot a better overview of the tactical situation in line with the doctrine of network-centric warfare. For the time being, however, the F-22 seems to be only capable of networked operations with others of its type. As far as their operational use is concerned, fifth-generation fighters do not differ from those of the fourth generation. Maintenance is similar, though much more expensive due to stealth technology.

Although fifth-generation fighters do not mark a revolution in military technology, they are clearly superior to their predecessors in terms of capabilities and characteristics and will transform the arms market.

Market transformation

International arms transfers are dominated by sales of fighter aircraft. Between 2005 and 2009, they and the associated weapons accounted for 33 per cent of the overall transfer volume of heavy weapons. Currently, only 12 countries build fighter aircraft. While China, France, India, Japan, Russia, Sweden, and the US develop and build their own types, a consortium consisting of Germany, Italy, Spain, and the UK produces the Eurofighter Typhoon. Pakistan's JF-17 Thunder programme is ultimately controlled by Beijing, as it was co-developed with China and is based on Chinese technology.

The market is dominated by the US and Russia. Their 4+ and 4++ generation aircraft – the various modernised versions of the US F-15, F-16, and F/A-18 and the Russian Su-30MK, Su-35, MiG-29SMT, and MiG-35, respectively – are exported in fairly large quantities. Exports by other producing countries, which primarily supply their own air forces, are comparatively small. In the case of China, this is intentional, since Beijing is aiming to equip the People's Liberation Army Air Force as quickly as possible. However, the Eurofighter consortium as well as France and Sweden would like

to see additional export orders for the Typhoon, the Rafale, and the Gripen in order to recover at least part of the development costs. The situation is especially precarious for France, which has so far failed to sell any Rafale units abroad, despite aggressive marketing. The affordable and simply designed Pakistani JF-17, on the other hand, might prove to be a successful export to poorer countries.

The small group of producing countries is soliciting bids from and supplying a broad range of potential buyer countries. Most of the combat aircraft exported in the past few years have gone to India, the Middle East, China, and several countries in East and Southeast Asia. While China and India are mainly supplied by Russia, other countries such as Israel, the United Arab Emirates, South Korea, or Singapore mainly procure their combat aircraft from the US. Sweden has sold smaller batches of Gripen fighters to the Czech Republic, Hungary, and Thailand in recent years. Germany and the UK have been a little less successful in selling the Eurofighter to Austria and Saudi Arabia. In order to secure orders, the producers are also courting smaller prospective buyers such as Switzerland. However, the most hotly contested markets are currently the procurement programmes of regional powers India and Brazil. Currently, the US F/A-18 Super Hornet and F-16, the French Rafale, the "European" Eurofighter Typhoon, the Russian MiG-35 and the Swedish Gripen are still competing to win the approximately US\$10 billion Indian Medium Multi-Role Combat Aircraft programme. In the Brazilian programme, which is worth an estimated US\$4 billion to US\$7 billion, the F/A-18 Super Hornet, the Rafale, and the Gripen are still in the running. India – the world's largest importer of armaments – and Brazil will probably also remain important buyers of fighter aircraft in the future.

It is questionable, however, whether the Europeans, and especially the French and the Swedes, will be able to assert their current positions as sellers on the market. There is currently no development programme for a fifth-generation fighter in Europe. It is true that the UK, Italy, Denmark, the Netherlands, and Norway – like Australia, Canada, and Turkey – are contributing considerable resources (by their own standards) to the US JSF F-35 project. But with the exception of the British, who are also well represented on the technology side by BAE Systems, they remain of

no consequence to the development of the aircraft. Their participation is mainly aimed at being able to procure the F-35 for their own air forces.

The US is now relying completely on the multirole JSF for the future equipment of its air units while phasing out production of the F-22. Originally, the F-35 was to have been built in separate configurations for the US Air Force, Navy, and Marine Corps, respectively. However, due to technical problems, delays in the test phase, and budget overruns, the plans for an alternative jet engine were discontinued and the development of a short take-off and vertical landing type for the Marine Corps was put on hold. Due to the global financial crisis, other countries such as the UK or the Netherlands have scaled down their planned orders of the aircraft. Nevertheless, the F-35 will be the most powerful combat aircraft of the future. This is why countries such as Israel are stepping up efforts to secure early delivery.

Beside the US, Russia has made the greatest progress in developing a fifth-generation fighter. The fact is that the Russian aircraft industry today is only a shadow of its former Soviet-era self. But for the past few years, Moscow has been undertaking enormous efforts to modernise the air force and is reorganising the partially privatised aviation industry. The development of a fifth-generation combat aircraft already began in the 1990s. Since the beginning of 2010, the prototype, designated the Sukhoi T-50 or PAK-FA, has been undergoing test flights. It has all the attributes of a fifth-generation fighter. However, its precise capabilities remain classified for the time being. India, which is having trouble in aircraft development, has chosen this fighter type for its advancement to the next generation and bought into the PAK-FA project.

Into 2011, China took the world by surprise when it unveiled the prototype of its fifth-generation fighter, the J-20. Beijing has for many years been investing huge sums in the state-controlled aviation industry in order to advance the modernisation of its air force. Until recently, China imported aircraft from Russia or produced licensed or modified versions of Russian models. But in the meantime, with the Chengdu J-10, Beijing has developed its first own modern fighter jet, and with the J-20, it appears to have advanced to the fifth generation. China's quantum leap is

mainly the result of purchasing, reverse-engineering, and further development of Russian technology. In certain areas, such as jet engine technology, there is a degree of dependency on Russia. The J-20, about which little is known, is probably powered by Russian engines. However, since Russia already considers China to be a potential market competitor, export licenses for aviation technology are not always approved. The situation is different in the case of Western states. Despite the Chinese arms embargo, the US and European countries continue to export dual-use technology because it is profitable to do so. Such equipment is probably also used in the J-20.

In all likelihood, the European producer states with their 4+ generation types will continue to assert their market position for a while longer. But they are in serious danger of being displaced sooner or later by the Chinese. They will only be able to prevent this if they join forces by way of consortium, as already seen in the case of the Eurofighter. This would ideally be reinforced by participation of France and Sweden down the line. The chances of such a consortium becoming a reality are questionable, though, since several European states have already committed their shrinking defence resources to the US JSF project. It will also be difficult for them to make up the development shortfall with regard to a fifth-generation fighter type. Only slightly more promising is Anglo-French cooperation. Both nations have significant armament capabilities, and both have declared their willingness to engage in defence and armament cooperation. Joint development of unmanned aerial vehicles is one small, but concrete step in this direction. But against this overall background, it is unlikely that a fifth-generation combat aircraft will be developed in Europe. Whether South Korea and Japan will go beyond the stage of theoretical project development for such an undertaking remains to be seen.

China's advance

The transformation of the market for combat aircraft will also change the political and military balance of power. Since the 1990s, China has reformed and financially strengthened its armaments industry with the goal of building strong and self-sufficiently equipped armed forces. The aviation industry and the air force received preferential treatment in this process. At least in material terms,

the Chinese leadership has been successful. Today, only the US and Russia have a more complete aviation sector that can produce the entire spectrum of military aircraft types. Even if the Chinese have not yet drawn level with the US and Russia, they will continue to catch up through technology imports, reverse engineering, and further development. Although China is currently prioritising equipment of its own air force, it is increasingly discovering export markets as a lucrative source of revenue. In the medium term, Chinese fighter jets will probably compete with 4+ generation types from Europe, Russia, and the US for orders from developing countries. In the longer term, the Chinese might supersede the Europeans in the market, and their – most likely relatively affordable – fifth-generation aircraft will be a significant competitor for the respective US and Russian models and 4++ generation types.

Future competition for orders between Beijing, Washington, and Moscow will be motivated not just by economic, but also by political considerations. Rather like the Cold War, the name of the game is to create mutual dependency between the leading players with those on the 'buy' side. By choosing their source of imports, buyer countries will reveal their geostrategic alignment. And given there will be few suppliers on the market, such political and military dependencies will inevitably increase. At the military strategy level, although a modern and self-sufficient air force will not put China in a position to offset US air superiority in East Asia, it could certainly pose a challenge. This would be in line with Beijing's more offensive anti-access/area-denial defensive strategy. With a view to the Chinese-US rivalry, the laughing third party might be Russia, which – as is currently the case with India – constitutes an alternative source of combat aircraft for buyer states.

Author:
Marco Wyss
wyss@sipo.gess.ethz.ch

Responsible editor:
Daniel Trachsler
sta@sipo.gess.ethz.ch

Translated from German:
Christopher Findlay

Other CSS Analyses / Mailinglist:
www.sta.ethz.ch

German and French versions:
www.ssn.ethz.ch