Fighter Aircraft

The importance of air power in modern military operations is now beyond dispute. New-generation combat aircraft, packed with the latest technologies and armed with modern weapons do not come cheaply but even small numbers provide a versatile and capable force that can be effective for many years. **Anil Pustam** reviews the main combat aircraft types under development or in production.

F/A-22 Raptor

Manufacturer: **Lockheed Martin**
Operators: *Orders placed*

First flown in 1997, the F/A-22 was conceived during the Cold War as an air dominance fighter to replace the F-15 Eagle in the US Air Force. The twin-engined F/A-22 is the first high performance stealth combat aircraft in the world. It has a conventional wing and horizontal tail configuration and twin outward-canted vertical tails, but one concession to stealth is the use of internal weapons bays, the first such use on a new-generation fighter. Designed to be twice as capable as its predecessor, the F/A-22 will have a "first look, first shot, first kill" capability. It will also be the first aircraft to supercruise (able to attain supersonic speeds without the use of afterburners).

Recent attention has focused on the ability to undertake precision air-to-surface attack. Its sensors and systems are well integrated in what the company calls the most advanced mission suite in the world. The intra-flight data link (IFDL) notably will allow information to be transferred among the various aircraft in a flight of F/A-22s without the use of voice communications and will enable the aircraft to share a common picture of the battlefield. The US Air Force has received low rate initial production (LRIP) aircraft for training. Equipping of the first combat unit will begin late this year with initial operational capability (IOC) planned for late 2005.

F/A-18E/F Super Hornet

Manufacturer: **Boeing**
Operators: *USA*

The F/A-18E/F Super Hornet is the latest version of the F/A-18 Hornet strike fighter, earlier models being used by Canada and others. The F/A-18E and F are respectively single and two-seaters. The Super Hornet can perform a wide range of fighter, attack and reconnaissance missions and can also function as an air-to-air tanker. Endurance and payload are greater than for the earlier aircraft. Systems fitted in the Block 1 aircraft include Link 16 Multifunction Information Distribution System and an integrated electronic countermeasures system. Block 2 machines will have a redesigned nose to accommodate modern avionics; new systems include the APG-79 AESA radar, new forward-looking infra red pod (FLIR), mission computer and displays. The AESA is expected to enter service in 2006. Likely future modifications include an advanced targeting forward looking infrared (ATFLIR), JHMCS and upgraded second cockpit. The F/A-18E/F was used operationally for the first time in Operation Iraqi Freedom last year, where it operated from US Navy carriers. Malaysia, already an operator of the F/A-18D, could purchase 12-18 aircraft. Meanwhile Canada, among others, is upgrading its early-generation aircraft with new avionics and systems, which will see them able to use an expanded range of weapons.

F-15E/I/S/K/T Strike Eagle

Manufacturer: **Boeing**
Operators: *USA, Israel, Saudi Arabia*

USAF PHOTO: SSGT GREG L DAVIS

The two-seat, twin-engined F-15E Strike Eagle adds all-weather, day/night attack capability to the air-to-air prowess of the earlier fighter-optimized (single-seat) F-15 models (the F-15 series as a whole boasting a 101-0 air combat record). The F-15E has a safety record unequalled by any other fighter type ever used by the US Air Force. An important Strike Eagle system is the Low Altitude Navigation and Targeting Infrared for Night package. Range is increased by the use of conformal fuel tanks. Israel's F-15Is have some indigenous systems. The ROKAF is to receive forty F-15Ks, the most advanced F-15 yet.

Weapons will include the AMRAAM, Harpoon and SLAM-ER missiles. The Koreans will have the option of upgrading the APG-63(V)1 radar, also used on the E, to an active electronically scanned array model. Other new avionics/systems include an infra red search and track system, electronic warfare (EW) and self-protection suites, real-time capable data links and the Joint Helmet-Mounted Cueing System (JHMCS). Some of this equipment may be retrofitted to US F-15Es.

F-16C/D/E/F Fighting Falcon

Manufacturer: **Lockheed Martin**
Operators: *Bahrain, Egypt, Greece, Israel, Singapore, South Korea, Turkey, USA*

The lightweight multi-role F-16 is the West's most widely used combat aircraft; if A and B variants are included, the F-16 is in service, or on order, in 22 countries. It has a conventional wing and tail but introduced an innovative blend of forebody strakes, underfuselage inlet, blended wing body, and wing/tail control surfaces, the latter linked to a fly-by-wire flight control system. The F-16 has compiled an impressive 71-0 air-to-air combat record while its air attack capability benefits from a wide weapons load. The aircraft further boasts outstanding reliability, maintainability, operational readiness and safety statistics and low operations and support costs. The F-16C/D, the result of the Multinational Staged Improvement Program, was first delivered in 1984. Block 30 aircraft were followed by the night-attack capable Block 40 and the upgraded Block 50 with a more powerful engine. About 650 USAF F-16C/D Block 40/50s are undergoing the Common Configuration Implementation Program upgrade which includes modifications to the computer, new color displays, the JHMCS and Link 16 data link. Israel is receiving 102 F-16Is (Block 52s). The I's modernized cockpit includes moving maps and color displays and the APG-68(V)9 synthetic aperture radar. Integrated EW systems are fitted and the aircraft also features conformal fuel tanks. Chile and Poland are also to receive C/Ds. The most capable F-16 yet is the F-16E/F with at least 70% new structure, an improved cockpit with new main avionics, AESA and integrated forward-looking infra red and targeting system and a modernized EW system. Maximum take-off weight is 50% greater and thrust is boosted by over a third. 80 are going to the UAE, the first flying on Dec. 6. The F-16 is destined to remain in service for at least another three decades.

F-35 Joint Strike Fighter

Manufacturer: **Lockheed Martin**
Operators: *Orders placed*

The F-35 Joint Strike Fighter (JSF) is being developed as a family of aircraft to fulfill a variety of future combat aircraft requirements of the US and British services. There are three versions, the conventional take-off and landing F-35A for the US Air Force; the short take-off and vertical landing F-35B with a vectored thrust engine and lift fan for the US Marine Corps and UK Royal Navy and the carrier-capable (CV) F-35C for the US Navy. These are based on a core design, having more than 80% commonality in structure and with common software.

The F-35, resembling the company's F/A-22 Raptor, is also a stealth aircraft. To an unprecedented extent, the F-35 has been designed to operate in a network-centric environment and can communicate with more than 100 other platforms while systems integration and sensor fusion will allow the pilot to maintain situational awareness. The pilot indeed has become more of a tactician than a system operator. A major recent concern has been weight growth and this will be a focus of this spring's Critical Design Review. Service entry with the US Air Force is planned for 2008. So far, at least 3,002 aircraft are to be built, including aircraft for the US and UK.

The UK has been designated a Level 1 partner, and Australia, Canada, Denmark, Italy, Israel, the Netherlands, Norway, Singapore and Turkey are involved in the development program at lower levels (with smaller investments and correspondingly less design influence). International partners though are concerned about work share and technology transfer agreements.

The F-35 has substantial growth potential and the company is considering further evolution of the design to suit specific customer requirements such as increased range or two aircrew.

JAS 39 Gripen

Manufacturer: **Gripen International (Saab/BAE Systems)**
Operators: *Sweden*

The single-engined delta canard JAS39 Gripen is the first new generation multi-role combat aircraft in the world, the type's maiden flight being in Dec. 1988. The company states that Gripen "is the world's most capable and cost-effective combat aircraft in operation today." Gripen features a high level of systems integration. It has been designed to operate in a network-centric environment boasting advance data links (the Tactical Information Data Link System). Forthcoming improvements include new flight control software (to adapt to systems and weapons requirements of customers), and the Cobra integrated helmet. The Swedish air force began receiving aircraft in 1993 and is preparing Gripen units for deployment on international military operations. South Africa is obtaining different (export) standard models with color displays, aerial refueling capability, NATO-standard identification-friend-or-foe (IFF)/communications systems and weapons and better EW equipment; South African Gripens further will have local systems and use the indigenous R-Darter air-to-air missile (AAM). Hungary is leasing 14 aircraft.

Mirage 2000-5/9

Manufacturer: **Dassault**
Operators: *France, Greece, Qatar, Taiwan, UAE*

The Mirage 2000 is a contemporary of the F-16. It is also a lightweight multi-role fighter and also uses a fly-by-wire flight control system but has a different configuration being a tailless delta. The Mirage 2000-5 is the latest version of the Mirage 2000 series. It benefits from technology developed for the Rafale such as mission computer, the EW system, and customer

options enable the Mirage to approach, and in some cases equal, the systems and capability of the Rafale. The 2000-5 has an RDY-2 multi-role radar with improved air-to-ground capability making this aircraft the most multi-capable of the 2000 family. Weapons include the Mica electromagnetic/infra red AAM and the Storm Shadow/Scalp ASM. The UAE is receiving 32 Mirage 2000-9s, similar to the Mirage 2000-5. These are joining approximately 60 Mirage 5 and earlier model 2000s already in service. The UAE's aircraft will be armed with the Black Shaheen version of the Scalp.

Rafale

Manufacturer: **Dassault**
Operators: *France*

According to Dassault, the Rafale is the first combat aircraft to be designed at the outset for both land- and carrier-based operations. It is destined to eventually replace all combat aircraft in the French forces. Rafale became operational with the French Navy in 1999. Current French Navy aircraft are the air-to-air optimized F1, equipped with the RBE2 electronic scanning array radar. The F2 now under test will introduce an air-to-surface capability with the Scalp EG air-to-surface missile (ASM) and AASM precision-guided bomb while the Mica air-to-air missile will be also be integrated. Systems include the front sector optronics sensor, Link 16 data link and digital database terrain-following. The F2 will join French forces this year for air force IOC in 2005. Multi-role capability will be further expanded with the F3, which will be equipped with 3D terrain-mapping radar and armed with the AM39 Exocet and ASMP missiles. 294 Rafales in total are to join French forces. Most of these will be two-seaters, operations in the last few years having confirmed the utility of including two aircrew. Notably the two cockpits have the same instrumentation. The Rafale will remain in French service to 2040, during which time the type could receive more powerful engines, upgrades to the radar and have the Meteor AAM integrated. The aircraft is a contender for a Singapore fighter requirement, Dassault interestingly inviting Singapore to fund development of a more capable version and in return offering to award work on the aircraft to local industry.

Su-30/35 "Flanker"

Manufacturer: **Sukhoi**
Operators: *China, India, Russia*

The Su-30 is a two-seat fighter developed from the Su-27. It is in service in Russia and India. The Su-30 is primarily an air-to-air machine but air-to-surface capability has been greatly improved in the Su-30MK. The first customer is China, whose aircraft are designated Su-30MKK. Weapons include the R-77 AAM and Kh-59M, Kh-29 and Kh-31P ASMs. India is receiving more capable Su-30MKIs with a triplane configuration (canards, wing and tailplane), thrust vectoring control and new radar (N011M phased array) and systems including some of Israeli origin. Malaysia has ordered the Su-30MKM, a development of the Su-30MKI but without Israeli systems. Sukhoi is upgrading the Russian air force's single-seat Su-27s to the multi-role Su-35 standard (designated Su-27SM). This modification has been developed from the Su-30MKK but with all-Russian systems. New-build Su-27SMs with a more modern airframe are also possible. Indonesia is to obtain a pair of Su-30 trainers (to join two recently acquired Su-27s).

Typhoon

Manufacturer: **Eurofighter**
Operators: *Orders placed*

The Typhoon is a single-seat, twin-engined combat aircraft of delta canard configuration produced by the Eurofighter consortium of UK, German, Italian and Spanish companies. Designed primarily for air superiority, Eurofighter believes that it is the most cost-effective Western-type in the air defense role. Air-to-surface capability though will be improved in later Tranches. Systems include the Captor radar, Infra Red Search & Track, Multiple Image Distrbution System, Defensive Aids SubSystem, and Voice Throttle And Stick. Man-Machine Interfaces were a priority and the design features a high level of systems integration. Emphasis was placed too on survivability, maintenance, reliability and operational availability. Planned service life is 25 years during which growth is possible in precision attack, interoperability, range/endurance survivability and deployability while roles could also be expanded. Deliveries of the first of 620 Typhoons to partner air forces have begun. Austria has also ordered 18 aircraft. Greece may receive 60 Typhoons from the second Tranche with an additional 30 as options.

Other Developments

Other combat aircraft under development are the Indian Light Combat Aircraft (LCA) and the Sino-Pakistani JF-17. Russia's RSK MiG-29 "Fulcrum" is also still available. Lightweight fighters have also been proposed, Korean Aerospace Industries/Lockheed Martin and EADS are offering the A/F-50 and Mako respectively, while the Aero L159A has entered service with the Czech air force. Other than acquiring new aircraft though, air forces could opt to upgrade types already in service, in many cases this can provide cost-effective fighter capability for many more years. FL

Anil Pustam is a military aviation writer and analyst.