

GAME CHANGER



Chengdu Aerospace's FC-1/JF-17

For more than 50 years, the US aerospace industry was the main supplier of inexpensive, lightweight fighter aircraft to nations that needed a multi-role aircraft, usually as a counter to the air force of a nation next door that was flying some model of the famous Mikoyan Design Bureau (MiG) fighter aircraft. There is probably no better case of how the US and the USSR (and later Russia) have consistently developed progressively more technologically advanced fighter aircraft types for export to their respective client states than the balance of air power that the two Super Powers have helped to maintain between Pakistan and India.

In the 1950s, for example, the Pakistan Air Force (PAF) took delivery of 120 North American F-86 Sabre aircraft and 12 F-104 Starfighters that later saw action against the Hunter and MiG-21 and other Soviet-model aircraft flown by the Indian Air Force (IAF). As the years passed, the F-86 gave way to the Northrop F-5 as the primary American export fighter (though not to the PAF) and



One of the two JF-17s at Farnborough on static display.



Wg. Cdr. Khalid, CO No. 26 Squadron PAF briefing VIP visitors at Farnborough.

then finally – beginning in the 1980s - the Lockheed Martin F-16 became the mainstay export fighter for the US and its allies. The PAF received 40 F-16A/B models in the 1980s as a response by the US to the Soviet invasion of Afghanistan and the Islamic republic is now taking delivery of the considerably more advanced F-16C/D Block 52 model.

However, in the present day neither the US nor Russia are able to offer their clients what they had been able to sell for decades: an affordable export fighter.



As the F-16 production line winds down, its swan song appears to be a variant of the aircraft that is offered to the IAF for its massive Medium-Multi Role Combat Aircraft (M-MRCA) tender. This will be some variant of the F-16E/F Block 60 model that is currently operated by the United Arab Emirates (UAE) Air Force that is equipped with an active electronically scanning array (AESA) radar. The price tag is expected to be in the neighbourhood of \$100 million per unit if India selects this aeroplane as winner of the tender.

At the same time, the Russian Aircraft-Building Corporation “MiG” (RSK-MiG) have a modernised version of the MiG-29, which they designate as the MiG-35. This aircraft also has an AESA from the Phazotron radar design bureau, a new complement of avionics, and a new structure that utilises more composites. But, again, the price tag for this aircraft – as well as the cost of operations because it is a twin-engine fighter – puts it out of reach of many potential buyers.

The aeroplane that now seems poised to take over the mantle of the world’s ‘affordable fighter’ for those countries that in the past would have been the preserve of the US and Russia, is China’s Chengdu Aerospace Corporation (CAC) FC-1, more commonly known in the region by its designation when produced under licence by the Pakistan Aeronautical Complex (PAC) in Kamra, the Joint Fighter (JF)-17 Thunder.

At what is advertised as between US \$20-24 million per unit, the JF-17 is

almost three times less expensive than the most reasonably priced western-made aircraft, the Saab JAS-39 Gripen from Sweden. The JAS-39, although having an extremely reasonable under \$4,000 per flight hour in terms of operational cost, is around US \$60 million per unit in terms of its flyaway cost.

The Gripen design mandates this kind of cost because of the advanced systems it has embedded within: an AESA radar, a full-set of modern avionics, the up rated GE F414 jet engine, and one of the most well-engineered cockpits of any fighter aircraft currently in series production. But many of the nations now talking with the PAC about becoming customers for the JF-17 do not require (nor can they support) this level of technology. It is an unnecessary expense for countries that do not have the industrial base to be able to absorb and work with these complement of aerospace technologies.

For developing countries looking for an inexpensive solution to their air power needs, the JF-17 is a game changer. It assumes the cost of acquiring a modern-day, lightweight fighter aircraft and reduces it considerably below that of any other option – even used F-16s. It is the type of low-end solution that the western world and the Russians used to have the monopoly on, but can no longer propose.

The 21st Century’s MiG-21

The JF-17 has the possibility to become what several people have dubbed “this century’s MiG-21.” A simple design that can be produced in large numbers, supplied to nations that have modest levels of technological capacity, require ease of maintenance and can be fitted with affordable on-board systems and weapons.

At the same time, the JF-17 offers the PAC – as well as some other potential nations – the ability to significantly enhance their own defence industrial capacity through the creation of a local production line. But, this aeroplane is not to be underestimated by any means. It may be the MiG-21’s modern-day successor, but it is by no means a simple, low-tech package. It may be a weapons platform that is designed to be easy to produce and inexpensive to own, but is entirely capable of fulfilling the mission



Subtle sting in the tail : 'Black Spiders' crest of No. 26 Squadron PAF.

requirements of any modern-day air force.

According to representatives from PAC, the construction of additional facilities to support the JF-17 production has resulted in the creation of a sprawling complex of four factories at the Kamra facility (formerly Campbellpur, an hour or so from Rawalpindi) that goes far beyond its original capacity as just an MRO. “We now call this place *Thunder City*, because it has become a major industrial entity solely dedicated to this programme,” said one of the senior Pakistan programme officers.

The concept that the PAC have for the JF-17 is to use this as a basic platform

that can be exported to multiple countries. The idea is to tailor the aeroplane for other customers, specifically those who do not want the Chinese-designed systems on board their fighters and are looking for another country’s set of hardware.

PAC, of course, has a long way to go before it is anything like the industrial empire that has been created in India in Hindustan Aeronautics Ltd (HAL), but on a smaller scale and in the long term, Pakistan’s aerospace industry wants to be able to pick and choose the systems that are put on board the JF-17s that it builds at its facility - just as the Sukhoi Su-30MKIs built at Nasik for the IAF have a combination of Russian, Indian-

made, French and Israeli hardware in their configuration.

PAC: Technical Independence

While the impression has for a long time been that the PAC were totally dependent upon Chengdu Aerospace to construct any new interfaces and integrate third-party systems onto the JF-17, PAC and Pakistan Air Force (PAF) officials claim to have achieved near-complete technical independence and state that “we have learned how to integrate different avionics and weapons systems onto the JF-17.”

The JF-17 Programme Manager, Air Vice Marshal Mohammed Arif, stated to this writer that the proficiency of his engineering team “extends beyond their ability to work with the Chinese on-board systems and weapons that are part of the JF-17’s original configuration. The long-term objective is for the PAC to produce these aircraft for export to other countries and to be able to tailor the aircraft to the wishes of individual customers.”

“We have learned how to integrate various avionics and weapons systems onto the JF-17 – meaning those from other countries – so once you give a piece of equipment we want put this onto the JF-17 on our own and without Chinese involvement.”

One of the earlier discussions about adding third party hardware onto the JF-17 involved a complement of French-made systems. PAC officials state “there is still active interest in having the set of French hardware for the aircraft – the Thales RC400 radar and MBDA air-to-air missiles for instance – that have been under discussion for some time now.”

The chances of this happening seem to be fairly unlikely, however, given two factors. One is that this is not in the interests of either Thales or MBDA to supply Pakistan with this hardware – given that the Dassault Rafale is one of the bidders in the M-MRCA tender in India. Secondly, the integration of non-Chinese hardware onto the airframe defeats one of the main purposes of the aircraft, which is that it would raise the cost per unit considerably.

For the moment, integration of third-party, non-Chinese equipment onto the aircraft is an option that would primarily be at the request of an export customer. The PAC programme managers are

quite satisfied with the aircraft's present hardware and state that the JF-17's avionics suite, its radar performance and the glass cockpit configuration are "superior to the older-model F-16A/B Block 15 aircraft that the PAF acquired in the 1980s." The latter are some of the oldest model F-16s still in operation and are fitted with the previous generation 'steam gauge' instrument panels.

One of the systems that the PAC designers give high marks to is the China Electronics Technology Corporation (CETC)/Nanjing Research Institute of Electronics Technology (NRIET) KLJ-7 radar set. A PAC programme officer, who is himself a fighter pilot, said that he has had the chance to compare the KLJ-7 with other radars – including the RC 400 from Thales – and said "that the Chinese radar is every bit as capable as its contemporary analogues." This same pilot also stated that performance of the CETC KG300G electronic warfare pod is "very effective" and that "there will be an upgraded version of this pod available from the CETC institute in Chengdu within a year and half."

The two JF-17 aircraft that made their first ever appearance at a western event during the Farnborough International show in July were part of the two aircraft that are involved in the operational testing. The PAF are putting the aircraft through its paces not only to validate it for operational service with the force, but also to clear all of the weapons and external stores.

Thus far, the JF-17 has completed trials dropping of un-guided bombs and test firings of the Luoyang Electro-Optical Technology Development Center (LOEC) Pi Li (PL)-5EII infrared air-to-air missile (AAM). China's answer to the Russian Vympel RVV-AE, the LOEC Shan Dian (SD)-10, which is an active radar-homing, medium range AAM, is in integration trials and should be cleared for the aircraft before the end of the year.

Engine Options

Just prior to Farnborough in July, the Moscow daily newspaper *Kommersant* reported that the Sukhoi and RSK-MiG General Director, Mikhail Pogosian, wrote an official letter to the Russian Federal Service for Military-Technical Cooperation (FSVTS) and the Russian state arms export monopoly, Rosoboronexport, opposing



Chinese-origin weapons and hardware on display with JF-17.

delivery of the next tranche of 100 Klimov RD-93 engines to China. These two organisations are the controlling agencies for all arms exports from Russia.

The RD-93 engine is powerplant for the JF-17 both for the Pakistan Air Force (PAF) and the Chinese variant of the aircraft, the FC-1. So far, this aircraft has been "export-only" product from China and is not in service with the Chinese People's Liberation Army Air Force (PLAAF). Pogosian is objecting to continuing deliveries of the engine to CAC in Chengdu on the grounds that re-export of the engine in the form of Chinese FC-1 sales to third countries is harming the market prospects for Russian fighters. The contract for the export of these next 100 engines remained unsigned for a short period of time, but the impasse was later broken and the deliveries to China have now resumed.

Pogosian's rationale for opposing the RD-93 deliveries was that MiG have interests in trying to either make new sales or sign follow-on orders of the MiG-29 to existing or potential customers in Egypt, Algeria, Bangladesh, Nigeria and others. The possibility of a sale to Egypt of MiG-29 aircraft has been mentioned several times. More recent details are emerging that Russia would be willing to sell these aircraft at "trade-in" prices in exchange for receiving back some of the MiG-21s that the Egyptians have been flying for decades.

The RD-93 is a specially-configured variant of the MiG-29's RD-33 that is

optimised for a single-engine aircraft. This version of the engine was originally conceived in the early 1990s as a option for upgrading older-model MiG-21 aircraft. A similar model of the engine, the SMR-95, was also developed in the same time frame for use in the South African Super Mirage F.1s and Super Cheetah D-2 aircraft. In both configurations the gearbox and other components of the accessory pack are rotated from the top (where they are positioned on the standard RD-33) to the bottom of the engine casing.

The first batch of 100 RD-93s were sold to China in 2005 for US\$237 million. There was an agreement in principle for China to purchase up to 500 of these engines. The Chinese had also stated an interest in purchasing up to 1000 units of a modernised RD-93 that would have increased thrust up to nine metric tons and possibly also a thrust vector control module. With all potential sale and options added in, the business of selling RD-93s to China has had a potential value of up to US\$3.75 billion.

There is some suggestion in Moscow that Pogosian's objections are not genuine and that he realises there is no way to put a halt to this very lucrative business with China. What seems more likely is that by raising these objections on these engines being sold to China for re-export to Pakistan – and the damage that it will do to MiG's market interests – is that he is laying the rationale for where to place blame when the MiG-29 fails to make sale in some of its potential export markets. This includes



Inside Hall 3 at the Farnborough Show, 2010.

the possibility of using these RD-93 sales as an excuse for why the MiG-35 will fail to win in the M-MRCA competition.

But, while the discussions with Russia are ongoing, the PAC are looking at other options. Arif, the programme manager, stated that these extend beyond just a Chinese engine, which has been the direction that the PAC was assumed to be heading in. A version of the Mirage 2000's SNECMA M-53 had been mentioned as possibility and PAC officials also stated that they would be interested in looking at the US-made GE F414 or an EJ200. Arif said that he and his team would be ready to look at putting the F414 into the aircraft "as soon as the US is willing to sell us the engine."

The better bet, however, is the Chinese-built WS-13 engine. This is an option that

the Chinese prefer because it would free them from reliance on the Russians (for the RD-93) – or from anyone else. The WS-13 was reportedly certified by the Chinese in 2007, has been in production since 2009 and is currently undergoing flight tests on an FC-1. It is rated at having up to 10 per cent more thrust than the RD-93, with a more advanced version of up to 10 metric tons of thrust now in development. A series-produced FC-1 or JF-17 fitted with the WS-13 could appear within the next 2 years. (A Russian 10-tonne engine in this class, which had in the past been referred to as the RD-43, is stated to have been in development for some time but has not yet officially been declared to be a live programme.)

Officially, however, the Pakistanis are not talking about replacing the RD-93



The joint PAC-Catic stand at the Farnborough Air Show, 2010.

anytime soon. Arif stated that the Chinese engine "needs time to mature, and it could be 5 years or more before it is ready." Other Pakistan programme officials were careful to not contradict their boss, but state that "he is giving the worst-case scenario and in reality the engine could be ready much sooner."

End Game: Export Strategy and Technology Transfer

The JF-17 itself is an impressive-looking aeroplane. It looks nothing like the more crudely assembled MiG-29s of the 1980s or other previous-generation Chinese aircraft. It looks like a high-technology product that has been developed with state-of-the-art machinery. The aircraft also is designed to carry an entire complement of modern weaponry, which includes the AAMs mentioned above, plus the LOEC LS-6 Glide Bomb precision-guided weapon, the WMD-7 Targeting Pod, and the China Precision Machinery Import-Export Corporation (CPMIEC) C-802A Anti-Ship Missile.

With Pakistan being the production centre for the JF-17, China is now able to reach markets with this aircraft that would have been difficult – if not impossible – if the aircraft were only produced at Aircraft Plant No. 132 in Chengdu. Furthermore, it is entirely possible that Pakistan will not end up being the only country outside of China to ultimately have a JF-17 production line.

The aircraft, aside from being like the MiG-21 in that it will end up being produced in several countries, is also a vehicle for attaching certain nations to the Chinese defence industrial base. It sets the stage for a series of potential alliances and trade arrangements that will assure China's access to the raw materials and other strategic access it is seeking in African and Asian nations.

The JF-17 also provides for a considerable level of technology transfer for those nations that will end up using it as one of their mainstay combat aircraft. "The cost-performance trade-off ratio for the JF-17 is exceptionally good," said Arif, "considering what you get at this price." He is correct in that there is no other aircraft in the world that offers this level of performance for such a reasonable price.

The good news for India is that Pakistan does not have endless resources,

and there is little chance that the JF-17 will be built in the kind of numbers where it could numerically mount a challenge to the IAF. “We are a poor country,” said Arif when I spoke with him about the long-term plans for the programme. “Sometimes we are literally living hand-to-mouth and so we have to be very careful about our resources.”

With this in mind, Pakistan has a long-term goal to have a ‘high-low’ mix of fighters with the newer-model F-16C/D Block 52 aircraft that they are receiving from the US as the upper tier of their force and the JF-17 on the lower tier. This creates a “trade-off” situation, said Arif. “We can employ fewer total numbers of fighters if we have more F-16C/Ds. For each one of these newer F-16s we have, we can delete 3 or 4 JF-17s from the force mix.”

This leaves the Thunder City complex at Kamra as one where the main emphasis may become production for third countries that are more inclined to work with Pakistan – either for political reasons or because it is an Islamic state. In the long-term the technology transfer to Pakistan is considerable and the transformation of the Kamra-based PAC complex into a fully-functional production and integration centre for the JF-17 will fundamentally shift the balance of power in the region.

More significantly, when interviewing Air Chief Marshal Rao Qamar Suleman, CAS of the PAF at Farnborough, he was clear that his country’s cooperation with China is likely to increase. In response to questions about the possible acquisition of the other famous Chengdu product, the Jian-10 (J-10) fighter, he stated the JF-17 “is not the last Chinese aircraft that we are going to buy.” Pakistan officials have repeatedly talked about procuring this aircraft, which they have designated in the past as the ‘FC-20’.

His statement has two possible implications for India and IAF force structure planning. One is that the F-16C/D acquisition may be more of a stop-gap measure in the long run, with the J-10/FC-20 being the longer term answer to the top-end of the two-tiered fighter force. This would mean a Pakistan force that is totally independent of the US and immune from any embargoes on spare parts or other technical assistance from the US.

At the same time, one cannot but think about the long-term implications



Smartly laid out: glass cockpit of the JF-17.

that this has on the Indian decision in the M-MRCA programme. There have been a number of assertions that the tender was being run as a window-dressing exercise and that ultimately – for political reasons – the IAF would select a US aeroplane.

However, given the increasing importance – one might almost say dependence – of the US on China and the growing influence of Beijing on overall US foreign policy, perhaps the IAF need to consider what their position might be in any possible future conflict with Pakistan.

If a PAF almost fully backed by China were to be standing off against an IAF equipped with 200 or more US-made fighter aircraft, would Washington adhere to its commitments, or might there be another scenario similar to that now faced by Taiwan in which upgrades of old and purchases of new fighters (in Taiwan’s case this is the F-16) would be held back in order to not antagonise Beijing? The more important Pakistan becomes to the overall fighter export strategy of Chinese aerospace, the more germane this question becomes.

Reuben F. Johnson



The Thunder’s array of weaponry.