

“No one offers the level of capability or price of ‘Thunder’...”



ACR Khalid is the JF-17s programme director . Image: Georg Mader

Pakistan Aeronautical Complex (PAC) Vice-Director and JF-17 sales & marketing manager **ACR Mahmood Khalid** talks to **Georg Mader** for Defence Industry Bulletin; Paris, June 2015.

DIB: *Air Commodore, thank you for receiving us and good to see you again since Dubai 2013. Congratulations also from an aviation point of view, since you've brought three JF-17s here to Paris. As we will discuss later, they have no air-refuelling capability – how did they fly here?*

ACR KHALID: You are most welcome! The three ‘Thunders’ were accompanied here by two C-130, carrying their ground equipment and personnel. The aircraft made six stops en route: one in Pakistan, one in the UAE, two in Saudi Arabia, one in Turkey and one in Italy. There, our Ambassador, Her Excellency Tehmina Janjua, was briefed on the aircraft by Squadron Leader Yasar Mudaasir of 26 Squadron (‘Black Spiders’). The total journey took three days.

DIB: *Who is doing the display demonstrations at the show?*

ACRK: Mainly it will be Squadron Leader Yaser. He is currently leading the new 3rd JF-17 squadron which is at PAF’s ‘Top Gun’-school, or the Combat Commander School

(CCS). With him in the Paris display, we can show some sharper and more aggressive JF-17 manoeuvres than we could in Dubai. We also have Wing Commander Usman Ali. That said, flying display regulations at the Paris Air Show are still very stringent. There’s a maximum altitude of 4,000 feet and a minimum of 500 feet and sector minimas, so we have to keep to those limitations. But our two pilots push the aircraft to its limits. We are not holding back. We want to show the full envelope of the JF-17.

DIB: *Since we last spoke, the first Block of JF-17 – that unique ‘role model’ where an air force is not buying from the industry but producing its own fighter jets – is in operational service. The second Block is in assembly. What is your interim ‘resumé’ on this type? Are you happy with the performance, the avionics, the engine, and so on?*

ACRK: : Yes, the 50 Block-Is are out there. The Block-II’s design is frozen and the first one flew on February 9. But I have to correct you because already four Block-II aircraft have been delivered to the PAF...There

will in fact be a new unit, a fourth squadron of Block IIs. It will be raised within this year, but not with these four airplanes yet. No number or name has yet been decided...All together around 60 airframes have been built, 50 are in operation and the rest are undertaking tests in Pakistan and China. As far as the operational aircraft goes and the whole ‘role-model’ concept, as you called it, we’re really happy with it. Happy with the avionics, including the radar. I can also reveal that this type can be called combat-proven as it has been used over the FATA-areas in western Pakistan, where it has employed both guided and unguided munitions. Also ‘jointness’ on a national level is working okay – the datalink is effective for what you can call a ‘national solution’ and allows an integrated picture from on-board and off-board sensors. Most importantly for Pakistan, ‘Thunder’ provides an F-16- or Gripen C/D-like capability at an affordable cost, which can be locally upgraded or have weapons added, as the PAF decides. Of course, this combination is attractive for many countries all around the world. ➔

DIB: *But for exports, you will need to be able to increase production, right?*

ACRK: We're able to do that. We're going to produce about 20 'Thunders' per year for our PAF, like we did with Block-I. This means that from today on, we will build Block-IIs for about two and half years. But we can then increase production to maybe 25 aircraft per year. As you rightly say, this aircraft is globally marketed – and it is getting serious attention from multiples parties. Therefore it's also my responsibility to fulfil sudden demand. We can never be 'surprised' by an order. So as I said, the infrastructure and the manpower is there for 25 per year. Our air force has certain requirements and other clients have – or will have – those too. Based on them, we are organising production with the suppliers, ordering long-lead items, some parts and the sub- and main-assemblies necessary to be delivered ahead of final assembly.

DIB: *Those suppliers are also fully under the control of Pakistan Aeronautical Complex (PAC) Kamra?*

ACRK: Those that are in Pakistan, yes. But as 42 percent of the JF-17's structure is built at and brought-in from China, and 58 percent in Pakistan, this production-organisation involves our Chinese partners as well. All avionics-integration, final-assembly, all flight-testing is done in Pakistan. Where it concerns suppliers, everything is controlled by or assembled in Kamra.

DIB: *We've heard rumour that the first 50 Block-I airframes will get some retrofitted features from the Block-II?*

ACRK: : That's true. They'll get improved avionics, better software and the air-to-air refuelling-probe. There'll be no other external

differences between I and II, except that we're considering chin stations under the intakes.

DIB: *I'm glad you mentioned the refuelling-probe. Why is this only being added to Block-II later rather than from the beginning?*

ACRK (smiling): You're well informed, as usual! JF-17 will have a South African-sourced in-flight-refuelling system, which is being implemented by integration of a fixed air-refuelling probe on the starboard of the fuselage, slightly behind the cockpit. The airplane is small, so there's no possibility to house it inside. Two aircraft from Block-I are upgraded for flight-testing of the system. The installation on the Block-II aircraft will be conducted from 2016 onwards, with about the 24th or 26th aircraft. Block-II aircraft 09-109 will be used to test it. I expect that earlier aircraft will be subsequently retrofitted with it – even Block-I is a possibility, if so decided. Because the fuel system was designed from the very beginning for air-to-air refuelling, it was a design requirement.



JF-17 cockpit detail . Image: Georg Mader

Maybe a few components need to be strengthened in order to take the loads, but that's all. It will be detachable too. If we don't need it, we can remove it and seal the position. That job can be done in 45 minutes.

DIB: *Earlier you said the current Block-II's design has been frozen, which means it retains the same engine – the RD-93. That further means any discussions on another engine, such as the EJ-200, or of conformal fuel tanks or an AESA radar will have to wait until the Block-III, which already on the horizon. What's currently under consideration?*

ACRK: There is a team at Kamra looking at what's happening in our world and what might be necessary. This includes the likes of HMD, AESA, IRST and the additional chin hardpoints for targeting pods. The currently completed Block-II aircraft has an improved version of the avionics and EW package, as well as the improved KLJ-7 V2 radar. This mechanical radar for the moment remains the same, but it will be replaced by an AESA radar in Block-III. Concerning the engine, right now we're very happy with the RD-93. But if a future customer indicates that they prefer another, more powerful engine, there are provisions from the hardpoints in the engine tunnel to accommodate that.

DIB: *Is it true that among the few JF-17s and FC-1s undertaking testing at China's CATIC or CAC, there's one which already flight-tests with a Chinese-made engine? Which one would that be? A WS-17, I assume, because of the complement name? Or WS-13?*

ACRK: : Yes, there are tests ongoing in China concerning a future engine-option*. We always keep the options open. The best equipment will find its way into the aircraft. The type of engine involved in that will be revealed very soon. ➔

DIB: *Concerning the radar – for an AESA you are depending on foreign suppliers? Chinese, I guess...*

ACRK: Yes, the AESA radar will not be produced indigenously. There is one under development at NRIST [Nanjing Research of Electronic Technology], I think. But the Chinese are just one option we have for this. That's not been decided yet.

DIB: *A question on weapons-integration...I suppose the heavy anti-ship missile C802AK is integrated, while the later CM-400AKG not quite yet. If the aircraft carries it, you need range to go out at sea and therefore you need at least one additional fuel tank. And if it's suspended, you'd need to re-balance the weight...*

ACRK: Yes and no. The C802 is in PAF-squadron-use in the Block-I at No.2 Squadron. Live-firing was done together with CATIC in China. The CM-400 is however integrated, but not contracted. And if we carry a large anti-ship missile, we will carry one or preferably two fuel tanks, with the other one at the centre station. After it's been spent, the automatic flight-control/management system will compensate the changes in loads.

DIB: *So the typical load of the 'Thunder' over the ocean would be one large anti-ship missile or ALCM, one fuel tank on the centre and one on the wing-station, plus self-defence WVR-missiles on the outer station...*

ACRK: Completely right...

DIB: *Let's talk about the upcoming two-seater. AVIC boss Mr. Li has said progress on it is being made. How essential is it?*

ACRK: For us in the PAF, it's not that essential. We've done fine in the operational conversion to the 'Thunder' with the high-fidelity, full-mission simulator at Kamra. It



JF-17 Display at Dubai . Image: Georg Mader

has everything – artificial targets from East and West, et cetera. Our pilots all come to Kamra to train and to keep an 80:20 hour-rate – that's 80 in the air, 20 in the dome. But several potential customers – I cannot tell you who – have asked for it. So the 'JF-17B' will definitely come. In fact, first metal has already been cut for it and it will fly next year.

DIB: *Will that be in China? Will it look different, besides the two cockpits?*

ACRK: In China, yes. I don't think it will look much different, other than with those two cockpits. This is all slaved to the operational capabilities we have to retain. We'll put the second cockpit behind the existing one, so the fuel cell there will be smaller. We're compensating this with fuel in a dorsal-tunnel up to the tailfin.

DIB: *Will this be a two-seater just for training or conversion, or a battle-manager role, UAV-coordinator or something like that...*

ACRK: No, no, just to convert to the type in the customers' squadrons, a few per unit. But not for our air force.

DIB: *And who might these customers' squadrons be? Several other air chiefs I've spoken to have mentioned 'Thunder'. Nigeria, for*

example, where the Air Ops Chief told me JF-17 would be a great decision and the Nigerian ACM has already been briefed at Kamra. You were once interviewed at Belgrade, where we heard rumours of Myanmar, Sri Lanka, Argentina, Egypt and others. Can you provide any update on these campaigns?

ACRK (smiling): Your selection shows that you really have your ears and your heart on the subject! I can confirm that there truly is an agreement signed with our first export-customer. It's in Asia. Other than that, all I can confirm is a high interest or demand from up to 11 nations. No one else offers this level of capability for this price, or without any political strings attached. We prefer not to disclose names yet due to contractual, commercial and other sensitivities. As you know yourself, this is a difficult terrain with many variables and mostly you depend upon what the customer nations allow you to tell. Sometimes it seems that a deal is around the corner, but because of reasons like political instability, early elections or financial troubles, the timelines often end up being pushed back – or collapse entirely. So one is never sure until the contract is inked.

DIB: *But the 'Thunder' today has at least a first export-success inked?*

ACRK: Yes, indeed! ➡

***Mader's Remark 1:** Since 2013 there have been indications that a future JF-17/FC-1 engine might well be the medium-thrust WS-13. Last year, a source at Guizhou Aviation Industry Corporation (the facility most frequently associated with work on WS-13) wrote in a report that: "The modified design-tool method was developed for a general blading design system and its application for the axial/centrifugal compressor of FC-1s Block-III powerplant. According to the similitude theory, at the precondition of the equivalence of converse mass flow and converse revolution speed at the second stage inlet, the increase of the mass flow was growing with the pressure ratio. By CFD computation and analysis, all the performances met the requirement and the design result was perfect. The results show that as the speed of the fan increases 1.1%, the mass flow increases 7.1%, the pressure ratio increases 7.4%, the efficiency increases 2.9% and the stall margin increases 0.8%. Analysis and valuation of the performance and matching characteristic indicate that this design can satisfy the more thrust requirement of the new turbo-

fan engine." This information describes the medium thrust engine in question as having a 4 stage LP compressor. This matches well with the RD-33 configuration of 4/9/1/1 (4 stage LP-compressor/9 stage HP-compressor/1 stage HP-turbine and 1 stage LP-turbine), on which WS-13 is reportedly based. Further the actual increase in mass flow achieved with a new fan closely matches Russian modifications of RD-33** (the 'ancestor of RD-93), using similar methods.

**The Russian RD-33MK (for MiG-35) used a new wide chord fan of identical diameter (similar to the Chinese efforts described above) to achieve a 6% increase in mass flow, along with a new FADEC and improved combustor liner resulting in an engine with 9070kg thrust and 1000 hour TBO. Of the improvements listed here, only an increased mass flow has a significant effect on thrust, FADEC and combustion liner changes improve TBO, reducing smoke and weight (via a lighter control system). Given the Chinese fan design has a higher mass flow increase (7.1% v.s. 6%) and the specific reference of increase in T4

(turbine-inlet) temperature to increase thrust (as oppose to the mere consequence of increased mass flow via air compression), it appears likely that the WS-13 variant aims to have higher thrust increase compared with the RD-33MK, or alternatively greater TBO. A useful reference perhaps is the 9.300kp thrust target of RD-93MA, under development currently for future JF-17 blocks.

At Paris (June 15), the author attended a press conference with AVIC vice-president Li Yuhai and with PAC's ACR Khalid. Li confirmed that "a new Chinese turbofan for the J-17 has completed lab tests and is in flight testing progress". He stated that the new engine would have a thrust slightly larger than the 8.7-ton thrust of the JF-17's current Klimov RD-93 turbofan. It was also confirmed that in 2010 China obtained a Russian commitment to meet a potential requirement of up to 500 RD-93 engines to support the JF-17 programme. This figure would support Pakistan's requirements for up to 275 JF-17s - plus all international exports.

***Mader's Remark 2:** A few days after this conversation took place, it became apparent that there may well be two (Asian) customers for JF-17: Myanmar and Sri Lanka.

In July, Myanmar was confirmed to be a buyer, having ordered 16 jets in the first phase while Pakistan is interested in selling over two dozen jets.



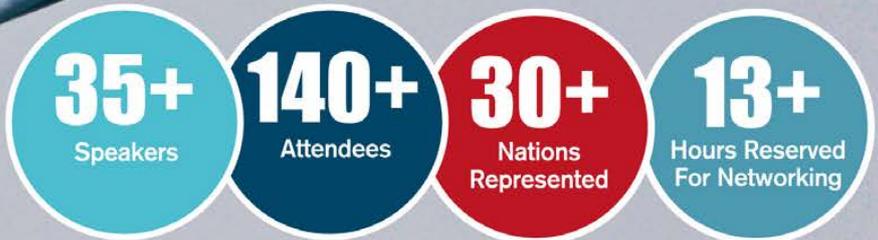
Islamabad: General Khin Aung Myint, Commander-in-Chief (Air) Republic of the Union of Myanmar Air Force, calling on Air Chief Marshal Sohail Aman, Chief of the Air Staff, Pakistan Air Force, at Air Headquarters, Islamabad. (21.05.2015)

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Main Conference Day Two



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