

■ Sukhoi's fifth-generation T-50 features lots of stealthy material shaping to reduce radar cross section. Note also the low-profile undercarriage, which takes up minimal space in the fuselage. However, unlike the Western F-22 and F-35, the T-50 appears to rely mostly on external weapons carriage.



Sukhoi: 1364630

Eastern approaches: Asia's next-generation fighter programmes

Traditional customers of US aircraft are starting to weigh up other options following the cancellation of Raptor production, with Russia and China looking to gain a share of the Asia-Pacific market, writes **Reuben F Johnson**

Ever since the decision by US Secretary of Defense Robert Gates to cancel further production of the Lockheed Martin F-22A Raptor two years ago, the big question on the minds of defence policy makers in Asia is where to turn to fulfil their next-generation tactical air requirements.

Traditional customers of US military aircraft – such as the Republic of Korea Air Force (ROKAF), the Japan Air Self-Defense Force (JASDF) and the Royal Australian Air Force (RAAF) – are all asking themselves if the other Lockheed Martin next-generation aircraft, the F-35 Joint Strike Fighter, can meet the projected adversary aircraft that will be operational in the region in the next decade and beyond.

What is prompting these nations to take a second look at the potential challenges they might face are the current status of Russia's Sukhoi T-50 Future Air System for Tactical Air Forces (PAK-FA) and the Chinese Chengdu Aerospace J-20, both of which are in the early stages of prototype validation.

In the case of the Chengdu aircraft there is still some speculation as to whether or not the aircraft that flew is a true prototype (Y-plane) or just a testbed technology demonstrator (X-plane) that is one step in the direction of a final production-series design. The stage-managed 'surprise' first flight that took place during an official visit by Gates to

Beijing – and the fact that nothing of the J-20 has been seen since – suggests that it is a programme that is not yet mature.

The rest of the world's fighter manufacturers are aggressively marketing their wares to the Asian nations planning the future of their air force inventories. European manufacturers have a definite chance of making inroads into what has previously been US-only territory due to two major factors.

One is that – barring an unforeseen reversal of the Gates decision to cap F-22A production at 187 units – both the Russian and Chinese aerospace industries are almost guaranteed to end up building a two-engine heavy next-generation fighter in far greater numbers than the Raptor. Nations in the Asia-Pacific region have already raised questions as to which type of aircraft currently in production in Europe could be extensively modified in order to meet the challenges posed by the projected operation of J-20 and T-50 fighters by neighbouring states.

The other factor is that the US no longer offers a replacement for the F-15s in service with the ROKAF, JASDF and Republic of Singapore Air Force (RSAF). The US has proposed the F-35 as an aircraft that would eventually take on some of the F-15's missions. However, some Asian defence policy makers have expressed concern that while the smaller, single-engined aircraft is stealthier than the F-15 and embodies some

of the latest technologies, it has limited carriage capability and is a question mark for some of the longer-range missions that their air forces require.

Import v Indigenous

Having been denied its wish to purchase the F-22A and faced with the choice of either the F-35 or another European platform, Japan has been looking at continuing its own indigenous stealth-fighter programme. The other major F-15 operator in the region, South Korea, is considering a 60-aircraft buy of a next-generation fighter that would be developed in conjunction with a foreign partner.

While not a panicked reaction, the responses of Pacific Rim nations to the progress of the Russian T-50 and the emergence of China's J-20 "demonstrate that they have been somewhat shaken out of a long-running complacency – an overall willingness to sit by off to one side and see how various programmes like the F-35 will play out and then decide how they want to proceed with their next procurement", said a defence analyst based in Washington, DC.

"These nations are now starting to take a second look at both the acquisition timelines and replacement requirements of their air forces. The previous 'wait and see' attitude seems to have been displaced by an increased willingness to accelerate their

procurement plans – even if it means taking more of a lead on their own programme or even, like the Japanese, possibly going it alone on their own.”

Numerous defence specialists pointed out to *Jane's* that historically, armed services will use the presence of a programme that is in development in another country as justification for accelerating their own acquisitions or requesting additional funding – or both. However, the same specialists also add that the situation in Asia at the moment is “not like the Cold War where the USSR and the US weapons development initiatives were a back-and-forth, ping-pong type response, when one nation felt compelled to develop a platform that matched the capabilities of some analogue on the other side”.

What has heightened the sense of urgency in Asian military establishments are two conditions that did not exist during the Cold War.

The Warsaw Pact-NATO face-off in Europe was a stalemate between two adversaries whose actions were more or less predictable and the nature of the confrontational stance was largely a stable one. Asia, unfortunately, is a volatile environment in which, for example, what the Kim regime in the Democratic People's Republic of Korea (DPRK) may do tomorrow and how far it will go with its ballistic missile and nuclear weapons programmes is never a certainty.

Complicating this dynamic is the fact that Tokyo feels almost as threatened by the DPRK as the country's southern neighbour. Pyongyang's missile development is seen as being aimed more at Japan than at the ROK in what is a curious case of proxy warfare.

A Japanese analyst with close ties to the JASDF and the intelligence services explained to *Jane's* “that an attack on Japan is seen by the DPRK as an indirect attack on the ROK. Attacking their brethren to the South is not the North's first choice, but they are happy to attack Japan, which is an ally of the ROK and also a nation that the DPRK has a national policy of hostility and long-standing hatred towards”.

Equally disturbing to the planners sitting in defence ministries in some Asian capitals is what they perceive as an erosion of the qualitative edge in air power they have enjoyed for decades. Just as NATO air forces always operated aircraft that could outclass their Soviet counterparts, Chinese and Russian-made fighters in the Asian theatre were usually a generation behind the western aircraft operated by the RAAF, ROKAF, JASDF and others.

However, with the projected initial operating capability (IOC) dates of the T-50 and J-20 this is no longer a given. Examining the range/payload capacity and other aspects of these aircraft, plus the type of on-board systems they are projected to be equipped with, provides a more in-depth understand-

ing of the potential challenge they present to the air-power environment in Asia.

Russia's T-50

Of all of the Asian next-generation fighter programmes in existence the Sukhoi T-50 is the programme that has to be taken most seriously. Despite all of its current-day weaknesses and internal conflicts, Russia's aerospace industry has a long and distinguished tradition of excellence in design techniques and what is still the most experienced cadre of scientific and technical personnel.

The other reason that the T-50 seems to have the best of all possible prospects is the agreement signed in December 2010 during Russian President Dmitri Medvedev's state visit to India, saying that the two nations will develop a two-seat version of the T-50 for the Indian Air Force (IAF) designated as the Fifth-Generation Fighter Aircraft (FGFA).

Russian aerospace analysts are expecting this programme to take the same path as the Sukhoi Su-30MKI, in which “India fronts the money for much of the development costs of the FGFA and this makes the programme economically viable”.

Following the signing of the agreement Konstantin Makiyenko, an analyst with the Centre for the Analysis of Strategies and Technologies (CAST) in Moscow, stated that “if the 29 January [2010 T-50 first test] flight verified the technical viability of the programme, then 21 December secures its commercial and industrial future”.

The December 2010 agreement calls for the funding of the preliminary design stage of the FGFA, for which India will pay US\$295 million. However, if the programme is carried through to its completion both nations will invest approximately US\$6 billion for the SDD and operational testing phases of



■ Sukhoi's prototype of the new T-50 as seen from above.

■ This image of a T-50 and Su-35 illustrates the relatively small planform of the new single seat T-50, as well as its much lower cross-section and profile.



Sukhoi: 1364629

Sukhoi: 1364632

the programme.

However, the T-50 still has to clear several obstacles before it can be considered a true next-generation programme.

The deadline by which the aircraft should begin service in limited numbers with the Russian Air Force (VVS), which has to take place before there can be any export deliveries, in addition to the developmental timelines for the currently non-existent onboard systems, have Russian air-power analysts projecting considerable delays beyond the originally scheduled IOC date.

The programme's original contract calls for 10 aircraft to be delivered by 2015 and then another 60 aircraft to be produced in the 2015-2020 timeframe.

However, some of the same CAST analysts see this plan as unrealistic, primarily due to the nature of the new production technologies and operational methods that will be associated with this aircraft. There is a "high probability" that the T-50's IOC will be delayed, they tell *Jane's*.

The overall assessment by CAST and others is that for the immediate future the workhorse aircraft of the VVS will be the Su-35 Super Flanker. Most projections are that this aircraft will have to be procured in larger numbers than the initial batch of 48 signed for by Russian Prime Minister Vladimir Putin at the MAKS 2009 air show. There is also the real possibility that potential export customers for the T-50 will have to initially satisfy their requirements with some variant of the Su-35.

In order to try and minimise the collateral damage that might be caused in relations with export customers over any extended delays in the T-50's availability, the aircraft will actually be a two-phased programme. Mikhail Leontiyev, a Russian journalist, has done a series of stories on the T-50 revealing some of these details.

In his coverage of the T-50 Sukhoi, officials admitted that the programme will have two distinct and separate phases. In the first phase the aircraft produced will have the Saturn 117S engine – the same model as is installed in the Su-35. Instead of the NIIP-developed AESA radar, these aircraft will be fitted with some variant of the Su-35's passive electronically scanned array (PESA) Irbis-E radar. In the second phase of the programme there will be a new, fifth-generation engine and a NIIP AESA radar – plus an entire new complement of avionics – installed in the aircraft.

Thus far no one in a position of authority is setting a timeline for where Phase I ends and Phase II begins. No deadline has been set for the introduction of these new systems.

■ **Caption**

TRDI: 1404621



Radar technology and electronic warfare designer specialists from Ukrainian firms with roles in developing a number of the T-50's subsystems told *Jane's* that it is almost impossible to project a completion date for the final, Phase-II variant of the T-50.

"Yes, of course there is this 'flying box' – the airframe," said one senior Ukrainian designer. "But there is a long way to go on the avionics development for this aircraft. Most of those systems did not even exist yet. As far as the AESA radar goes, we all know that [NIIP General Director Yuri] Bely and his people can design an active array and all of the back-end modules that go with it, but the question remains to be seen if there is a way to series-produce such a radar set at a cost that does not bankrupt the programme."

Some think that the T-50's new engine is another question mark. In April 2010 an agreement was signed in Moscow for the engine programme to be a joint development between the Unified Aeroengine Building (ODK) consortium and the Salyut engine plant. "I do not know how this engine can now be developed without [Salyut GD Yuri] Eliseyev," said another Ukrainian designer familiar with the T-50 programme.

Eliseyev was abruptly removed from his position at the head of Salyut during November 2010's Air Show China. He was generally seen as one of the more capable managers in the Russian aerospace industry, and was also one of the individuals central

to the long-running business that Russian industry has enjoyed with the People's Republic of China (PRC). The budget for developing this engine is projected to be equal to the cost of developing the rest of the T-50's design.

Despite all of these initial problems with the programme there remains the very real chance that the promise of the T-50 will ultimately be realised, which is what disturbs those nations who might be seeing it in use next door. Pakistan will undoubtedly turn to a solution from its Chinese partners to counter the IAF's version of the T-50 and Vietnam – a regional rival of the PRC – has been mentioned as a possible T-50 customer along with Indonesia.

An Australian defence analyst and former RAAF pilot told *Jane's* that "once the T-50 is a real, operational aircraft it is going to be able to outrun, outfly and outperform almost any other aircraft that will be available in the same timeframe. Additionally, its weapons bay promises to be capable of carrying more missiles or air-to-ground ordnance than the F-35. It could constitute a game-changing capability once the design has finally matured".

Also of concern for those looking at the future air-power equation in Asia is the fact that VVS production plus export sales of the T-50 could total as many as 800 aircraft, a large percentage of which would end up being deployed in the Pacific Rim. The 187 F-22As that will be the final production number for this aircraft "make the US capability to respond in a conflict almost anemic by comparison", said the Australian analyst.

China's J-20

The 11 January 2011 flight of what was officially called "Engineering Project 718 Prototype 01" or "Chengdu Machine 2001" and has been since labeled "J-20" has been the closest to a real demonstration of technological surprise in the area of tactical air power.

Chinese officials had made cryptic comments about a next-generation fighter being prepared for a first flight as far back as November 2009. Appearing on the CCTV programme "Face to Face", People's Liberation Army Air Force (PLAAF) Deputy Commander He Weirong officially acknowledged the programme's existence and said that the development of the fifth-generation fighter is being "intensely made". The first test-flight would come "later", he said, and initial PLAAF deliveries would take place within eight to 10 years.

However, the rapid transition from blurry photos taken at distance appearing on the internet to a publically reported existence of the programme and coverage of what has been called its first flight happened at what is – for a Chinese programme – unprecedented speed. The same amount of time between the appearance of the first photos on Chinese aircraft websites and a subsequent

official Chinese government acknowledgement of its existence spanned several years for another previous famous projects from Chengdu – the J-10.

The 11 January flight of the J-20 took place from the Chengdu Aircraft Design and Research Institute (CADI) and Aircraft Plant No. 132 aerodrome. The total time in the air for this first flight was reported at around 18 minutes, which is somewhat less than the 47 minutes of the T-50's first flight. The short duration of the J-20 flight suggests that there is a low level of confidence in the aircraft's configuration thus far.

Additionally, the fact that little to nothing has been heard about it since lends credence to the argument that the purpose of the flight was to embarrass Gates during his official visit to Beijing that same week rather than to fly the aircraft at a time that coincides with the programme's design validation requirements. Like the hurried revelation of the aircraft's existence through state-managed "leaks" of photos on the internet, the J-20's public flight seems to have been out of character with typical Chinese aircraft developmental procedure.

China's Ministry of State Security mysteriously did not hack into the websites carrying J-20 images and erase them – as they have done many times in the past. This rare break with the usual procedures of China's security apparatus again suggests that the entire coming out of the J-20 was a carefully scripted exercise.

The existence of the J-20 is worrying to other Asian nations for the simple reason that, given its size and configuration, it promises to be a long-range platform that has a considerable weapons load-out. If its development continues along the lines seen thus far it promises to be very close to the 2002 proposed stretch, strike version of the F-22A; the FB-22.

A Chinese aircraft capable of carrying the full range of air-launched weapons in the PLA arsenal could allow Beijing to accomplish its goal of being able to strike at bases throughout the Pacific Rim. Complete areas of the Pacific could also be denied to the US and other nations' naval vessels.

Russian industry specialists who spoke to *Jane's* are somewhat sceptical about the programme for several

reasons. One is that "if you know anything about the back and forth process between Chinese and Russian industry over the past decade, you can see that at least 50 per cent of this aircraft is of Russian design", said one representative who has had years of interaction with Chinese industry.

Another factor is that Chinese industry continues to rely upon Russian and Ukrainian design and production centres for major aircraft subsystems. The J-20 is also supposed to also utilise an AESA radar set, but it remains to be seen when this radar will be available and in a production-standard configuration.

By far the Achilles heel of any Chinese fighter aircraft programme is the dependence upon Russia for jet engines. There have been persistent rumours that the engines used in the J-20 prototype are the same Saturn/Rybinsk 117S design that is in the Su-35. Photos of the J-20 show that at least one of the prototype aircraft is fitted

with either a 117S or standard AL-31F engine from Russia.

During the last days of Air Show China 2010, Russian Defence Minister Anatoliy Serdyukov returned to Moscow from an official visit to China "carrying a number of proposals in the sphere of military-technical co-operation", reported the Russian daily *Vedomosti*. The article, entitled "China Has Not Copied Everything," quotes sources from inside both the Ministry of Defence (MoD) and Rosoboronexport, the Russian arms export monopoly.

According to these sources, the list of items China's military was seeking to purchase from Russia included an unspecified large number of the 117S engine and the Almaz-Antey S-400 air-defence system. Given the unique modifications that have been required to fit Russian engines to other Chinese fighter aircraft, the 117S models can only be for the use of this new, Chengdu J-20 fighter.

Ilya Kramnik, a military analyst for Russia's RIA Novosti news agency, commented that the Chengdu aircraft was a major advancement, but that it is still far behind the rest of the world in building a stealthy fighter.

What everyone is calling the J-20 fighter "was produced nearly 20 years after the US YF-22, 17 years after the Russian MiG-1.44 MFI and 14 after Russia's S-37/Su-47. If the J-20 is accepted as the prototype for a new series, China will be able to produce a fifth-generation fighter plane within 10 years. If not, it will begin batch production no sooner than 15 or 20 years from now".

Japanese stealth

All of the realities about how many years it might be before whatever comes of the J-20 enters series production aside, there is now a renewed sense of urgency in Japan to develop its own fighter programme: the Advanced Technology Demonstrator-X (ATD-X). The project is also referred to as Shinshin, and it is reportedly being accelerated due to the existence of the J-20 programme.

Lieutenant General Hideyuki Yoshioka, the Director of Air Systems Development at the Japanese MoD, stated that the Shinshin will fly by the year 2014 and that currently the country is "two years into the project and we are on schedule."



TRDI: 1364628
The Japanese Ministry of Defence's Technical Research Development Institute (TRDI) has developed and tested models of its ATD fifth generation fighter.

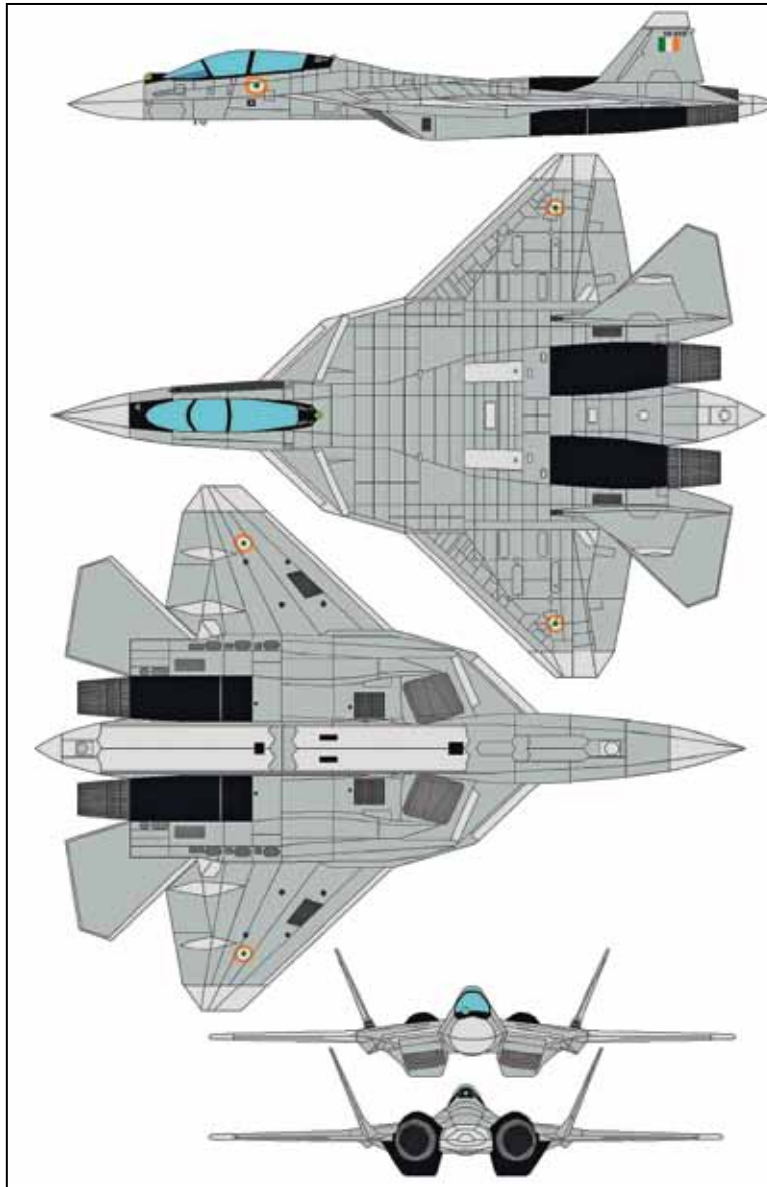
One of the other government officials responsible for the programme, Colonel Yoshikazu Takizawa of the MoD's Technical Research and Development Institute, stated that "if the countries surrounding Japan have stealth capabilities, Japan will need to develop those capabilities itself to ensure our own defence".

Yoshioka explained that if the 2014 test-flights are successful it does not follow that the next step would be full-scale production of this aircraft. The Shinshin prototype is intended to be a technology demonstrator that validates certain design concepts. The MoD intends to evaluate these test flight results and then make a decision for the next stage of the programme only in 2016.

The aircraft is intended to be twin-engine, low radar cross-section design that takes some of its platform concepts from the F-22A. It will have a 3-D thrust vector control engine nozzle, an integrated avionics/AESA radar/Electronic Counter-Measures (ECM)-Electronic Warfare (EW) suite and the possibility of using the aircraft's radar array for an on-board directed energy weapon function.

Among the other innovations discussed for this aircraft's design is the long talked-about "fly-by-light" flight-control system that utilises fibre-optic cabling in place of the standard electrical wiring used in fly-by-wire flight control systems. The flight-control system is also supposed to contain "adaptive", almost artificial intelligence-type programming. According to the design concept, the system can re-calibrate itself and compensate for a damaged or failed control surface by utilising the other control surfaces to maintain the aircraft's aerodynamic stability.

Two growing issues for Japan are the need to maintain a cadre of qualified personnel within its industry and what effects the current earthquake disaster reconstruction might have on defence budgeting. If any outlays for this programme are pushed to the right due to the need to commit funds to earthquake recovery projects there could conceivably be a deficit of qualified industry personnel to support the later development of an aircraft derived from the Shinshin tests.



■ Caption.

A report earlier this year from the Society of Japanese Aerospace Companies stated that, of the 13 major aerospace companies surveyed, only one stated "it could return fighter engineers to fighter work after a five-year gap" in contracted work to develop a combat aircraft. This puts the country in a race with itself – as well as with China and Russia – and creates a difficult balancing act of how to not commit to a final design configuration too soon and at the same time not be too late in sustaining industrial capabilities.

Which advantage?

How the Asian fighter market plays out will roughly be determined by which factor delivers the greatest advantage in terms of being able to develop a new aircraft on time and at a reasonable cost.

Russia has the advantage in experience, a broad-spectrum industry that can de-

velop almost all aspects of the aircraft indigenously. Russia's weakness is that its industrial capability is declining as its aging design workforce dies off and it is not capable of developing a next-generation aircraft without the deep pockets of a partner like India.

China has no problems with resources and can fund its own programme, but it lacks the generations of developing one model of aircraft after another and the insight and design maturity that comes from a workforce with this kind of background. China also remains dependent on the outside world for many of the commercial-off-the-shelf components it purchases for its industry and still requires assistance from Russia and Ukraine for propulsion and other critical technologies.

Japan, South Korea, Taiwan and Singapore all have the resources they need to either develop an aircraft on their own, develop a modified version of some existing fighter with a foreign partner (such as the F-15SE) or just buy something new outright from the US or Europe. The trouble here for these nations is trying to decide to what extent they want to be dependent on a foreign power that can either grant or block access to critical technologies,

or how much capability they are ready to spend the resources to create and be able to control on their own.

What seems likely is a patchwork of new aircraft programmes that are in one way or another responses to the Russian and Chinese challenges presented by their programmes. Clearly, however, Asian nations are no longer just picking a fighter programme and then just passively accepting what the manufacturer offers. Instead, what will continue to be the case in most nations is that they will be looking for a specialised, tailored platform that they perceive as the proper response to the threats to their own national security. ■

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