by Carlo Kopp

ASIA'S ADVANCED FLANKERS

It is unfortunate that the media spectacle of Operation Iraqi Freedom diverted the public's focus in Australia away from happenings in the nearer region.

In recent months several important developments have taken place, with Malaysia and Indonesia signing delivery contracts for their first top-tier Sukhoi Su-30 fighters, and India taking delivery of its first fully configured Su-30MKI aircraft. While these developments have not been unexpected, they represent an ongoing shift in regional aerospace power and capabilities which Australia should not choose to ignore.

Some defence analysts in Canberra have argued vocally in the media that the War on Terrorism demands that Australia fundamentally restructure its basic strategic doctrine and indeed reshape its force structure. It is proposed that the needs of coalition warfighting in distant locations should take precedence over the 'Defence of Australia' in the nation's force structuring and funding priorities. Media comments attacking established doctrine and ridiculing it as 'Fortress Australia Policy' suggest that this perspective is more popular than one might imagine.

Such reasoning is dangerous and ill informed – reflecting on the part of most protagonists of this view a weak if not wholly absent understanding of modern airpower and its implicit strategic influence. To better understand how foolish this point of view actually is, we must explore more closely the capabilities of the latest Sukhoi fighters and their implicit longer term growth potential.

Sukhoi Su-30 derivatives

The early history of the Su-27 family of fighters has been widely documented, and some excellent references exist (Andrei Fomin's *Su-27 Flanker Story* published by RA Intervestnik is arguably the single best printed reference, while Easy Tartar's reference at www.sci.fi/~fta/Su-30.htm is the best website).

The original design aim of the Perspektivnyy Frontovoy Istrebitel (PFI – Future Tactical Fighter) was to kill the US Air Force's then new F-15A, and both the Sukhoi and Mikoyan bureaus submitted designs. The Sukhoi T-10 concept emerged in the early 1970s, and was conceptually closest to a fusion of the fixed wing Grumman VFX-404 configuration with the blended strake/wing/body configuration of the GD LWF demonstrator, later to become the F-16A. From the outset the design was to use various combinations of mechanical hydraulic and fly-by-wire (FBW) controls with some reduced static stability to achieve exceptional manoeuvrability.

The early T-10-1 demonstrator evolved into the current T-10-15/Su-27 configuration through an almost complete but necessary redesign during the early eighties. The result has been the most aerodynamically refined of all of the third generation fighters. Like the MDC F-15A, the basic design was devised from the outset to accommodate both single and dual seat configurations. The Su-27UBK tandem dual trainer airframe became the basis of the Su-30 series.

Introduction into PVO-S (Protivo-Vozdushnaya Oborona Strany – air defence force) and FA (Frontovaya Aviatsia – tactical air force) service was protracted, especially due to problems with manufacturing an airframe with a substantial amount of titanium alloy and honeycomb laminates, but also due to difficulties with the complex 'F-15-like' avionics package.

To demonstrate the aircraft's potency as an F-15 killer, the Sovs in 1986 stripped and modified the T10-15 prototype, redesignated it the P-42 and promptly took out no less than 22 FAI records, mostly in the 'time to height' categories previously held by the F-15A. Such impressive basic performance results from the exceptionally clean aerodynamic design and the pair of large Lyulka AL-31F series afterburning turbofans – the P-42 would have used early variants of the engine.

The baseline Su-27 airframe resulted in two nearly identical variants for the PVO and FA, the Su-27 and Su-27S, with a common dual trainer in the Su-27UB. The single seat Su-27/Su-27S was manufactured by the KNAAPO plant at Komsomolsk-on-Amur and the dual Su-27UB was manufactured by the IAPO plant at Irkutsk, with design authority remaining at the Sukhoi bureau. The principal distinction in the Frontal Aviation Su-27S was a capability to deliver dumb bombs and rockets – not unlike the F-15A/B/C/D models. Both types were to carry the large pulse doppler Myech air intercept radar, which was to use a mechanically steered planar array antenna with electronic vertical beam steering, but production aircraft with the NIIP N001 used a simple mechanically steered cassegrain antenna.

Several early derivatives of the Su-27 are of much interest since they paved the way for the production Su-30 subtypes now seen in the Asian export market.

The navalised Su-27K (for 'Korabl'ny') was developed for the Project 1143.5 55,000 tonne class aircraft carrier, of which four were to have been built. The Su-27K had beefed up undercarriage with twin nosewheels, upgraded hydraulics, a tailhook, enlarged flaperons, a modified ejection seat angle, folding outer wings and stabs, upgraded FBW, modified LERX (Leading Edge Root Extensions) with canards, enlarged leading edge slats, and a deployable aerial refuelling probe.

The refuelling probe modification included a pair of deployable floodlights in the nose, used to illuminate the tanker aircraft, here intended to be either an Il-78 Midas or another Su-27 buddy tanker carrying a centreline UPAZ hose-drogue pod. The probe permits a fuel transfer rate into the fighter of up to 1815kg (4000lb)/min.

Another notable Su-27K feature to migrate to later variants was the right offset IR Search and Track housing, this improving the pilot's downward view over the aircraft's nose. Production Su-27Ks operated by the Russian Navy are often designated the 'Su-33'.

Perhaps the most important feature of the Su-27K/Su-33 is the enlarged LERX/canards which increase the available body lift of the aircraft, and shift the centre of pressure forward, thus enhancing achievable pitch rates. The Su-27 series shares with the F-14 a large body lift capacity resulting from the wide fuselage tunnel – as a result the aircraft's effective wing loading is much lower than that of aircraft with different configurations. This is reflected in superb high alpha handling and sustained turn rates.

The side-by-side dual navalised trainer was so successful it evolved into the F-111 like Su-34 series bombers, intended to replace the Su-24 Fencer. As yet no production orders have been received for this series, although Chinese interest has been reported more than once.

While the navalised Sukhois spawned key aerodynamic design innovations in the series, the land based variants accounted for most of the avionics and propulsion improvements. The most important early derivative was the dual role single seat Su-27M strike fighter, frequently labelled as the Su-35. Initiated in 1982, the Su-35 best compares to the F-15C in basic capabilities. It was to be the initial platform for the then new Vympel R-77 'Amraam-ski' active radar guided AAM. The Su-35 was to carry a complete EWSP package, a cockpit wide angle Head Up Display (HUD), triple MFDs, an improved RSLU-27/N011 fire control radar package using a new slotted planar array antenna rather than the N001 design, an N012 tail warning radar, an improved OLS-27K Infra-Red Search/Track (IRST), the Schchel-3UM Helmet Mounted Sight (HMS), ShO-13A Doppler nav, an inertial nav package, air/air and air/ground GCI (Ground Control Intercept) datalinks, two additional inboard wing hardpoints to permit up to 12 external stores, and the aerial refuelling probe.

Structural changes were required to the forward fuselage to accommodate the larger radar aperture, relocated IRST, aerial refuelling probe and revised avionics. The additional 1360kg (3000lb) of empty weight required strengthened undercarriage, dual nosewheels, detail structural changes, and the Su-33's canards were later incorporated. To offset the loss of combat radius due to additional weight the wet portion of the wing was extended to the 13th rib, from the 9th, and a 360 litre tank was added to each vertical tail, thus providing a total internal capacity of 10,250kg (22,630lb). The dual combat trainer variant designed by KNAAPO is designated the Su-35UB. Twelve preproduction Su-35s were built, and tail number 711 became the Su-37 demonstrator.

The Su-37 was to incorporate two important advancements over the Su-27M/35. These were thrust vectoring nozzles and the new NIIP N011M passive shifter technology ESA (Electronically Steered Array – phased array). In addition, an electrical sidestick controller was mounted in the right side of the cockpit. The Lyulka bureau designed the first axisymmetric two dimensional thrust vectoring (2D TVC) nozzle ever deployed during this demonstration program – the nozzle Time Between Overhauls (TBO) is reported at 250 hours vs the 1000hr TBO for the AL-31FP core.

The all important Flight Control System (FCS) in the Su-27 family evolved incrementally, with the first generation hybrid analog system running in parallel with the conventional hydro-mechanical design. The Su-37 introduced a genuine redundant digital system, similar in concept to its contemporary western designs.

The Su-30 series is not directly evolved from the Su-27M line, but has incorporated many design features demonstrated in the Su-27M/35/37 line. The origins of the Su-30 lie in the last years of the Soviet era, when the PVO sought a combat capable derivative of the existing Su-27UB conversion trainer. The dual variant was to be equipped for aerial refuelling and used as a long range long endurance interceptor and combat 'command and control fighter' to lead long range CAPs. The aircraft was initially designated the Su-27PU (Perekhvatchik – Uchebnoy) and later relabelled the Su-30. The Su-30 was developed in part by the Irkutsk plant, responsible for manufacturing the Su-27UB. The export variant of the Su-30 was designated Su-30MK and unveiled in 1993 – as a multirole strike fighter rather than interceptor.


IAPO/Sukhoi Su-30MKI IAF

The hard sell by the Irkut plant (formerly IAPO) and Sukhoi paid off in late 1996 when the Indian Air Force signed for an advanced derivative of the baseline Su-30, the Su-30MKI (M-Improved, K-Export, I-India). In a complex deal which saw initial deliveries of basic Su-30K and progressive development and later delivery of full configured and licence build Su-30MKI, India negotiated a buy which will see around 180 of these aircraft deployed with IAF squadrons.

The Su-30MKI is a fusion of technology from the Su-37 demonstrator and Su-30 program, with additional Indian designed and built processor hardware in the Mission Computers, Radar Data Processor provided under the Vetrivale (Lance) industry program, and some items of Israeli and EU hardware. The aircraft has a Thales (Sextant Avionique) HUD and RLG (Ring Laser Gyro) INS/GPS, glass cockpits, NIIP N011M phased array, AL-31FP TVC engines, enlarged rudders, Su-33/35/37 canards and aerial refuelling probe, and an improved OLS-30 IRST package. The Indian developed Tarang RWR is used in the EWSP suite.

The TVC system in the Su-30MKI has evolved beyond the Su-37 system, which deflected only in the vertical plane. The Su-30MKI variant has a 32 degree canted TVC plane to introduce a lateral and vertical vectored force component, and is driven by the engine's fuel system rather than the main aircraft hydraulic loop.

The Indian Su-30MKI is to date the most advanced Su-27 derivative to enter production and with the exception of mission avionics and software is a credible equivalent to the F-15E/I/K/S family. It also underscores the ‘no holds barred’ international arms market, in which an export customer is supplied with a product which is half a generation ahead of the Russian air force – the IAF designates it as its ‘Air Dominance Fighter’.

However, the greatest Sukhoi export success to date has been KNAAPO’s deal to supply and licence build Su-27SKs and Su-27UBKs for the Chinese PLA-AF – also the very first export deal for the aircraft. The initial order was for 20 Su-27SKs and four Su-27UBKs, essentially the same configuration as Soviet Frontal Aviation units flew but claimed to be fitted with Phazotron Zhuk rather than the NIIP radars. A second batch of aircraft, consisting of a further 16 Su-27SKs and six Su-27UBKs, was supplied in 1996, bringing the fielded total to 46. That same year KNAAPO was awarded a contract to set up licence production of the Su-27SK at the Shenyang plant in China – these are designated as the J-11 and up to 250 may be built. An additional buy of 20 or more imported Su-27UBK dual trainers was reported in 2002.

India’s buy of the Su-30MKI triggered a response in Beijing – the PLA-AF ordered around 50 Su-30MKK fighters from KNAAPO. The KNAAPO Su-30MKK is not the same as the Irkut Su-30MKI in configuration, despite the shared ‘Su-30MK’ designation. The baseline Su-30MKK has the Su-35/37 vertical tail design, no canards, no TVC capability, Russian avionics and a variant of the Phazotron Zhuk planar array radar. An improved OEPS-31E-MK IRST package is fitted. There are reports the aircraft has an increased maximum takeoff weight against the Su-30/Su-30MKI, requiring structural changes. Like the PLA-AF Su-27SK the Su-30MKK uses the original analog FCS.

The Su-30MKK is a KNAAPO development which is closest in concept to a dual seat Su-35 without the canards added to the production Su-35. It is, like the Su-35, a dual role fighter, occupying the same niche as the F-15E but less accurate, and less capable in the air-air role than the Su-30MKI. A version for the Chinese navy is claimed to be under development, designated the Su-30MK2, to be armed with the Kh-31A ramjet anti-shipping missile.

Russian sources put the current Flanker total supplied to the PLA-AF as 76 Su-27SK/UBKs, 50 Su-30MKKs with outstanding orders for 19 more, and a commitment for licence production of around 200-250 aircraft. Russian estimates of the ultimate size of the Chinese air force Su-27/30 fleet fall between 350 and 500 aircraft. For comparison, the US Air Force fielded around 400 F-15Cs and 200 F-15Es, putting the PRC’s orders into a similar force structure size bracket – and almost twice the size of the Indian Su-30MKI fleet.

Malaysia has recently committed to purchase 18 Su-30MKMs beating the Boeing F/A-18F bid – evidently Malaysia’s bilateral MiG-29 support relationship with India exposed the RMAF/TUDM to the Indian Su-30MKI program and they liked what they saw. The Su-30MKM is being supplied by Irkut and will therefore be of similar configuration to the Su-30MKI, although as yet no details are available on the specific fit of the MKM variant – it is known that some French avionics will be used. The aircraft will be delivered from 2006. It is likely that a large portion of the deal will be financed by barter of Malaysian industrial and consumer goods.

Indonesia’s TNI-AU has had a long standing interest in the Sukhoi fighters and prior to the Asian economic crisis committed to purchase the Su-30KI. This aircraft was to be supplied by KNAAPO and was derived from the single seat Su-27SMK, a midlife upgrade design package for the baseline Su-27S. The Su-30KI is thus an improved single seat Su-27S, with the improved N001E radar and cassegrain antenna, aerial refuelling probe, centreline OLS-27 IRST, ILS-31 HUD, and provisions for the R-77 Adder missile. This variant is more the air superiority fighter than dual role strike fighter and is essentially a low cost upgrade of the basic production KNAAPO Su-27 line – the use of the early configuration centreline IRST installation suggests the Su-30KI may be built from refurbished low time PVO Su-27 airframes.

In late April this year Indonesian President Megawati signed an MoU with Russia for the supply of four Sukhoi fighters, two Su-27SKs and two Su-30MKs (some sources claim Su-35, others Su-30KI) to the Indonesian TNI-AU later this year. Media reports from Jakarta indicate that the TNI-AU intends to acquire between 48 and 54 of these aircraft over this decade, and often report the inclusion of an aerial refuelling capability – part of the Su-30KI configuration. Whether the TNI-AU aircraft are Su-27SKs, Su-35s, Su-30KIs or Su-30MKs is immaterial in the longer term, since the basic KNAAPO/Irkut T-10 family of designs permits incremental retrofits, and cash permitting any of these variants can over time morph into a more advanced model.

SU-30 GROWTH PATHS

The Su-27/30 series is by far the aerodynamically most refined of the third generation fighters in the market and is a direct equivalent to the late build F-15E/I/K/S variants. While it does not offer quite as good supersonic performance and handling to the F-15, it makes up for this with exceptionally good low speed high alpha handling and performance.

From an ‘information age’ warfighting perspective, the basic Su-30 series airframe has some very attractive features absent in competing western third generation fighters.

The first of these is its massive radar bay, capable of fitting a one metre phased array antenna. In the long range BVR combat game, radar range is a key factor and for any given radar technology, the larger the aperture the better. While the current N011M/ME uses passive array technology which delivers less peak power than competing active arrays (AESA), it is only a matter of time before NIIP and Phazotron adapt commercial GaAs MMIC technology (98%

of the total GaAs chip market) to build an AESA variant competitive against the AESAs in the latest western third generation fighters (some upgraded F-15Cs, F-16C Block 60, F/A-18E/F). With similar TR (Transmit-Receive) module performance, the fighter with the largest aperture size wins in this game – for instance the N011M has around twice the aperture size of the JSF AESA and F/A-18E/F's APG-79 and even with inferior TR module technology will be highly competitive. It is worth noting that India is only the fourth nation worldwide to field a phased array equipped third gen fighter, after France, the US and Russia.

While the existing N011M has limitations in its older technology back end processing, the future is the path India has followed, retrofitting third party hardware with better performance than the Russian processor hardware. With widely available commodity processor chips in the 1 to 2 GHz class, we can expect to see many other Sukhoi users emulate the Indians in coming years, be it in MLUs or new build aircraft.

The existing N011M series lacks a Low Probability of Intercept capability, in part due to antenna bandwidth limits and in part due to processor limitations. This is likely to change over the coming decade as customers demand an ability to defeat or degrade western ESM equipment and the technology to do this becomes more accessible.

The N012 tail warning radar has been reported to be part of the Su-30MKI suite and is offered as a retrofit to other models.

Another attractive design feature is the large IRST housing, which can fit an aperture larger than competing western IRST systems – the more photons the IRST can capture, the greater its detection range potential. The baseline OLS-27 IRST can scan a 120x75 degree field of regard, and cover a field of view as narrow as 3x3 degrees, but has poor sensitivity with a head-on detection range of about 8nm (15km). The integrated laser rangefinder is effective to about 1.5nm (2.8km). Specifications for the OLS-30 have not been disclosed – it is known that further development is underway on an IRST/FLIR design similar in concept to the Eurofighter's Pirate system.

As with radars, IRST and FLIR aperture size matters, and the Sukhoi is in a commanding position with the existing OLS-27/30 package. With commercial technologies such as Quantum Well longwave/multiband imagers of 800x600 pixel resolution in the EU market, it is only a matter of time before this technology finds its way into an OLS-30/31 derivative. Current US IRSTs using older MCT imaging arrays have detected fighters at distances of many tens of miles.

The cockpit of the existing Su-30 series provides plenty of opportunities for further growth, both in display technology and back end processing. With militarised commodity AMLCD display panels becoming increasingly available, the trend we have observed with the Thales (Sextant) displays in the MKI is likely to grow over time, driven by the need to compete against US and EU cockpit designs. We should not be surprised to see India and Israel become prominent in the Sukhoi MLU market. The same will be true of mission computer equipment.

Maturity in flight control software has seen aggressive improvements in types such as the F/A-18E/F, and it is reasonable to surmise that the adoption of digital FBW controls in recent Su-30 variants will see similar evolution in the Sukhoi types – especially given the Russian obsession with close in manoeuvre performance.

In terms of propulsion, we have seen incremental improvements in the AL-31F series, with the F-3 model cited at 28,250lb (125kN) (with the baseline F-1 at 27,600 lb/123kN). The Russians have been quite coy about the thrust ratings of later AL-31F subtypes, and we should not be surprised to see the AL-35F/FP (~31,000lb/138kN) and AL-37F/FP (~32,000lb/142kN) appear either in export models or MLUs, in basic and TVC variants. KNAAPO/Irkut are offering TVC kits as retrofit items to existing models, as they are offering seamless engine upgrades. It is unclear whether the 35,000 to 40,000lb (155 to 178kN) class AL-41F will find its way into the Su-30 series.

The engine configurations in current export models such as the Su-30MKI and Su-30MKK have not been disclosed – given the Sukhoi penchant for obscure nomenclature, we way well see AL-35/37 derivative engines marketed as AL-31F-X numbered variants. With uprated engines even the heaviest Su-30 models deliver impressive combat thrust weight ratios in the 1.2:1 class, competitive against the latest F-15C configurations.

In terms of avionics systems and propulsion we can expect to see ongoing incremental growth in the Su-30 series, as market pressures drive KNAAPO and Irkut to integrate newer technologies in the aircraft. As the Su-30 is the primary export revenue earner in Russia's defence industry, and a primary means of exporting Russian guided munitions, it is apt to continue to be the platform for the deployment of the latest domestic and imported technologies. The unknown factor is how much modern EU and Israeli technology will find its way into the Sukhois over the next decade. With Germany, France and Israel active in the MiG MLU market, the existence of Asian aggregate fleet numbers around 600 or more aircraft will present an irresistible attraction for the sale of avionics and systems upgrades, be they incremental or major block upgrades.

Air-to-air weapons is one area where the Russians have been very aggressively developing and marketing new products. The baseline Su-27S was armed with the R-27 (AA-10 Alamo) semiactive radar homing BVR missile and the R-73 (AA-11 Archer) WVR missile. The thrust vectoring R-73 (refer AA 4/97) was a trend setter and we have since seen an improved R-73M marketed, as well as a digitised seeker equipped R-74E variant credited with 75 degree off boresight capability and kinematics to kill 12G targets. Indian press reports suggest the Rafael Python 4 has been offered to India and it is not inconceivable that this missile will find its way on to Indian and other regional Sukhois –

A major asset of the original flanker design was the ability to accept a wide range of modifications and equipment upgrades including thrust vectoring and canards. The ability of these powerful aircraft to neutralise high value assets at long range should not be discounted. (Paul Merritt)

India is currently negotiating for the Phalcon AEW&C system fitted to the Ilyushin/Beriev A-50E airframe and has acquired ballistic missile defence radars from Israel.

The Vympel R-27 is the Russian equivalent to the late model US AIM-7 Sparrow series BVR missiles, but the similarity ends there since the R-27 is available in a plethora of variants. The basic airframe is supplied in long and short burn variants with differing range performance, and with heatseeking or datalink aided inertially midcourse guided semiactive radar seekers. The R-27R1 and R-27ER1 are the radar guided long and short burn versions, respectively, credited with F-pole (distance between shooter and target at missile impact) ranges of 43nm (80km) and 70nm (130km). The R-27T1 and R-27ET1 are the respective heat seeking equivalents, credited with slightly lower engagement ranges. The X-band anti-radiation seeker equipped R-27P/EP has been reported, designed to kill emitting fighters in the forward quarter by homing on their radar emissions. More recently Agat has offered new build or retrofit active radar seekers as the R-27A/EA, the 9B-1103M/9B-1348E, derived from the R-77 seeker.

The most recently exported missile in the region is the Vympel R-77 RVV-AE (AA-12 Adder), the 'Amraam-ski'. This missile, with unique lattice controls, is a modern BVR weapon designed to kill 12G targets, and credited with an A-pole (distance between shooter and target when missile becomes autonomous) range of 54nm (100km), although some reports suggest early production rounds are not delivering the kinematic performance advertised, not unlike early AIM-120A Amraams. As the R-77 has Amraam-like capabilities, it permits an Su-30 to launch multiple rounds and guide these concurrently, engagement geometry permitting. As the R-77 matures, we can expect to see refinements in propellants, autopilot kinematics and seeker jam resistance.

We have yet to see reports of regional deliveries of the Vympel R-77M RVV-AE-PD (Povyshlenayya Dal'nost') ramjet Adder, credited with an A-pole range around 80nm (150km). This missile is a direct derivative of the R-77.

Alternate seekers for the R-77 have been advertised – the heatseeking R-77T using an MK-80M seeker from the R-73M and R-27T, and the anti radiation R-77P. The deployment of the new F/A-22A later in the decade will see significant pressure on Vympel to supply heatseeking, anti radiation and electro optical imaging seekers on the R-77/R-77M in an attempt to counter the combined kinematics and all aspect stealth of the F/A-22A. While such seekers may do little to offset the overwhelming advantages of the supercruising F/A-22A, they are likely to prove quite effective against inferior types such as the F-35 JSF, F/A-18E/F, late model F-15E and F-16C/B50. If the Su-30 can close to a range where an advanced longwave IRST can track the target, an optical seeker equipped R-77 variant can be used to affect an engagement, defeating the RCS reduction measures on these aircraft. The anti-radiation R-77P could be used to engage at maximum missile range.

In the long range missile domain, the Vympel R-37 (AA-X-13) series of AIM-54 Phoenix look-alikes has been proposed – a developmental R-37 successfully engaged a target at 162nm (300km) of A-pole range in 1996. A more interesting proposal has been the use of the Novator KS-172 RVV-L (AAM-L) missile, a 215nm (398km) range 750kg (1650lb) launch weight long range AAM. The KS-172 uses datalink/inertial midcourse guidance and an active radar terminal seeker, and Russian sources claim a snap-up capability to 100,000ft and snap-down capability to 10ft AGL. KS-172 mock-ups have been photographed on Su-30 displays but its production status is unclear.

Of no less interest is the Kh-31R (AS-17 Krypton) family of ramjet anti-radiation missiles, offered as a standard store on the Su-30/35 subtypes. This missile, in basic anti-radiation and dual mode seeker variants (refer Part 2 next issue) is often dubbed the 'AWACS killer', and would be used to destroy opposing AEW&C aircraft, or surface based radars. Sukhoi advertises a load of up to six rounds, two on the inlet stations.

The dominance of US ISR capabilities (refer AA 7/03) is producing an increasing demand for 'counter-ISR' weapons and the Sukhoi fighter equipped with missiles like the Vympel R-77M, R-37, Novator KS-172 and – Zvezda-Strela Kh-31 variants qualifies exactly as that.

It is clear that the Su-30 has at least two decades more of yet to be exploited technological growth capacity, especially in systems and weapons. The excellent kinematics, large airframe and large apertures give it a decisive long term advantage in growth potential against all teen series types, and with an increasingly borderless international upgrade market, regional users with the cash required will be able to fit some very capable upgrades over time.

Part 2 of this feature will explore the longer term implications of the Su-30 fighter in the region.

SAAB FP 4C

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