Sukhoi fighters evolve potent capability

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RECENT ANALYSIS AND DEBATE ON SUKHOI FIGHTERS FOCUSSES ON THE NEW Su-35BM/35-1 Flanker E+ series, the late generation Su-30MKM Flanker H, and the new 'digital' Su-27SKM Flanker B+ variant. No less important strategically is the Su-34 Fullback and production of the navalised Su-33 and Su-33UB Flanker D, resulting in further gains in strategic potency for regional nations that procure these combat aircraft.

The Su-33 Flanker D is best described as the Soviet response to the US F-14 Tomcat, but while the F-14s are now being wrecked at AMARC the Su-33 is set for further production. The Su-34 Fullback is an entirely new airframe design derived from the Flanker series, but considerably larger, and recently introduced into service. The Su-35BM/35-1 is latest variant in the T-10 series, and a completely digital design.

KNAAPO/SUKHOI SU-27K/33 AND SU-27KUB/SU-33UB FLANKER D

The navalised Su-27K was developed for 1143.5 55,000 tonne class ski-jump aircraft carrier, of which four were to have been built. The Su-27K is the Russian equivalent to the US Navy F-14 series. Indeed some years ago two prominent US experts proposed the US Navy licence the airframe design to replace the F-14.

The Su-27K has folding wings and stabilators, strengthened 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.

Rollout of first LRIP Su-34 Fullback at the Novosibirsk NAPO plant. A high level Chinese delegation is reported to have visited the NAPO plant recently.

> With unrefuelled combat radius performance in the 1,000 to 1,500 nautical mile class, the Fullback is well suited to the Pacific Rim geographical environment.

The refuelling probe design includes a pair of deployable floodlights in the nose used to illuminate the Il-78 Midas tanker or another Su-27 'buddy' tanker carrying a centreline UPAZ-1A hose-drogue pod. The probe permits a fuel transfer rate into the fighter of up to 4,000 lb/min. Another notable Su-27K feature, which migrated to later Flanker variants, was the right offset IR Search and Track housing, improving the pilot's downward view over the aircraft's nose. Production Su-27Ks operated by the Russian Navy were redesignated the Su-33.

Experience from initial Su-27K flight testing indicated problems with training pilots for carrier recoveries. Without the large range of aircraft types and specialised carrier trainers operated by the US Navy, the Soviet AV-MF needed a training aircraft identical in handling to the basic Su-27K but dual-seated and without the visibility impediments of the existing tandem configuration Flankers.

Design of the Su-27KUB combat trainer derivative began in 1989, intended to produce an airframe suitable for a range of other carrier-based roles such as reconnaissance, aerial refuelling, maritime strike and support jamming. F/A-18E/F derivatives fill these slots on US Navy carrier decks.

The Su-27KUB (Korabl'niy Uchebno-Boyeviy - Shipboard Trainer-Combat) has a radically revised forward fuselage and a range of incremental aerodynamic changes. The latter are cited as enlargement of the canards, stabilisers, fins and rudders. The wing fold position was moved further outboard. The new side-by-side cockpit provides crew access via a nosewheel-well-deployable ladder. The crew sit on upward firing ejection seats under jettisonable canopy panels. The circular cross section of the nose was retained but the baseline NIIP N-001 multimode radar was to be replaced by a Phazotron Zhuk derivative. In the latest demonstrator this is the Zhuk-MSFE PESA radar. The OEPS/OLS-27 IRST housing was located on the centreline of the cockpit.

The prototype Su-27KUB first flew in April 1999 but production was suspended due to the collapse of Russian carrier aviation funding post 1991. Production aircraft designated as Su-33UB would be built by KNAAPO at Komsomolsk Na Amure.

A demonstration Su-33UB aircraft has been flown at a Russian airshow, equipped with thrust vectoring Saturn AI-31FU engines. A TVC capability would be useful for ski jump launches, reduced approach and trap speeds, and improved turning performance. This is compromised to some extent by the heavier forward fuselage against baseline Flanker variants.

The Su-33 can carry most of the weapons used by the Su-30MK series, and is the intended initial platform for the air launched Kh-41 Moskit (SS-N-22 Sunburn), Kh-61 Yakhont (SS-N-26) and 3M-54AE/AE1 and 3M-14AE Club (SS-N-27 Sizzler).

NAPO/Sukhoi Su-34 Fullback A

The Su-34 Fullback was developed to replace the F-111-like Su-24 Fencer deep strike fighter equipping Soviet Frontal Aviation and land based Naval Aviation strike and reconnaissance units.

Early thinking was to produce an F-15 style tandem two seat design using the Su-27UB as a baseline, but this was abandoned as the client wanted a spacious side by side cockpit for long range and long endurance missions. The tandem two-seat concept was later revived in the Su-30MK Flanker G/H developed for the PLA and Indian Air Force. Conceptual design of the Su-27IB as an Su-24 replacement began in 1983.

The Su-27IB (Istrebityel Bombardirovshchik - Fighter Bomber) concept resulted in a large side-by-side cockpit more akin to a flight deck in a larger bomber, in a substantially enlarged and reshaped forward fuselage.

Specific aims of the new design were to provide better ergonomics for long range / long endurance / high workload profiles, better sanitary conditions for the crew, facilities for the crew to eat meals on long duration profiles, and saving the cost of duplicated cockpit displays and instrumentation. The flight deck was to be fully pressurised so crews did not need to wear masks, and whole flight deck was built into a welded titanium tub to protect the crew from ground fire, with access via a ladder in the nosewheel well. The crew sat on K-36DM zero-zero seats.

The enlarged, chined and blended forward fuselage was attached to what was essentially a modified Su-27UB dual trainer airframe, with the production main undercarriage, wing and aft fuselage sting. The ventral stabiliser surfaces were removed.

Designated the T-10V1, the prototype included Su-35 canards for low altitude ride improvement and load alleviation, the Su-35 wing and revised fixed Mach 1.6 inlets without the FOD suppression hardware used on the Su-27. The Su-27 stabilators and tails were retained. Internally, the centre-section was strengthened to accommodate a 45 tonne maximum gross weight, increased over the baseline 28 tonne Su-27S. Internal volume was increased by about 30 per cent over the Su-27.

The T-10V1 included a phased array multimode attack radar, internal forward looking IRST/TV/laser targeting system, external podded FLIR/laser targeting system, aft fire control and tail warning radar, and internal defensive jammers. Development was authorised in 1986 with the baseline configuration set in 1987. Leninetz, designers of the Backfire's Down Beat and Bear's Clam Pipe attack radars were contracted to develop the radar, with Ural and Geofyzika contracted to develop the electro-optical systems.

The Su-27IB was to be fitted with a heavily integrated digital weapon system closest in concept to US designs of the period. The first prototype T-10V1 flew in April 1990 and was first publicly exhibited in 1992. The second prototype, the T-10V2, was built in 1993 adopting the Su-35 wing with additional stations, enlarged internal fuel tanks, enlarged spine and lengthened tail stinger, the production reinforced centre section design, and the representative production configuration of the tandem dual wheel main undercarriage. The first Low Rate Initial Production airframe, the T-10V5 was flown in early 1994 and renamed the Su-34.

This prototype was labelled the 'Su-32FN' and presented at the 1995 Paris airshow as a maritime patrol and strike fighter. Two more Su-34s were built in 1996 and 1997, and presented at the Paris airshow in 1997, again as the 'Su-32FN'. Russian sources claim this nomenclature was further changed with a new designation of 'Su-32MF', presumably standing for Mnogofunktsioniy Frontoviy (Multirole Tactical). While the Su-32FN and Su-32MF/34 are essentially identical T-10V5 derivative airframes, there are important differences in their intended roles and avionics.

In comparing the basic Su-32/34 airframe against Western types, the design with 12.1 tonnes (26.7 klb) of internal fuel sits in between the Boeing F-15E and F-111 in combat radius and weapon payload capabilities. It will provide at lower gross weights lower agility than the F-15E, but higher agility than the F-111. Its top end supersonic performance is inferior to both US types. Like both US types, the aircraft is intended to perform low altitude penetration using terrain following radar (TFR) functions. Unlike the F-15E with a podded LANTIRN TFR and the F-111 with a dedicated redundant APQ-171 TFR, the Su-32/34 uses a phased array which interleaves TFR and other modes, a concept used previously only the in B-1B's APQ-164 phased array.

The basic configuration of the production Su-32MF/Su-34 aircraft is a multirole deep strike fighter intended to perform the battlefield interdiction, close air support and deep strike roles now performed by the Su-24 in Russia, the F-15E in the US and the F-111 in Australia. In addition, the Russians envisage a long endurance / range air combat role for the aircraft, with the intent to use it to attack ISR platforms with standoff missiles; in this respect its tasking reflects early US Air Force thinking on the F-111 series.

Sukhoi state that the Su-34 is designed to defeat the F-15, F/A-18 and Eurofighter Typhoon in air combat engagements.

EU reports claim that production Su-34 will be fitted with the newer AL-41F engines rated at 35 klb wet/SL/static thrust rather than the AL-35F used in the demonstrators. However, Low Rate Initial Production (LRIP) aircraft are being delivered with late models of the AL-31F engine, the AL-31MF. The aircraft has an aerial refuelling probe, plumbing for three drop tanks, and can carry the Sakhalin UPAZ-1A aerial refuelling pod performing as a buddy tanker.

The Su-34 carries the Leninets B-004 multimode Passive Electronically Steered Array (PESA) radar. The radar is highly modular and redundant, emulating the APQ-164 model to achieve very high mission reliability. The X-band design is claimed to achieve a 15 kiloWatt peak power rating. Modes include ground mapping capability to 150 km (81 NMI), Doppler beam sharpened ground mapping to 75 km (40 NMI) and GMTI target tracking to 30 km (16 NMI), the latter similar to contemporary Western attack radars like the APG-79. A Synthetic Aperture Radar high resolution groundmapping mode was planned, with interleaved low altitude terrain avoidance and automatic terrain following capabilities. An inertial navigation system supplemented by a GNSS receiver (Glonass and likely GPS C/A) is employed.

The planned internal electro-optical suite appears to have vanished in more recent reports, although the new design on MiG-35 could be adapted. The Sapsan-E thermal imaging and laser targeting pod will be carried externally. Development Su-32/34s were fitted with a large circular upper fuselage

Russian Navy Su-33 Flanker D.

The PLA-N is believed to be negotiating for around 50 Su-33s for the Varyag.

Prototype Su-27KUB showing the side by side cockpit.

Su-33UB demonstrator equipped with TVC engines and Zhuk MSFE PESA radar.

Su-33 and Su-33UB at MAKS2004.

The Su-34 can carry an impressive payload of dumb bombs, in addition to a wide array of smart weapons.

Su-34 under construction.

Su-34 demonstrator cockpit. LRIP aircraft are expected to have a new arrangement with AMLCD displays.

The Leninets B004 PESA attack radar is conceptually similar to the B-1B's APQ-164.

satellite communications antenna and a digital datalink of an undisclosed type. The cockpit uses a single dual combiner Head Up Display, and AMLCD displays.

The electronic warfare self protection suite configuration is not well documented. The new Khibiny M Radio Frequency Surveillance system, common to the Su-35BM, is to be used. Wingtip jamming pods will be fitted, likely the same Digital RF Memory (DRFM) based design developed by TsNIRTI for the Su-35BM series, supplanting the KNIRTI L-005 Sorbstiya used in development. It is also likely the new generation MAWS displayed on the MiG-35 will migrate into this design. Like some Su-30/35 configurations, the aircraft was to carry the Phazotron/Rassvet N012 tail warning radar, in the aft fuselage 'stinger'.

In terms of weapons, the design will be cleared for the same suite of air to air and air to ground weapons carried by the Su-30MK series.

Like the Su-24 Fencer, the Su-32MF/34 is expected to be used for tactical reconnaissance. Candidate pods include the recently revealed M400, equipped with a Raduga multi-band IR imaging system, AP-403 and AP-404 panoramic cameras, and optional modules with the M402 Pika SLAR radar and AK-108FM oblique camera.

A support jamming variant, an analogue to the EF-111A or EF-18G Growler, has been proposed. The podded L175V / KS418 high power jammer was being developed for this purpose, comparable to the US ALQ-99 jamming pods on the EA-6B and EF-18G.

The Su-34 will provide an incrementally better penetration and strike capability over the top tier production Su-30MKI/MKM and Su-30MKK/MK2 configurations by virtue of more internal fuel, higher gross weights, much better avionics, terrain following capability, better crew comfort and larger weapons payloads. The Su-34 is to carry three 3,000 litre external drop tanks, matching the radius performance of the F-111, but with less disposable weapon payload.

The Su-34 Fullback entered LRIP in 2005 and the first two production aircraft were delivered to the Russian Air Force on the 15th December, 2006, by NAPO in Novosibirsk, with full rate production expected this year following major upgrades to the Novosibirsk Aviation Construction Association plant. Russian sources claim a requirement for 58 aircraft by 2015, and 300 by 2022, primarily to replace the strike/recce force of Su-24M/MR Fencers and MiG-25RB Foxbats.

Flanker D and Fullback versus the Region

China's PLA-N is currently in the process of fitting out the former Russian Project 1143.5 aircraft carrier Varyag in the Dalian shipyard. The Varyag was near completion in a Ukrainian shipyard when the Soviet Union disintegrated, and without funding was progressively stripped by shipyard personnel for scrap, in lieu of absent salaries.

The PLA-N acquired the Varyag via a convoluted deal involving a series of front companies, on the pretense that the hulk would become a floating 600-room hotel and casino in Macau. The Ukraine sold the Varyag as scrap metal for US$20 million, upon which it was towed to Dalian where it rusted while the PLA argued for the funding to rebuild it into an operational attack carrier. In mid 2005 the Varyag was towed into a drydock for refitting, where it has remained since. The ship requires engines, controls, and the full complement of shipboard systems and weapons.

This January the PLA-N publicly canvassed a proposal for a fleet force structure with three carrier battle groups. It is believed that the Varyag would be used as the template for an indigenous carrier design.

Numerous reports surfaced after 2005 stating that the PLA-N had negotiated a deal for about 50 Su-33 Flanker D aircraft to equip an air wing for the Varyag. Given that the PLA-N operates the Su-30MK2 and China does not operate the MiG-29, the Su-33 series is the natural choice to equip a PLA-N carrier force, and 50 aircraft is an appropriate number for a Carrier Air Wing. The composition of the order or delivery dates have not been disclosed. Currently, KnAAPO/Sukhoi is in dispute with China over the unauthorised reverse engineering of the Su-27SK into the J-11B by Chinese industry.

How many Su-33 will be built for the PLA-N will depend on how many CVAs are built and deployed, and how many reserve squadrons are required to sustain rotations. A figure of 150 to 200 aircraft long term is feasible. What fraction would be dual seat Su-33UBs will depend on how the PLA chooses to operate. The avionic configuration is likely to reflect more recent demonstrators, including the new Zhuk MSFE PESA radar.

The Su-34 Fullback has yet to find an export customer. Post 2000 there was intense speculation in Asian analysis circles about an impending order by the PLA-N but this has yet to materialise. With unrefuelled combat radius performance in the 1,000 to 1,500 nautical mile class, the Fullback is well suited to the Pacific Rim geographical environment. As it shares many components with the Su-27/30 designs, it would be easy to introduce for any air force already operating the Flanker. Fullback will, however, be considerably more expensive than the Flanker, as it is much larger, more complex and has a more extensive avionic suite. It will also never achieve the build numbers and economies of scale seen with the Su-27/30 series.

The likely future regional users of the Fullback will be those nations that have a strategic need for a long range or persistent maritime strike and reconnaissance capability. In practical terms this means most current operators of the Su-30MK series.

For the US and its allies in Asia the Su-33 and Su-34 are not welcome news, in strategic terms. These highly survivable and lethal aircraft will extend the strategic reach of their operators considerably.