Backfires for China?

by Dr Carlo Kopp

(photo – Paul Merritt)

In late June, Hong Kong media reported China's PLA-AF (People's Liberation Army – Air Force) would seek to become a 'strategic air force' with the acquisition of the Russian Backfire cited as a core tenet of this fundamental policy change.

To best appreciate the potential strategic impact of the Backfire upon the Asia Pacific region it is worth exploring the capabilities of this potent aircraft in detail.

THE TUPOLEV TU-22M-3 BACKFIRE C

The latest variant of the Backfire is the third generation Tu-22M-3 Backfire C model, which remained in production until 1993.

The earliest origins of the Backfire were in the earlier Tu-22 Blinder, broadly Russia's equivalent to the US Convair B-58 Hustler. Inferior to the shortlived B-58, the Soviet air staff sought a significantly more capable design. After much research and internal argument during the mid 1960s, the Tu-22M designation was allocated to a largely unique design.

The first Backfire variant was the Tu-22M-0, using an F-4 Phantom style inlet arrangement, long inlet tunnels, a variable geometry wing, and B-1A style side-by-side seating, unlike the tandem Tu-22 Blinder. A pair of NK-144-22 afterburning turbofans – as on the supersonic Tu-144 airliner – were employed. The embryonic Backfire inherited the single centreline Kh-22/AS-4 Kitchen supersonic standoff missile as its primary weapon. Flight testing progressed concurrently with low rate initial production, but only 10 were built by late 1972.

Dissatisfaction with the baseline Backfire led to an extensive rework of the design, under the designation Tu-22M-1 or Backfire A. Aerodynamics were refined, 2950kg (6500lb) of weight removed, span was increased by 152cm (60in) and the speedbrake was relocated. The Backfire A was also a disappointment, and only nine were built by late 1972.

Yet another cycle of redesign work followed, resulting in the Tu-22M-2 or Backfire B designated article 45-02, the first mass production variant. It was around 1360kg (3000lb) lighter than the Backfire A, and powered by a pair of new NK-22 engines. With more thrust, the Backfire B could lift up to 24 tonnes of weapons, including a payload of three Kh-22/AS-4 Kitchen missiles.

The aircraft carried a tail turret with paired NR-23 guns, a PRS-3 Argon-2 ranging radar and remote TV gunsight. The PNA-B Rubin/Down Beat attack radar was designed to provide over 300 degree coverage, and was supplemented by a ventral remote TV bombsight arranged like that in the Avro Vulcan. Air force IOC was achieved in 1974, with AV-MF naval aviation regiments receiving their Backfire Bs in 1976. By the end of production in 1983, no less than 211 examples were built.

Even so, the underpowered Backfire B was considered inadequate and design work commenced early on the improved Tu-22M-3 or Backfire C, which first flew in 1977, following trials of the more powerful NK-25 engine in a Backfire B airframe. The redesign was extensive, including some use of titanium structure to further reduce empty weight, and was led by the Tupolev Bureau's Deputy Chief Designer Boris E Levanovich.

The most visible changes were the adoption of F-15 style ramped inlets and revised auxiliary inlets. Less visible were changes to the wing design, permitting a 65 degree sweep, more than earlier variants. The reshaped and stretched

nose incorporated a revised refuelling probe design. Further changes were made to the vertical tail, undercarriage, defensive gun package and avionics.

During the mid-1990s the author discussed the Tu-22M-3 with Levanovich, who was adamant that the production aircraft had a hi-hi-hi combat radius of 4000km (2160nm) with a payload of three Kh-22M/AS-4 missiles, well in excess of then current western estimates.

Avionics improvements were no less extensive. The Avtomat 3 Radar Warning Receiver was fitted, with an internal variant of the KNIRTI SPS-171/172 Sorbstiya wideband phased array jammer and AG-56 automated noise generator also carried. The SPS-171/172 is claimed to provide noise and deception jamming modes, and is available podded for the Su-27/30. The tail barbette was fitted with a single GSh-23 gun, supported by an improved PRS-4KM Kripton/Box Tail ranging radar and remote TV camera. Ventral and dorsal infrared L-082 MAK-UL series Missile Approach Warning System turrets are fitted to many aircraft.

The earlier PNA-B attack radar was replaced with an improved Leninets PNA-D, which includes Doppler beam sharpening and terrain avoidance modes for low level penetration, there are no reports of the Sopka Terrain Following Radar used in the Tu-160 fitted to Backfires. The SMKRITS (RORSAT Targeting Datalink Receiver) is fitted, using a Molniya satcom link. The Groza OBP-15T TV remote optical bombsight common to the Tu-160 was used.

The weapons suite for the Backfire C reflects its late Cold War Soviet tasking. The primary weapon for AV-MF naval Backfires were anti-shipping, anti-radiation and nuclear variants of the Raduga Kh-22/AS-4 Kitchen. Anti-radiation and nuclear variants were also carried by Dal'naya Aviatsia Backfire C aircraft as defence suppression weapons. The Backfire bomb bay can be fitted with doors which have contoured recesses to fit a centreline conformal Kh-22 round. Two external rounds can be carried on BD-45K/F adaptors, mounted on the outboard glove hardpoints.

The bomb bay can also be fitted with a MKU series rotary launcher for six AS-16 Kickback nuclear armed defence suppression missiles, a Soviet equivalent to the US AGM-69 SRAM. Four additional rounds can be carried on the outboard glove stations, and inboard ventral inlet tunnel stations, for a total of 10.

Like US heavy bombers in the era predating precision bombs, the Backfire C can also carry a large payload of dumb bombs. External beam ejector racks can be fitted to the outboard glove stations and inboard ventral inlet tunnel stations,

Basic weapons for the RuAF Tu-22M-3 are the Kh-22, Kh-15 and FAB series dumb bombs. Growth options include a wide range of precision munitions. (Author)

each carrying nine FAB-250 500lb bombs, which including the 24 round bomb bay stations permits carriage of up to 69 FAB-250 rounds, more than the Mk.82 payload of the B-52H. The external stations can also be used to carry paired FAB-1500 3000lb dumb bombs, for a total of eight. The maximum weapons payload is usually cited at 24 tonnes.

In terms of performance the Backfire C is best described as a 124 tonne 'oversized F-111', carrying around 54,480kg (120,000lb) of internal fuel, with Mach 2 class dash speed and a combat radius between 2000 and 2500nm (3705 and 4635km), subject to weapon payload and profile. Eastern European sources claim that low level penetration profiles can be flown, in addition to the 'classical' high altitude supersonic profile. Tupolev data indicates that the aircraft is compatible with any runway capable of supporting a later 767 variant.

The Tu-22M-3 remained in production until 1993, and various sources claim that up to 268 were built. As IOC was achieved in 1989 and operational flying rapidly curtailed after 1991, the average number of fatigue hours accumulated by the Backfire C fleet is very low, especially for the last aircraft built, which have a calendar age of only 11 years. US sources currently put Russian air force inventory numbers at 70 to 105, Russian naval aviation numbers at 105, and Ukrainian air force numbers at 14 (with 16 Backfire Bs).

BACKFIRE C GROWTH PATHS

Sources in Eastern Europe observe that the Russian Air Force has planned for some time to equip the Backfire C with a conventional precision weapons capability, emulating the current trend pursued by the USAF with its heavy bomber fleet. There are no reports as yet that this has materialised, due to the Russian military's parlous budgetary situation. With experience from the glass cockpit Su-27SKU upgrade package design, there would be no issues for Russian designers in retrofitting a glass cockpit.

The conventional instrumentation in the cockpit, here the defensive systems officer station, reflects the late Soviet era design heritage of the Backfire. A glass cockpit upgrade following the Su-27SKU model is a feasible option. (Paul Merritt)

The defensive barbette on a Tu-22M-3. (Paul Merritt)

It is very unlikely that Russia would export the Kh-55/AS-15 Kent strategic cruise missile or the Kh-15A/R/S/AS-16 SRAM-ski as part of an export package, although an anti-ship Kh-15 has been offered for export. Conventional variants of the Kh-22 were apparently offered to India and would not present any major issues for export. Indeed, as China operates variants of the Styx/Silkworm which use a closely related rocket engine and the same propellants, the Kh-22 would be very easy for the PLA to support and operate. We should not be surprised if the PLA opts to licence build the Kh-22 as it could be rapidly assimilated given the infrastructure to manufacture the C-601/611. The Kh-22 remains a formidable anti-shipping weapon and with precision guidance, an extremely potent land attack weapon.

Integration of the 1000lb KAB-500L and 3000lb KAB-1500L laser guided bombs would be relatively simple, exploiting hardware for the FAB-1500. Adaptation of the existing nine round FAB-250 rack to carry six KAB-500 is feasible. A thermal imaging laser targeting pod like the Sapsan-E could be carried externally, but also repackaged into the existing bombsight fairing beneath the flight deck, exploiting the extant Weapons Officer's display for the remote OBP-15T bombsight. The latter arrangement offers lower drag and a better field of regard, but would require additional infra-red transmissive window integration, yielding similar packaging to the JSF EOTS. Such as arrangement is likely to be attractive as it doubles up as a day/night thermal imaging sight to replace the OBP-15T.

Clearance of the fire-and-forget KAB-500/1500Kr GBU-8-ski would present little difficulty, but inflight retargeting would require wiring additions to the glove and ventral inlet stations. The KAB-1500TK GBU-15-ski would require integration of the APK-9 Tekon pod, already carried by the Su-30MKK and Su-27SKU.

The very new GPS/Glonass aided inertially guided KAB-500S-E based on the KAB-500 kit (refer July 04) is currently being integrated on the Su-27SKM and Su-30MK, with KAB-1500S-E integration now planned. These weapons would require software and wiring changes to integrate, and would essentially replicate the capabilities of the JDAM on US heavy bombers.

There are no fundamental obstacles to integrating the KAB family of weapons on the Backfire C.

Indian sources claimed that the integration of the Kh-31/AS-17 Krypton series, adopted by China for the Su-30MKK, was a likely prospect for the planned Indian Backfire C lease. As an inventory weapon for the PLA-AF, it is another likely development. Similar claims were also made for the Kh-35U Kharpunski, and it also could be integrated for tandem carriage on suitable launchers. A variant of the existing bomb rack fitted with tandem AKU-58 launchers would easily accommodate both the Kh-31 and Kh-35U in a low drag configuration.

It can be expected that the PLA-AF would seek to carry its planned ALCMs on the Backfire C. As the weapon is similar in size and weight to the FAB/KAB-1500 series, a similar external carriage arrangement is to be assumed. As the Chinese weapon will have unique software requirements, it would likely be a later rather than earlier addition to the aircraft.

The PLA-AF already operates the podded L-005 Sorbtsiya and it is likely that a block upgrade of the SPS-171/172 jammer would be performed to bring them to a similar configuration.

If a laser targeting system is fitted, there will be little near term pressure to upgrade the attack radar system. The current state of Russian multimode radar development is best exemplified by the NIIP BARS which has Ground/Maritime Moving Target Indicator and Synthetic Aperture Radar high resolution mapping capabilities. A block upgrade of the PNA-D signal and data processors

A Ukrainian air force Tu-22M-3 uses afterburner to takeoff during an airshow display. The high speed penetration profile and powerful jamming suite of the Backfire makes it extremely difficult to intercept by smaller fighters like the F-16, F/A-18 and JSF. (Paul Merritt)

as against replacement with a derivative Su-30 radar will present an interesting dilemma for PLA-AF planners. The stabilised gimbal and large radome volume present considerable flexibility for retrofits.

The PLA-AF would have a wide range of options in avionic block upgrades and weapons upgrades for the Backfire C.

THE STRATEGIC IMPACT OF A PLA-AF BACKFIRE

The media report flagging China's strategic change (http://www.phoenixtv.com in Chinese) quoted from a resolution recently passed at the PLA-AF's internal 10th congress of the Communist party of China. The report stressed that the main challenge to be faced in building a 'strategic air force' would be the acquisition of 'long range bombers', with the Backfire cited repeatedly. While many Hong Kong sourced reports are of poor quality, this report was replete with citations of characteristic Communist Party language and is remarkably detailed, covering issues of training, doctrine and force structure.

The large scale build up in PLA-AF capabilities over the last decade is clear evidence of some fundamental changes in PLA-AF strategic thinking, as a large fraction of the investment was being put into assets designed to project power over regional distances. The Su-27SK, Su-30MKK, Su-30MK2, A-50 AWACS, H-6U tankers and Il-78MKK tankers are all assets that can achieve control of the air and strike to distances beyond 1000nm (1850km).

Until now, however, there has been no stated doctrinal shift in the role of the PLA-AF, historically intended to provide defence of Chinese airspace and support of land armies and the navy in combat. The 10th Communist party congress announcement formalises the change in the PLA-AF's role, but also sets it apart from army and navy forces as a service with a unique and independent role – an important shift given the historical early Soviet-like basis in PLA-AF thinking. Given these prior circumstances, there is good reason to regard the 10th congress report to be accurate. If so, the implications are far reaching.

China's first attempt to acquire Backfires was during the first round of Russian equipment acquisitions after the fall of the Soviet Union. Russia at that time was still uncertain about its future global position, and courting western investment on a large scale. Russian reports claimed that the 'Nyet' then given to China was the result of intensive lobbying by Japan and the US.

But today, most of the Russian Backfire fleet is grounded through lack of funds, and needed upgrades cannot be paid for. India was to lease four Backfires, and Indian press reports claimed that aircrew were despatched to Ryazan for conversion training, so an export precedent has been set. And the Russians have not discouraged competition between India and China, reflected in 'tit-for-tat' acquisitions of Su-30MK, R-77, 3M-54/3M-14E missiles, A-50 AWACS, Il-78 tankers and submarines.

(left) Emitter array for internal SPS-171/172 electronically steerable jammer, dedesigned to focus jamming power into a narrow sector (podded L-005 depicted). (centre) Detector aperture for the MAK series infrared Missile Approach Warning System, here installed on a Bear H. (right) The ventral OBP-15T remote TV bombsight is used to target dumb bombs. The fairing for this device is well placed to fit a laser targeting system.

In practical terms, the impediments to the mid 1990s Backfire export are now gone, and the cash cow of Sukhoi exports presents Rosoboronexport and Tupolev with a titillating example of decades' worth of support and upgrade funding. By limiting the weapons package on a Chinese export Backfire and not fitting plumbed for refuelling probes, Russia could argue that it is exporting a regional rather than strategic weapon. Indeed, the Su-30MKK supported by sufficient Il-78MKK tankers covers a similar footprint to the unrefuelled Backfire.

China has strong strategic incentives for the deployment of the Backfire. It is competing with India for strategic primacy on the Asian mainland, and several squadrons of Backfires add significant potency to China's position. Closer to home, simmering tensions with Taiwan and the prospect of US Navy intervention put a high premium on assets capable of deterring carrier battle groups.

It is reasonable to surmise that increasing tensions over Taiwan have intensified interservice competition for funding in the PLA, and the potential of the Backfire to deter US carriers and blockade Taiwanese shipping lanes with naval mines and missile strikes provides a near term PLA-AF buy of refurbished Backfires with much political potency, when competing against PLA-N submarines and long sought after aircraft carriers.
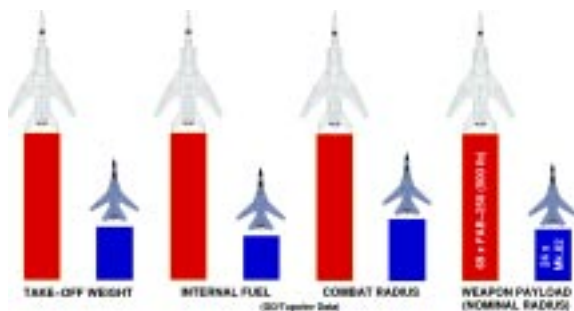

With the US now restructuring its PacRim forces, by increasing more responsive air and naval power at the expense of ground forces, deployment of the Backfire would effectively frustrate the US effort by balancing out increased US air strike and naval fleet capabilities.

China's possible intention to field the Backfire reflects a multiplicity of agendas, and accordingly roles. At the upper end of the spectrum, the Backfire provides a sledgehammer strategic strike capability in the regional context, using a range of supersonic and subsonic precision guided weapons. It replicates the formidable sea control capability of the former Soviet naval air arm.

Yet with a precision guided bomb capability, it also provides battlefield interdiction and close air support capabilities similar to the US heavy bombers, as used in Afghanistan and Iraq. Given the age and fatigue hours in the existing Russian stock of Backfire Cs, a service life into the 2040 timescale is not an unreasonable expectation for factory refurbished and well maintained aircraft.

A single Backfire equates in punch to a pair of F-111s supported by a large medium sized tanker such as the A330-200, delivering equiva-
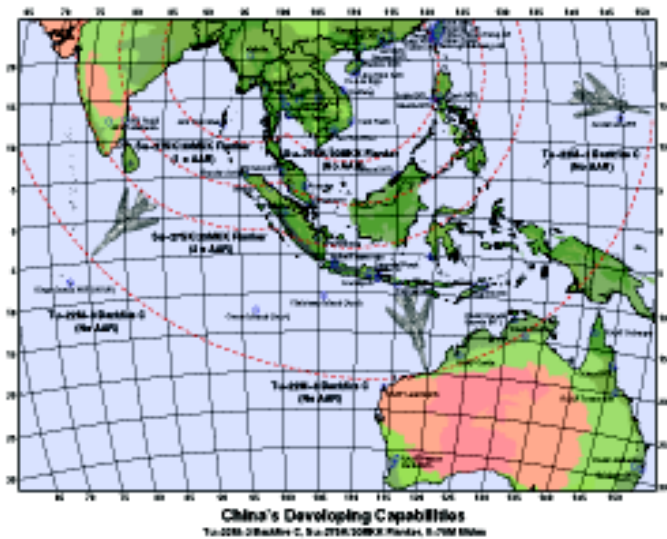
The useful footprint of the Backfire extends from Diego Garcia to Guam. (UNSW/Author)

lent weapon payload to a 2000+nm (3700+km) combat radius. It is a more economical way of delivering large guided weapon payloads to such distances than the use of three to four Su-30MKKs and two supporting Il-78 tankers.

In terms of survivability the Backfire compares closely to the F-111 and B-1B, and its supersonic high altitude penetration profile remains very difficult to stop. Armed with even a 200nm (370km) class standoff weapon, it provides limited opportunities for defending interceptors to successfully engage it. It is no accident that the US Navy deployed both the SPY-1 Aegis and the F-14, based on the F-111B weapon system, as defensive measures to stop the Backfire, and did so at extremely high cost.

The useful footprint of the Backfire, operating from Hainan Island and Meiktila (in Burma), extends almost to Diego Garcia to the west, Guam to the east, and covers an arc between the Gascoyne and Northern Territory to the south. The Backfire can hold at risk any surface target within this footprint, without aerial refuelling support.

The regional strategic balance will shift markedly should China operate this formidable bomber.

This chart compares the strategic punch of the Backfire against tanker supported F-111s. (Author)

THROW WEIGHT EQUIVALENCE