East versus West: Divergent paths in air power

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F-22A Raptor.

OVER the past decade, increasing divergence in the direction of air power planning in Western nations and their counterparts in Asia and Russia is changing the balance in traditional East versus West global air power. China, India, Russia and lesser nations in Asia have invested increasingly in top tier air power and the full spectrum of supporting capabilities, while the United States and its allies have been downsizing their air forces – replacing top tier capabilities with lesser assets.

Air power seems less important in most Western defence departments, reflected by deliberate policy decisions and funding choices, perhaps best encapsulated in public statements by US Secretary of Defence Robert M Gates who observed in May 2008: "I have noticed too much of a tendency towards what might be called Next-War-itis — the propensity of much of the defense establishment to be in favor of what might be needed in a future conflict."

Military professionals found Secretary Gates' statements offensive, as centuries of defence planning practices were being arbitrarily overturned. The objections could be best summarised as, "do you want to go into a gunfight armed with a bow and arrow?"

Secretary Gates' comments were serious, as he sacked the Chief of Staff Air Force and the Secretary of the Air Force. This action was unprecedented, and in the assessment of many American observers, a result of their objections to Gates' intent to cease further funding for the F-22A Raptor, the only upper tier combat aircraft in production in the United States inventory.

Since then, a good many high achieving US Air Force generals have been denied promotions, and quietly pushed into early retirement. What is being done to the US Air Force now differs little from that observed in other Western nations over the past decade: to be employed military professionals who put the profession and national interest ahead of bureaucratic agendas cease to be military professionals thereafter.

This broad and deep attack on the military profession itself is not isolated, and reflects a wider pattern in Western nations of actively denying the need for advanced high technology military systems with competitive upper tier capabilities, and actively making an effort not to fund them.

While the West is pursuing a deliberate policy of unilateral disarmament in upper tier capabilities,

Right: PAK-FA Prototype.
Far right: J-20 Prototype.

the very opposite is true on the Asian continent, and Western Pacific Rim. China, India and Russia are recapitalising their Cold War aircraft fleets, radar inventories and air defence missile inventories with modern high technology systems. Russian and Chinese industry have exploited the stagnation in the West and closed the gap in most key technologies that matter in modern air wars. The West now holds only incremental advantages in some stealth and radar technologies; in most other categories Russian and Chinese analogues are now available, which are equally good and often better than the products made by the US/EU industries.

American analysts Blumenthal and Mazza this January labelled the effect as "A One-Sided Arms Race", referring to China's large scale restructuring and recapitalisation of its military capabilities. While the United States Air Force combat fleet ages into oblivion, shrinking progressively in numbers, China has deployed over 300 Flankers, is building hundreds of J-10 Sinocanards, developing the very good J-20 stealth fighter to rival the F-22, and modernising its weapons inventory with domestically manufactured analogues to the US AMRAAM, JDAM, and Small Diameter Bomb.

China now operates the largest modern Integrated Air Defence System globally, with over 200 airfields, of which at least 40 have underground superhardened hangars to resist air and nuclear attacks, and more surface-to-air Missile batteries of the modern SA-20 and HQ-9 systems than Russia operated in numbers of older, less capable SA-10 and SA-12 batteries.

While China pursues its military capability expansion, Russia is exploiting this by selling advanced weapons across Asia to China's increasingly uncomfortable neighbours, while continuing to sell advanced systems to China.

The policy in Western senior bureaucratic and political circles of putting domestic political porkbarrel and bureaucratic ideological agendas ahead of real military capabilities, and of ruthlessly sacking generals (and analysts) who object or fail to enthusiastically endorse the bureaucratic agenda, will result over the coming decade in the single greatest shift in the balance of global military power observed since the late 1930s, when Germany and Japan were ascendant.

The Western world has a few years left to reverse direction in its air power planning, but this will not happen until there is political acceptance of the need for change, which senior defence bureaucrats in the West have resisted strongly over the past half decade. Having behaved similarly to their predecessors during the late 1930s, the expectation that Western bureaucracies will change their behaviour without decisive political intervention is not realistic.

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Impact of Russian and Chinese Stealth

Russia's PAK-FA and China's J-20 are high performance aircraft, developed specifically to compete against the F-22A Raptor. Both are likely to outperform the F-22 in aerodynamic performance and agility once fitted with the intended engines, and both will have sufficient stealth performance to seriously degrade the effectiveness of all Western radar systems.

In Washington, and most other Western capitals, both aircraft have been almost uniformly dismissed and labelled irrelevant by senior defence bureaucrats. The arguments put forth are most commonly along the lines of neither the Russians nor Chinese being intellectually competent to engineer the stealth capabilities, or to produce the aircraft at a viable unit procurement cost.

In the simplest of terms, Western bureaucrats are mirroring Western experiences onto nations that have completely different military equipment definition and development cycles, very different funding models, and no shortage of engineering and scientific talent to place into defence industry jobs. In the West, a high achieving engineering or science graduate with qualifications up to PhD level is unlikely to consider a career in the defence sector, be it industry or government, but in Russia and China such employment has high social status and is most often much better rewarded relative to other sectors, and highly secure. Funding for top end military programs, especially in China or in Russia for export products is usually generous. Prototyping and experimentation is actively encouraged.

No less importantly, the United States as the leader in these technologies for four decades now has carried the heavy cost burden of doing the basic research required to learn how to best build such equipment. Russian and Chinese engineers exploit knowledge of United States designs to take smart shortcuts in their design cycles, saving many years of development and many billions of dollars in funding programs.

As a result, the PAK-FA and J-20 are now in development, and both will be operational well before 2020, notwithstanding claims otherwise by technologically illiterate bureaucrats in the West. While their stealth performance will not be quite as good as the F-22, it does not need to be such to produce strategic effect, especially if large numbers are built.

The strategic impact of non-Western stealth fighters will be profound. Western built Integrated Air Defence Systems (IADS) rely primarily on S-band, and to a lesser extent L-band and UHF-band acquisition radars for land based and shipboard use. Airborne Early Warning capabilities are similarly constrained, with the E-3/E-767/APY-2 AWACS operating in the S-band, the E-737 Wedgetail/MESA and G.550 CAEW / EL/M-2075 the L-band, and the E-2C/APS-145 and E-2D/APY-9 (US Navy) in the UHF-band.

While the L-band MESA and EL/M-2075, and UHF-band APY-9 will have significantly better detection performance against a PAK-FA or J-20, compared to an S-band radar such as the APY-2 or SPY-1 Aegis, it will be much lower than that achievable against a non-stealthy conventional aerial target.

As a result of the introduction of robust stealth capability, the coverage footprint of United States and allied IADS globally will be severely reduced,

Top: Russian KAB-1500L 3,000 lb LGB.

Above: Chinese Luoyang LT-3 "Sino-Laser-JDAM".

Left: Chinese CETC DLW002 three dimensional Emitter Locating System.

Below: Russian NNIIRT 55Zh6M Nebo M counter-stealth AESA radar.

no differently than that of the Warsaw Pact IADS when confronted by the F-117A Nighthawk from 1985 onward. The result of this will be large holes in IADS coverage, permitting operators of the PAK-FA and J-20 to bypass most Western air defences. Engagement radars employed for Surface-Air Missile defences, such as the Patriot MPQ-53/65 and Aegis SPG-62, and most fighter multimode radars operate in the C/X-band, and some in the Ku-band. Semiactive and TVM missile seekers mostly operate in the native C/X-band of the fire control system, while active radar seekers mostly operate in the Ku-band or above. The effectiveness of all of these systems will be severely impaired when confronting mature variants of the PAK-FA and J-20. Intercepting these fighters is apt to present the very same challenges confronted in intercepts flown against the F-22A Raptor, both in terms of acquisition by radar, guidance of missiles and kinematic intercept by aircraft or missile.

In the Western world, most intellectual and development effort in air defence radar and missiles since 1991 has been concentrated into two discrete areas, specifically to provide TMD (Theatre Ballistic Missile Defence) capabilities at the upper end, and C-RAM (Counter Rocket Artillery Mortar) capabilities at the lower end. Capabilities to intercept and destroy high performance low observable aircraft and guided munitions have received little if any attention.

Unless a large scale investment is made to replace extant air defence radars with new designs, specifically built for the 'Counter-Stealth' role and operating in much lower frequency bands, Western air defences will become impotent in the manner of Saddam's systems in 1991.

The Impact of Russian and Chinese PGMs

At the end of the Cold War Soviet and Western Precision Guided Munitions capabilities were very different. While the Soviets dominated upper tier heavyweight anti-shipping cruise missile capabilities, the West decisively dominated in guided bombs and cruise missiles. Two decades later this is no longer true. Both Russia and China are now producing modern guided bombs in volume, while Russia continues to dominate in supersonic anti-ship cruise missiles. China is now mass producing at least two cruise missile types, the YJ-62 and CJ/DH-10, modelled on the BGM-109 Tomahawk, for launch from surface ships, submarines, and 8 x 8 all terrain vehicles, with air launch variants in test. India is producing a licenced Russian Yakhont supersonic cruise missile, for air/sea/land launch platforms.

Russia now manufactures and exports electro-optically guided, laser guided and satellite/inertial guided bombs. China manufactures and exports laser guided and satellite/inertial guided bombs, as well as dual mode guidance bombs, and long range glide wing kits modelled on the Australian Kerkanya/JDAM-ER.

To correctly state that Western bomb guidance kits are more accurate and reliable misses the essential point, which is that Russian and Chinese guided bombs are just as good or better than the weapons used to eviscerate Iraq, Serbia and Afghanistan since 1990. They are available to any client globally. Much the same can be said for current Russian and Chinese cruise missiles in the Tomahawk class.

Synthetic Aperture and Doppler Beam Sharpening radars, and electro-optical targeting pods made in the West are still superior to those built in Russia and China, but the latter are as good or better than Western systems of a decade ago, in fact Russia's best pod is a licenced Thales Damocles pod. The additional capability in Western targeting systems exists to permit all weather attacks on small targets such as dismounted insurgents, and will often provide little gain over older systems when targeting targets like tanks, trucks, airfields, ports and other infrastructure.

The asymmetrical advantage held by the PGM equipped West over dumb bomb equipped foreign opponents no longer exists, the advantage is at best incremental in system quality and accuracy.

Impact of Russian and Chinese counter-stealth

Since 1991 Russian industry has invested enormous intellectual effort into developing a new generation of low band radars intended to defeat Western stealth capabilities. While some are digital rebuilds of late Cold War era VHF designs, many are entirely new designs, fully digital and exploiting the global market for high power microwave solid state components. The 55Zh6 Nebo UE, 1L119E Nebo SVU and RLM-M Nebo M, the Vostok D and E, the Rezonans N/NE are modern digital VHF band radars. Some, like the Nebo SVU and M series, are 3D active phased arrays with electronic beamsteering akin to the SPY-1 Aegis. Sophisticated digital processing techniques such as sensor fusion, akin to the US Navy CEC system, and Space Time Adaptive Processing (STAP) recently introduced in the E-2D Hawkeye, are incorporated in several of these designs.

Digital radio datalinks, dedicated to these radars or modelled on the NATO Link-16/MIDS, are being integrated or are part of these systems.

In parallel with these active sensors, Russian and Chinese industry are now manufacturing sophisticated passive detection systems capable of 2D or 3D detection and tracking of emitting aircraft, using Time Difference of Arrival (TDOA) and interferometric techniques. These systems are accurate enough to cue Surface to Air Missile batteries or fighters, and sensitive enough to track an emitting Link-16 terminal from well over 100 miles away.

'Shoot and scoot' hydraulic deployment systems are typically employed, on high mobility vehicles. The Vostok D and E radars can deploy or stow in less than ten minutes.

While these counter stealth systems are not good enough to overwhelm the B-2A and supercruising F-22A Raptor, they are easily good enough to defeat less stealthy systems. The latter will fare only marginally better than legacy unstealthy types. Economy stealth is alas a false economy.

The Impact of Russian and Chinese Advanced Surface-Air Missiles

Russian and Chinese Surface to Air Missile technology has evolved considerably since the end of the Cold War, along two distinctly different tracks. The very good Soviet S-300PS / SA-10B series has displayed linear evolution to greater ranges, more lethality, and better jam resistance, through the S-300PM/PMU1/PMU2 or SA-20 and S-400 or SA-21. The latter can fire SAMs on ballistic trajectories, extending range from 50 – 100 nautical miles to well in excess of 200 nautical miles. The engagement radars are regarded to be significantly better in jam resistance and low altitude capability than the Western benchmark, the Patriot MPQ-53/65. China's new HQ-9 is a direct derivative of the S-300PM series.

While the reach, speed, lethality and jam resistance of long range SAMs have improved enormously since the Cold War, point defence SAMs have also evolved. Russian design offices re-engineered the last generation of mobile battlefield SAMs into "Counter-PGM" systems, intended to kill the AGM-88 HARM and smart bombs in flight. The 9K332 Tor M2E or SA-15D Gauntlet, and 96K6 Pantsir S1 or SA-22 both use phased array engagement radars to rapidly track multiple fast targets and prosecute multiple concurrent missile engagements. These active defences for missile batteries are supplemented by various defensive countermeasures, including active emitting seduction decoys.

All Russian SAMs are now built on modern high mobility all terrain vehicles, using 6 x 6 and especially 8 x 8 chassis, a pattern emulated by the Chinese, with a typical shoot and scoot capability of around 5 minutes.

Modern SAMs are lethal, long ranging, and extremely difficult to locate and kill because of their high mobility, and the use of active and electronic terminal defences. The style of concentrated saturation attack used in 1982 and 1991 would be unexecutable against contemporary SAM systems.

Right: The late build SA-20B and SA-21 both share the common "shoot and scoot" 5P85TE2 TEL.

Far right: The Pantsir S1 was specifically built to kill PGMs in flight.