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Conference Report

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Air Forces as Weapons Systems

A KEY QUESTION TO ask ourselves, as countries around the world examine their future combat air capabilities, is whether air forces can, or indeed should, seek to fight like a single weapons system, thereby abandoning the individual platform-centric approach that characterised the fourth generation of air combat.

This conference brought together speakers and delegates from the US Air Force, Royal Air Force, Italian Air Force and the European Air Group, alongside presentations examining Indian, German, Russian and Chinese air force modernisation efforts. All are exploring significantly different strategic approaches and force mixes. Likewise, all are seeking to generate maximum air combat capability within the confines of their financial and political circumstances, and offered valuable insights to airpower practitioners and theorists who often risk becoming intellectually stove-piped within their own national approaches.

The problems posed by a widely perceived return to great power competition and the spectre of high-end warfare against a state adversary as a defence task are myriad, but appear to have been grasped conceptually by most air forces and militaries in NATO. It was widely agreed upon that there is a need to generate combat mass and resilience, not simply exquisitely capable platforms, to link them via resilient, self-healing and secure network constructs for command, control and communications (C3) purposes, and to shorten capability development and technology refresh cycles. Despite the potential risks in terms of cyber/electronic warfare (EW) attack surfaces, pursuing a revolutionary increase in systems and network integration to allow NATO air forces to interoperate and integrate ever more closely was presented as desirable and one of the only ways for NATO's various national air arms to generate sufficient combat mass and resilience.

What remained unclear, however, is how large, bureaucratic organisations such as air forces, which rely heavily on extremely expensive equipment programmes with timeframes spanning decades, can adapt sufficiently to meet these challenges within existing structures and budgets. For all the presentations detailing the innovative approaches being planned or trialled, and new priorities being pushed to enable air forces to cope with the demands of high-end warfighting at scale, there was much less detail provided on what would no longer be done to generate capacity for these new activities – a point repeatedly discussed in the question and answer sessions.

At the same time, NATO's potential adversaries are not standing still, with both Russia and China in particular exploring various potential ways to undermine and disrupt the C3 and information-dependent Western approach to modern air warfare. While Russia's own air and space forces' modernisation programme is heavily dependent on imported Western electronic components and, therefore, has suffered significant setbacks due to sanctions in the years since the annexation of Crimea in 2014, China has no such problems. As such, the People's Liberation Army Air Force (PLAAF) is exploring a raft of innovative intelligence, surveillance, target acquisition and reconnaissance (ISTAR); EW and kinetic approaches with a heavy focus

on operations against the US in its immediate neighbourhood. With massive industrial and financial capacity and a correspondingly rapid innovation and technology refresh rate, the PLAAF's capacity to improve and consequently close the gap with the US Air Force and US Navy should not be underestimated.

The conference took place under non-attribution rules, although selected presentations were given on the record. Some of the most interesting discussions took place during the question and answer sessions, but as these were off the record they unfortunately cannot be reproduced here.

The View from the US¹

The new US National Security Strategy identifies inter-state strategic competition rather than terrorism as the future priority for national security planners, with a view to reversing what Defense Secretary James Mattis sees as a long period of atrophy in strategic thinking in the Department of Defense (DoD). The fundamental assumption now underpinning US defence planning is that 'America can afford to survive'. In other words, defence planning – against the backdrop of rising threats from Russia, and especially China – must seek to create and sustain 'a military that can win, should deterrence fail' rather than attempting to solely fine-tune forces to a budget. Against this backdrop of a threat-based defence planning imperative in the US, financially based European defence planning approaches must be questioned.

There is a recognition in the DoD that the competitive edge of the US, along with that of its NATO allies, has been eroded in every domain of warfare. Therefore, there is a determination to foster a more competitive culture and structures within the Pentagon, which, along with rising military budgets, is intended to deliver a more lethal and survivable force. These forces need to be able to counteract aggression from a major power while simultaneously defeating opportunistic aggression from another power and maintaining forces to combat terrorism wherever needed. However, due to the widening technological capabilities of threat actors around the world, the US Air Force will prioritise forces that can survive, operate and regenerate while under attack, with a focus on adaptive basing and mobility. Allies and partners are crucial to this latter focus since they greatly increase the geographical spread and number of potential forward basing, in addition to their own combat power contributions.

The NATO alliance needs to be strategically predictable, but operationally unpredictable in order to maintain deterrence and stability against aggressive peer threats. Flexible basing is a key asset for the Alliance especially in this regard.

While a free and strong Europe committed to democracy and collective security under Article 5 is understood as crucial to American national security, the US expects European NATO partners to fulfil their spending promises from the 2014 Wales Summit and to show that they care

1. Much of this section is based on the conference's keynote speech by Colonel Lee Wingfield, Air Attaché at the US Embassy in London. The full speech can be viewed here: <<https://rusi.org/conference/rusi-conference-air-forces-weapons-systems>>.

about their own survival more than the US does. European allies should plan for their defence requirements as if they are not part of a larger alliance and then put those resources towards common defence, which will ensure a formidable and secure NATO in the future.

European Air Force Integration

The conference heard that Western nations face challenges from threat actors who will exploit technological, political and legal asymmetries to try to gain advantages over our way of warfare. NATO air forces are ISTAR driven and extremely C4-heavy (command, control, communications and computers), having many political and legal limitations on how and when capabilities can be employed.

All the panellists agreed that there is a need for a revolution in the levels of interoperability between the various platforms operated by different NATO nations, but also that the differences in national timescales and approaches taken in modernisation and procurement have made harmonisation extremely difficult. The US, in particular, is modernising its systems and platforms so much faster than most other NATO members that existing interoperability gaps are growing in many cases rather than shrinking. Security classifications in particular are a huge limiting factor in terms of achieving interoperability, especially where fifth-generation assets are concerned.

Likewise, the requirement for all air platforms to be able to 'plug and play' in the 'Link' ecosystem in future was understood, but with the proviso that the enemy will increasingly have a vote and, having observed and understood Western information dependence, is already working hard to disrupt and, if possible, deny Link and other forms of connectivity within a future battlespace. Therefore, networks will have to be resilient, multi-nodal and self-adjusting to outages in combat.

While F-35 and other modern air platforms offer air forces huge advantages in terms of individual platform combat capabilities, manpower shortages in many European air forces are a serious problem in terms of denying planners the flexibility to innovate. Equally, the extremely high OpTempo that most NATO air forces have maintained for over a decade makes it extremely hard to find capacity for thinking, training and operating in new and innovative ways.

Equally, national demands continue to overrule requirements on paper to build interoperability into new air systems from the start, leading to costly and time-consuming retrofitting and upgrade requirements to allow different national capabilities to train, operate and fight together when needed.

The European fighter mix c2028 will be comprised of only around 20% fifth-generation aircraft, compared with the 80% that will be fourth-generation or older. In consequence, seamless interoperability between F-35 and older platforms will be absolutely critical to enabling the bulk of European combat aircraft in that timeframe to be supplied with the situational awareness and 'eyes forward in the Missile Engagement Zone (MEZ)' needed to be effective against state threats.

However, this goal is unlikely to be reached without common tactics, techniques and procedures across the partner air forces, and the associated networked synthetic training environment to allow such tactics to be practised and developed securely and affordably.

Future Capability Strategies

The conference heard that the Indian Air Force (IAF) provides an excellent contrast to the strategic outlook of Western air forces. Due to its size and the immediacy of its state threats, namely Pakistan and China, the IAF has great clarity in terms of purpose. However, it must also deal with internal and external terrorist threats and cover an enormous and varied geographic area of responsibility. As a result, the IAF is focusing on developing long-range standoff weaponry, completing its multi-layered ground-based air defence network, as well as coalescing its many fast jet types into a more streamlined and supportable force over time, with the replacement of the Mig-21, Mig-27, Mig-29 and Jaguar with the Rafale, Tejas and MMRCA single-engined procurement. The IAF is also prioritising education for its personnel to improve their ability to understand and respond rapidly and flexibly to future innovations and challenges.

In terms of Russian Air Force modernisation efforts, the conference heard that in every aircraft modernisation effort, Russia is hugely dependent on Western electronic components. The Su-35, for example, is dependent on French avionics, and without continued deliveries promised by contracts signed before 2014, Russia would be unable to manufacture them.

Both of Russia's surface- and air-launched missile modernisation programmes are dependent on continuing to try and squeeze more incremental improvements from Soviet-era designs. Furthermore, many developing Russian air-to-air missiles (AAM) were manufactured in Ukraine and have, therefore, been unavailable since 2014. In terms of very long-range surface-to-air missiles (SAM), such as the S-400's 40N6 missiles, the seeker is still not properly functional even after fifteen years of development. Also, the capacity to cue missiles with SAM and fighter radars cannot be stretched far enough to take advantage of the kinematic potential of the missiles themselves. Therefore, Russia is working to develop the capability to conduct cross-platform missile cueing using Mig-31 Foxhounds and the prototype A-100 next generation AWACS, ELINT, UAV and Command and Control aircraft.

The Su-57 (T-50/PAK FA) fifth-generation fighter programme has major problems and incorporates significant design compromises in terms of radar cross-section (RCS) reduction. Due to large internal weapons bay requirements, the engine intakes are less S-shaped than Western designs, increasing RCS due to turbine blade visibility to frontal radar scans. However, if Russia can get the innovative L-band decimetre radar arrays buried in the leading edges of the wings to work properly, it would give the Su-57 a significant potential counter-stealth radar capability.

In terms of Chinese threats, the conference heard that the PLAAF is heavily focused on optimising capabilities for a confrontation with the US within its immediate neighbourhood. As a result, developments such as the J-20A stealth fighter emphasise long-range and missile capacity over all aspect stealth. They need only to be difficult to detect within the background noise of a

major air battle, but with sufficient range to threaten US bases and support-enabler aircraft, such as tankers and AWACS.

China has an unmatched ability to build modern fighter aircraft in large numbers, and does not view building new aircraft purely in terms of cost, given their employment and technology development benefits for the wider economy (although its willingness to purchase platforms from Russia at scale is limited). This enables it to rapidly prototype and introduce new variants of air platforms, often retiring older variants or airframes that have been subject to much wear and tear in favour of newly manufactured models, as opposed to conducting mid-life upgrades.

To give an example of China's exploitation of this industrial capacity, the PLAAF operates multiple different AWACS types using a variety of different passive and active electronically scanned array (PESA/AESA) radars. It is producing and trialling them simultaneously to explore and develop best practices. Furthermore, China is developing the 'Divine Eagle' high-altitude UAV with radar payload to detect stealth aircraft using an approach that envisages multiple orbits with ground-based signal post processing and analysis to 'join the dots' in terms of pinpointing and triangulating scarce radar returns.

China's huge access to Western, Israeli and Russian airpower technologies through licences, reverse engineering and industrial espionage enables it to pick and choose elements from all these sources on everything from missile design and stealth airframes to sensor packages. An adopt, adapt and improve approach, coupled with huge production capacity and an appetite for experimentation, trial and error means that not only is China rapidly closing the capability gap with Western air forces, it threatens to overtake them in the not so distant future.

What Does Success Look Like, What Disruptors Might Change the Game?

In this final session, the conference explored the potential pitfalls and disruptors in current airpower thinking. The Combined Air Operations Centre (CAOC) at Al Udeid Air Base in Qatar was compared to the Death Star of the famous *Star Wars* film series; a huge, slow-moving and technologically exquisite construct that by virtue of its huge size and often very narrow, high-granularity target focus is extremely slow to change course and adapt to new operational or technological realities.

The hugely bureaucratic process inherent in high-complexity modern air operations, such as the famous *Red Flag* series in the US, was compared to an orchestral symphony. The act of getting some 60 or more aircraft into a small area of sky and out again requires such precise timing, preparation and marshalling that any opportunity for tactical or operational innovation is completely stifled. The 'symphony' works beautifully when executed to plan and everyone knows their exact role, steps and timings. However, in inter-state, high-end warfighting, that sort of plan will not survive contact with the enemy and Western air forces will need to be able to improvise, more like jazz musicians. Current C2 and training structures are not configured to

allow this sort of flexible and adaptable operational approach, making this is a core weakness in Western airpower capabilities.

The centralised control, decentralised execution (often centralised control, centralised execution) command model that has grown up within the CAOC construct and now dominates operations such as Shader encourages the withholding of permissions and authority at the highest possible level and far away from the cockpit. Risk aversion is a key political and hierarchical challenge in this respect. In high-end warfighting, this high level, centralised C2 approach will simply not be possible, but will NATO air forces be able to adapt quickly enough in operational, conceptual and legal terms to meet such a challenge? Air forces should train and prepare for 'managed anarchy'.

As earlier on in the conference, discussions returned to the idea that air forces need to improve how they think about the way they should fight wars, rather than what they are going to buy. There needs to be a coherent narrative about how NATO air forces will fight and why that will allow them to win wars. Measures of OpTempo and periodic refreshes of the concepts of operations documents are not enough.

NATO also needs to bear in mind, when it looks to technologies or conceptual developments to deliver game changing answers to its problems, that any gap or advantage eventually closes and that inferiority is a fantastic driver for innovation in opposing forces as well as our own. We must not forget that a narrative of returning focus to deterring, and if necessary being ready to fight, big wars will not eliminate the incidence of small wars. How can air forces continue to be prepared for both, especially when defence budgets appear too small to support even a singular focus on the high-end in many countries? Is high-end capability still suitable to handle low-end wars by default?

Developments in unmanned combat air vehicles (UCAVs) need to be seen both as potential disruptors to the high-end manned combat aircraft market, but also as disruptors for lower-end markets where the level of technology seen in late fourth-generation or fifth-generation fighters is not necessarily required. Developments such as the Defense Advanced Research Projects Agency's (DARPA) swarming Gremlin UCAV being able to be released in large numbers from transport aircraft might significantly alter the balance of investment logic for both attack and defence in airpower in future. In both the manned and unmanned air system space, industry is being forced by military customers (for good reasons) to go down the open architecture, flexible mission payload/effector design route, and create systems that in future can have their electronics and mission systems regularly upgraded without large-scale deep maintenance work.

Conclusions

There was a broad consensus that in future there will need to be great improvements in international interoperability between NATO members states' air force systems, especially in terms of network architectures with low probability of intercept/detection (LPI/LPD) capabilities. Most Western air forces appear to be going down the centralised, highly networked, platform-agnostic path in terms of future airpower strategies capable of, in theory, leveraging

sufficient combat power from limited numbers of platforms to credibly deter state threats. Poorly aligned timescales and continuing security and classification problems in terms of information sharing remain major barriers to true trans-national operational interoperability. NATO has no choice but to work to overcome these challenges.

The introduction of significant but limited numbers of fifth-generation fighters into the European combat air mix over the next decade will make interoperable LPI/LPD network capabilities essential, to enable improved survivability and lethality of older platforms against peer threats. However, there is also no doubt that Russia and China in particular are developing both kinetic and non-kinetic options for attacking Western airborne C2 and networking nodes in any future conflict, and these may well be exported to other nations. Furthermore, the centralised control model that the highly information-saturated and communications-rich CAOC model encourages may be entirely unsuitable in a fast-moving inter-state conflict due to a heavily contested electromagnetic, information and kinetic environment that makes effective 'long screwdriver' control impossible.

In the end, politicians and senior military leaders may have to return to trusting the person in the cockpit to make correct split-second decisions during operations with potentially dire strategic consequences. Whether air forces should seek to fight as weapons systems or not, the issues of international cooperation and the delegation of permissions, authorities and trust to the tactical level in order to guard against strategic C3 vulnerabilities are ultimately political ones and need urgent attention.

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