EDITOR'S NOTE

The war in Ukraine continues to dominate the global attention. Russia's offensive is tending to grind. There are gains and setbacks for both sides. As each tries to wear the other down, there is continuous loss of life for both. Despite Russia's dominant military might, there has been no swift victory as initially envisaged. The Ukrainian counter-offensive in the north has successfully pushed back Russian forces from the second largest Ukrainian city of Kharkiv. In the south, Russia has decisively cleared all resistance in the port city of Mariupol. Russia continues to make slow but steady advances in the Donbas. Ukraine continues to innovatively destroy Russian armoured vehicles using Unmanned Aerial Vehicles (UAVs) and anti-tank missiles. Russia is making heavy use of artillery and Surface-to-Surface Missiles (SSMs). The Ukrainian forces are well dug in, in defensive positions, but Russia is trying to bleed them dry, and Ukraine is suffering significant casualties. Ukraine's President Zelensky has said that Ukraine's eastern Donbas region has been "completely destroyed".

Ukraine remains outgunned, despite significant military support from the West, which includes US M777 howitzers and weapon locating radars. The West is also supporting Ukraine with intelligence and surveillance pictures. Analysts believe that Russia has underutilised its air power. It is important for Russia to control the Donbas region for it to be able declare some form of victory. But the Russians are getting bogged down in the urban areas. Fighting in town and cities always favours the defender. Russia is still not deploying sufficient troops to avoid own casualties, but that could slow down advances in urban areas. Mobilising of its reserves is also taking time.

It appears currently that it could be a long war. It is not a stalemate. Russia is making slow advances. It is also using economic and political means to inflict

as much damage as possible. While Russia's economy is taking a hit from the Western sanctions, Ukraine's is likely to suffer even more. Most Western countries are facing high inflation due to the prices of gas and oil and food grains, significant supplies of which were coming from Russia and Ukraine.

President Vladimir Putin wants to seize the whole of Luhansk and then do something similar in Donetsk, to be able to call it a victory. Western military analysts have commented poorly about the Russian military tactics and strategy. In particular there are adverse views about the logistics back-up, air cover and command approach.

Meanwhile, the world has to factor in the nearly 14 million people displaced by the war, and the pressure on the neighbouring countries. The US Congress has approved $40 billion in aid for Ukraine and other countries affected by the conflict. This is the sixth aid package since the war began. Of this, $19 billion is for immediate military support to Ukraine, $3.9 billion to sustain US forces deployed to Europe, $2 billion for long-term support to the North Atlantic Treaty Organisation (NATO) allies and defence modernisation programmes, and $16 billion for economic support to Ukraine. Only a small part of this would be usable immediately, while the remaining will take years to be utilised.

Meanwhile, some feel that Ukraine fatigue has begun to set in. The rising authoritarian China and its belligerence in the South China Sea and expansion in the Indo-Pacific region is of greater concern. The leaders of the Quad nations—Australia, India, Japan, and the United States—had a summit meeting on May 24, 2022, in Tokyo. This was the fourth time, and the second time in person. The Quad is today a leading regional partnership to advance a common vision of a free and open Indo-Pacific. It has six leader-level working groups—on COVID-19 Response and Global Health Security, Climate, Critical and Emerging Technologies, Cyber, Space, and Infrastructure. At Tokyo, the Quad leaders welcomed a major maritime initiative: the Indo-Pacific Partnership for Maritime Domain Awareness (IPMDA). This will enable the partners in the Pacific Islands, Southeast Asia, and the Indian Ocean region to fully monitor the waters so as to uphold a free and open

Indo-Pacific. It will allow tracking of "dark shipping" and other tactical-level activities. The Information Fusion Centre, Indian Ocean Region, based in India, and the Information Fusion Centre, based in Singapore, would be strengthened.

The four countries are committed to work jointly on critical and emerging technologies. Vulnerabilities in global semiconductor supply chains, 5G supplier diversification, interoperability and telecommunications cyber-security are areas to be pursued. The plan is to strengthen information-sharing among the Quad Computer Emergency Response Teams (CERTs). The agenda includes unlocking opportunities in critical and emerging technologies through stronger engagement with the private sector. In the space domain, they will strengthen cooperation by pooling collective expertise to exchange satellite data, enable capacity-building, and consult on norms and guidelines. A Quad Fellowship programme will sponsor 100 American, Australian, Indian, and Japanese students to study in the United States each year for graduate degrees in the Science, Technology, Engineering, and Mathematics (STEM) fields.

The Quad Infrastructure Coordination Group will promote collaboration in digital connectivity, transportation infrastructure, clean energy and climate resilience. The Quad Humanitarian and Disaster Relief Mechanism will coordinate and mobilise disaster assistance efforts.

The Quad is committed to maintaining its global leadership in responding to the COVID-19 pandemic and bolstering global health security. India's expanded vaccine-manufacturing capacity will be used, and Japan will support with funding. The Quad Climate Group will look at existential issues for the Indo-Pacific Island countries and how to mitigate them. The Quad will also cooperate on disaster risk reduction through the Coalition for Disaster Resilient Infrastructure (CDRI).

Meanwhile, India continues to push for indigenisation (*atmanirbharta*) in defence production. The central government has earmarked 68 per cent of the capital budget for 2022-23 for the domestic manufacturing industries. The third Positive Indigenisation List includes restrictions on the import of

351 systems and components. Earlier, in June 2021, the Ministry of Defence (MoD) had notified the second negative import list of 108 items. The first list comprising 101 items was notified in August 2020. The Defence Acquisition Procedure (DAP) 2020 has been made "Make-in-India" friendly. India is also trying to diversify defence imports to reduce overdependence on a single country. Meanwhile, India's defence exports increased from Rs 1,521 crore in 2016-17 to Rs 8,434.84 crore in 2020-21. The government has set an ambitious target to achieve exports of about Rs 35,000 crore ($5 billion) in aerospace and defence goods and services by 2025.

This issue of the *Air Power Journal* brings into focus important geopolitical issues. The continual expansion of offensive air and missile weapons capabilities has led militaries to develop commensurate defensive capabilities. These "air and missile defence" systems provide surveillance, tracking, command and control, and weapons delivery capabilities to field commanders. These include early warning radars, fire-control radars, and strategic and tactical surface-to-air missile systems. Gradually, they have become more connected, and today, several of these systems can communicate and operate collectively in what is called the Integrated Air Defence System (IADS). A comprehensive air battle space picture can be generated for better situational awareness and control.

No vision of the 21st century national security can be complete without factoring in the significance of the elements of air, space and cyber space. Air and space afford fullest and most rapid mobility with truly global range, capable of operating above any part of the earth's surface – land or sea – unconstrained by the barriers of geography. In order to achieve this pre-eminence, aerospace power would need to adapt and develop, to tackle a broad spectrum of threats extending from the high to the low end, from conventional wars to irregular warfare. The threat analysis will result in strategic and perspective planning issues such as force structure and modernisation priorities. Aerospace power would have to be applied in a joint multi-domain environment. There is, thus, a need for structural appraisal of the way to transform Indian aerospace power.

The US has long recognised the Indo-Pacific as vital to its security and prosperity. It is committed to an Indo-Pacific that is free and open, connected, prosperous, secure, and resilient. To promote integrated deterrence in the Indo-Pacific, the US defence budget has been prioritising to counter the challenges of China's growth. The 2023 Pacific Deterrence Initiative (PDI) budgeting is meant to build the concepts, capabilities, and posture necessary to meet these challenges, along with the allies. The US Defence Budget for Financial Year (FY) 2022 earmarks over $66 billion for the Indo-Pacific region, of which $5.1 billion is for PDI.

Space has become the ultimate enabler for most activities on planet earth. As capabilities and usage of space platforms increase exponentially, it is becoming an arena of both competition and collaboration. The dynamic and complex space environment is increasingly being used for supporting and enhancing military operations. Execution of operations in the space domain requires actions in the orbital, terrestrial and intermediate segments. Space operations face threats across all domains, including those that are intentional, unintentional and naturally occurring. These could be directed energy, cyber threats, Electro-Magnetic Pulse (EMP), and physical attacks. The unintentional could be from the environment and debris. Space security is, thus, important for stable and secure access to space. There is a need for global cooperation on many counts. Meanwhile, each country needs to harden space platforms for cyber, and defence against the adversary's directed energy of kinetic attacks. Space will support combat power projection. Each country will have to improve the speed and quantum of space access through better and more frequent launch capability, and on-orbit sustainment. Information mobility (data), communications, Positioning, Navigation, and Timing (PNT) will be crucial for space situational awareness and targeting. Modern sensors will be required for Intelligence, Surveillance and Reconnaissance (ISR).

For over 60 years, the UK's independent nuclear deterrent has existed to deter the most extreme threats to its national security. Since 1969, the deterrent has been based only on the Royal Navy, with at least one nuclear-armed ballistic missile submarine patrolling the seas undetected at all times.

The Dreadnought programme is to replace the Royal Navy's Trident missile Vanguard class submarines.

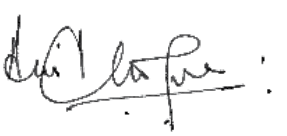
Aircraft engines are among the most complex systems on board. They have to produce very high thrust yet remain sleek to reduce in-flight drag. They operate at very high rotation speeds (Rotations Per Minute – RPM). This requires a very fine balancing of the compressor and turbine blades, and high-quality bearings which have to be suitably lubricated. The engine burns aviation fuel in the combustion chambers and reaches high temperatures, requiring special materials technology for the hot sections. The engine has to operate efficiently from sea level to very high altitudes up to the stratosphere. Also, the engine must operate at a mix of subsonic, transonic, and supersonic flights. This implies large changes in atmospheric temperatures and pressure conditions. Special alloys, sophisticated air cooling schemes, and special mechanical designs are required. There are just a few aircraft engine manufacturers in the world. Even emerging major aerospace powers like China and India are still struggling to have their own engines flying. It is important for India to finalise a route-map for indigenous aircraft engine production.

The Beginning: A History of Military Aviation in India 1901-1947, a book authored by Air Marshal Bharat Kumar covers the evolution of military aviation in India from 1901 when the first and the only balloon unit was inducted for purposes of reconnaissance work in the North-West Frontier. It navigates through the formation of the Indian Air Force in 1932 and the action it saw in World War II.

We cover all these and more in this issue of our *Air Power Journal*.

Happy Reading!

Jai Hind!



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