EDITOR'S NOTE

The year just gone by will be remembered for more reasons than one. For air power enthusiasts, and also for those who watch developments across our western border, a new paradigm to deal with the scourge of terrorism was born when ordnance was dropped by Indian Air Force (IAF) fighter aircraft on February 26, 2019, on Pakistani sovereign territory to neutralise a terrorist training camp at Jabba Top near Balakot in the Khyber Pakhtunkhwa province of Pakistan. This was a demonstration of political will of the strongest kind; resoluteness to punish the enemy for its unabated acts of terrorism. The instrument of national power chosen to convey the message was the IAF. The new paradigm was the inherent message in the action: "You mess with us, we will get you, no matter where." This message was conveyed loud and clear to the 'deep state' within Pakistan.

For far too long (since the Nineties), the Indian leadership had been faced with the dilemma of finding space for conventional conflict within the 'nuclear overhang' – a 'professed' readiness by Pakistan to use its nuclear weapons if the Indian state ever crossed the cleverly articulated – by Maj Gen Khalid Kidwai – red lines (which have, of course, never been acknowledged by the Pakistan side as being the official policy). Pakistan had created an aura about itself of being an irrational state in the minds of not only the Indian leadership, but across the globe. This, then, had weighed upon Indian political decision-makers, besides other considerations, while choosing their options for dealing with Pakistan. The ghost of 'self-deterrence', due to an imagined certain use of nuclear weapons by the adversary, if India were to cross the Rubicon, was finally laid to rest by the actions of February 26, 2019.

As far as the mission execution, *per se*, was concerned, the timing decided for the mission demanded the maximum from the pilots; flying at an unearthly

hour of 2.30 in the morning – at a time when the biorhythms of humans are known to be at their lowest – put a lot of stress on the pilots who knew the stakes involved in this mission of national importance. They carried out the mission flawlessly, with utmost professionalism. Equally important was the requirement that the mission be carried out in utmost secrecy, for obvious reasons. It goes to the credit of the IAF and the leadership at every level that despite the very large number of aircraft involved, taking off from several bases, not a word 'leaked' to the other side. This speaks volumes for the integrity of air warriors belonging to the Bharatiya Vayu Sena.

The response by the Pakistan Air Force (PAF) on February 27, 2019, has been debated *ad nauseam* since the event.

Suffice to say that the technological edge that the IAF had enjoyed vis-à-vis the PAF during the Kargil conflict – that of Beyond Visual Range (BVR) weapons, which the PAF did not possess at the time – had been blunted by the PAF with their acquisition of 500 AIM-120 C-5 A Advanced Medium-Range Air-to-Air Missiles (MRAAMs) from the US, the first batch of which arrived on July 26, 2010. The effective launch range of the AMRAAM is greater than that of the BVR missiles in the IAF's inventory. This asymmetry needs to be addressed at the earliest – without waiting for the arrival of the Meteor on the Rafale – as a repeat of a Pulwama or Uri type of incident cannot be predicted. If the air force is called in again, it would then be able to do so with all guns blazing.

Another event in the year gone by that has set a new benchmark for asymmetric warfare was witnessed when an impoverished group of rebels (Houthis) in Yemen were able to cause significant damage to the oil fields of their affluent neighbour, Saudi Arabia (that is among the top twenty economies of the world, and is the world's third largest defence spender whose annual defence expenditure is between 11-12 per cent of its GDP). September 14 saw the inspirational use of 'modified' Qasef 1 drones (loitering munitions) that easily evaded the acquisition radar of the sophisticated MIM-104 Patriot Air Defence System that had been integrated with the 'Peace Shield' Integrated Air Defence Command and Control System – one of the most sophisticated

air defence systems in the world. Having penetrated the Saudi air space with impunity, the Houthi drones were able to carry out successful attacks against the Abqaiq and Khurais oil fields. Saudi Arabia's oil output was neutralised by half – a huge 5.5 million barrels per day! Crude prices across the world shot up by 15 per cent; fire-fighting by the US stabilised the price of oil.

These were NOT isolated attacks carried out by the determined Houthis – who had nothing more to lose as they had already been bombed relentlessly since 2015 by the coalition created by the Saudis from among the Gulf countries. In May 2019, the Houthis had attacked the East-West oil pipeline of Saudi Arabia, causing fires, although production was not affected then. They also flew past the Saudi water purification plants – a lifeline for the Saudi people – and posted pictures of the same in a warning to Saudi Arabia to stop further attacks. The Houthi rebels, members of the Zaidi branch of Shi'ite Islam, have been able to stave off attacks from the powerful coalition created by Saudi Arabia so far. Of course, they appear to be receiving active support from Shi'ite Iran which is using them for continuing a proxy war on its (Iran's) behalf against the Sunni kingdom and other Gulf states.

The Houthis have also been using drones laden with bombs (having a low yield) to successfully cause casualties among the Saudi troops. This appears to be an innovative use by the Houthis of very low cost drones for carrying out 'air strikes', despite not having an air force of their own. Commercial drones are increasingly being used for political violence as well. While the Venezuelan president survived an assassination attempt from a drone in August 2018, a Saudi army brigadier general was not so lucky; on January 10, he, along with five other military personnel, was killed when a Houthi drone – similar to the one that carried out the attacks on the Aramco oil fields later – arrived over the Al-Anad air base and detonated near the grand stand. The inherent danger of use of drones for sub-conventional warfare needs careful consideration by those dealing with national security across the globe.

Accent on counter-drone technology has only picked up after such devastating attacks – including political assassination attempts. The first basic requirement, of course, would be to spot the incoming threat. Use of all kinds

of trackers – electro-optical, infra-red, acoustic, radar – would be necessary. To neutralise the threat, it would first need to be identified as a genuine threat before it is engaged, lest an innocent object is shot down. To cater for the multi-directional threat not only from a single drone but also from swarms, companies like the Syracuse Research Corporation (SRC) of North Syracuse, New York, are working on the use of Artificial Intelligence (AI), along with machine learning, in view of the nature of the threat being beyond human capability to handle 'manually'. The panoply of anti-drone weapons could include the Global Positioning System (GPS) jammers, Radio Frequency (RF) jammers, laser and high-power microwave weapons (also called 'phasers'). While laser weapons are highly directional and would almost certainly destroy the incoming threat completely, phasers would prove more suitable for neutralising swarms. Also, since high-power microwave energy would only affect the electronics inside the drone, the drone itself would remain largely unharmed; this would help in identifying the source of the threat later. Drone manufacturers are deeply concerned about the threat to their products from anti-drone systems (also termed 'counter-small Unmanned Aerial Systems (UAS); they are, therefore, attempting to make their drones resistant to counter-drone systems. This counter counter-drone technology includes attempts to make the drones completely silent and invisible to radar. The race is on!

Air defence planners need to sit with industry to work on optimum solutions to cater for the existential – not emerging any longer – threat from drones and swarms.

The third event – that has the potential to tilt the battle for air dominance in the Western Pacific in favour of China in the future – was the first long range joint air patrol carried out by the Russian Air Force (RuAF) and the People's Liberation Army Air Force (PLAAF) over the Takeshima/Dokdo group of islands on July 23. Although a seemingly minor incident, this first joint air action by the RuAF-PLAAF had the potential to spin out of control because of the "unlawful and dangerous actions" (as per the Russians) of the Republic of Korea Air Force pilot who fired almost 400 live rounds of front

gun ammunition to warn off the RuAF A-50 Airborne Warning and Control System (AWACS) aircraft that overflew sovereign air space over the islands mentioned above (and which are claimed by both Japan and South Korea).

And, finally, as the year comes to a close, the Government of India announced that Gen Bipin Rawat, the outgoing Chief of the Army Staff (COAS), has been appointed the first Chief of Defence Staff (CDS) of the Indian armed forces. Our congratulations to Gen Rawat on this singular honour; we wish him an eventful, successful – albeit challenging – tenure as the CDS.

We wish all our readers the very best of health and joy in the New Year.

Happy reading.