ARMY GETS READY TO INDUCT APACHES

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Iran's Strike and Israel's Response

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EDITORIAL

Lessons form the Israel-Iran Strikes

Maj Gen (Dr) GD Bakshi, SM, VSM

Mercifully, a devastating escalation has been aborted in the Middle East. However, the Iran-Israel exchange of missiles strikes and air attacks has showcased the new paradigm of missile war to the whole world. What we are seeing is a Revolution in Military Affairs (RMA) driven by drones, ballistic and cruise missiles. It has transformed the way wars will be fought and won in the future.

The shift to missiles and rockets had begun in the wake of Gulf War 1 and 2, when Iraq used Scud missiles to hit back. China was then totally out-classed in air power. Chinese took this lesson to heart and, today, they have the largest arsenal of ballistic and cruise missiles in their Strategic Rocket Forces. The Chinese have also invested very heavily in drones and quadcopters. The Armenia-Azerbaijan War first showcased the lethal capabilities of drones. This trend was soon confirmed in a major way in the Russia-Ukraine War. Ukraine first used $2000 drones to plink Russian tanks worth couple of million dollars. The Russians have now caught up in a very big way with their own Kamikaze drones and Iranian Shahid drones (retro-fitted with Russian Glonass-based satellite navigation system).

Courtesy mass use of drones, there are now major changes in the way of war-fighting. Advances are now slow and incremental - several small, creeping arrows instead of a massive push and big red arrows on the map. The Ukrainians tried massive corps-sized offensives last year and came to grief. We are now waiting for the ground to harden in Ukraine, so Russia can launch its major offensive.

Meanwhile, after decades of a proxy war against Israel, Iran retaliated in rage with 320-strong barrage of some 170 drones, 35 Paveh cruise missiles and some 120 Shahab ballistic missiles. Israel is just 27,000 square kilometres in size and a very compact target to defend. Iran hit two air bases (the Nevatem and Ramon airfields) and one intelligence gathering unit 8200 in the Golan Heights. Israeli air defences were networked with the US Anti-Ballistic Missile (ABM) shield with the HQ in Colorado. it was linked to hundreds of US satellites, computation systems, sensors and shooters. Two Ageis-class missile destroyers with ANTPS-Y-2 X-band over the horizon (OTH) radars and 200 British, French and American fighter jets were scrambled to shoot down the drone swarms. Some 98% of the Iranian projectiles were shot down. However, the very serious aspect was that the 2 to 3% that got through the most heavily defended air space in the world were very lethal ballistic missiles. Out of seven Iranian missile fired on the most highly defended Nevatem air base, five hit the runway and storage facilities.

Iranian drone firing practice at an undisclosed location in Iran

What if these missiles had been nuclear-tipped instead of conventional ones? The disaster would have been complete and horrific. So there are no leakproof ballistic missile defence umbrellas. They are unusually costly and there is no such thing as 100% assurance in missile defence. Iranian missiles also hit the Ramon airbase and the Israeli intelligence gathering facilities. These were the precise bases from which Israel had struck Iran's consulate in Damascus. Iran had made a telling point. Despite 72 hours advance notice, despite the densest air defences in the world, they got through. What if 1,500 drones and missiles had been fired instead of 300? The damage would have been horrific.

India's Ballistic Missile Defence and Air Defence Capabilities

In the light of Iran's missile and drone strikes where does India figure in AD and ABM capabilities? India is a huge target to defend. There is no way the entire Indian air space can be defended. We have to focus only on some Vulnerable Areas (VAs) like airfields, command and control centres, logistics and ammunition dumps, tank concentrations, etc. So where does India stand today?

- **Anti Ballistic Missile Shield.** The DRDO had developed two systems. The first is Exothermic - to intercept ballistic missiles of 5000 km range and more, and the Endothermic missiles to intercept at 2000 km or less, within the earth atmosphere, at 15 to 20 km.
- **S-400 Triumf.** We had placed on order for five batteries in 2018 for the Russian air defence system of 380 km range. Three have been received, others will come by 2025-26.
- **Long Range Kushal SAMs.** DRDO is developing a 350 km long range SAM which could be ready by 2028-29.
- **Medium Range Barrak SAMs.** This system has a range of over 70 km and was jointly developed with Israel. It is being inducted in all three Services.
- **Aakash SAM.** The IAF has 15 squadrons and the Army has two regiments worth of Aakash indigenous system of 25 km range.
- **Spyder.** This is a low level quick reaction SAM that was developed with Israel. It has a range of 15 km and has been fielded in the Indian Army and Air Force.
- **Short Range SAMs** of 6 km range. The project to develop these is underway. Besides we have shoulder-fired Igla and Igla-S missiles of 5-6 kms range. We are developing the V-SHORADs. Amongst legacy systems we have the OSA-AK (10 km range) Pichora SAM-3 systems along with their upgrades and the World War II era L-70s being upgraded.

India is confined to point defence of vulnerable areas and vulnerable points, using layered air defences which are fairly lethal but will need to be enhanced and optimised. Our ABM systems have been tested but are yet to be fielded. Considering that our primary threat is from China (a formidable missile and drone power) we will have to take urgent and energetic steps to fill the gaps in our air defence and ballistic missile defence. That is the primary lesson learnt from the ongoing conflicts in Ukraine and the Middle East. Drones are the future of warfare.

Iran-Israel Missile War (Part 1)

An Analysis of Iran's Strike

Maj Gen (Dr) GD Bakshi, SM

There has been a paradigm shift in the power balance in the Middle East which will have long term implications for that region. So far, thanks to unqualified American support, Israel had technological supremacy in the Middle East and could attack any nation at will. Iran's missile power has now put a major check, at least on direct attacks on Iran. So far, Iran had been waging a proxy war with Israel through its surrogates - Hamas, Hezbollah and Houthis - along with the Shia militias in Syria and Iraq. Now it has graduated to a direct clash between two state actors with serious risk of major escalation.

It all started with Israel's attack on Iran's consulate in Syria on 1 April. Iran retaliated with a massive 320 drone-cum-missile barrage on 13 April, which left the world stunned with its scope and scale. There were fears of a massive war in the Middle East that could torpedo the global economy. For the time being, this threat has abated and the world can breathe a sigh of relief, but for how long remains to be seen.

Iran's ballistic missiles arsenal

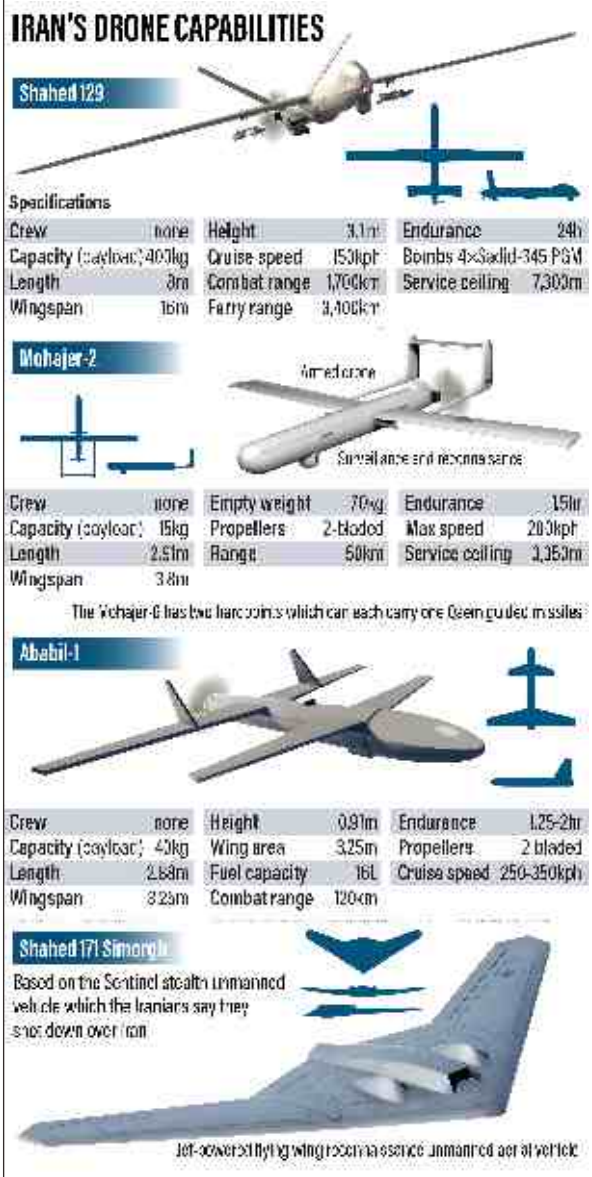
Missile Power vs Air power

There is a wider professional military debate that has been ongoing since the start of the war in Ukraine. What is the inter-se emphasis that armed forces should place on missile/ drone power vs manned air power? This is a seminal question of allocation of resources that must now be seriously addressed. After Gulf War I & II, where Iraq had used Scud missiles to hit back at USA's far superior airpower, China had drawn its lessons. Today, it has the largest Rocket Force in the world, which India, Taiwan, Japan and Philippines, etc, must all worry about.

The Israelis have traditionally placed very heavy emphasis on airpower and that has been the key to their technological-military superiority in the region. They could hit any country or non-state actor anywhere in the Middle East without any chance of effective response. Not anymore. We are witnessing a military paradigm shift in the region. Missiles and drones have caused a dramatic escalation of stakes. Even the Russian Air Force, though vastly superior to the Ukrainian Air Force in qualitative and quantitative terms, has been fairly restrained in its operations due to the sheer density of the air defences. Most of its attacks have been stand-off attacks with cruise missiles fired from own side of the border. It is only now that Russian Air Force has become more active over the tactical battle area with its Glide Toss Bombs (FAB- 2000 and 3000).

Density of AD Coverage: Israel vs Ukraine

There is also the aspect of force to space ratio. Israel is a small country with just 27,000 sq kms of area to defend. Ukraine is over 6,07,000 sq kms. Flight times from Russia for drones and missiles are far shorter. They are much longer in the case of Israel and so warning/ reaction times are far greater. Hence, military professionals in India must closely watch these ongoing missile wars and prepare accordingly. We will have to drastically enhance our drone and missile power, both in quantitative and qualitative terms. We will have to re-examine our allocation of resources to manned vs unmanned attack platforms. Air defenses are increasingly becoming more lethal. Missile-cum-drone wars are, therefore, the future. The Chinese have a head start in this



respect and we have reason to be concerned. That is why, the recent Israel-Iran missile war has serious and pertinent lessons for us and we must examine these in depth. Israeli armed forces are very innovative and we must study the counter-measures they evolve. So let us now analyze the recent Iran-Israel conflict for immediate lessons learnt.

1 April Israeli Strike

On 1 April, Israel's F-35 jets struck the Iranian consulate in Syria. Technically, under the Vienna Convention, that was sovereign Iranian territory. From their intelligence gathering facility in the Golan Heights, they had been tracking Iranian IRGC commanders on the way to Damascus for a conference. It is noteworthy that they did not attack them outside the consulate, but struck while they were in conference within the building. Some 11 Iranians, including three top commanders of the Iranian Revolutionary Guard Corps (IRGC) were killed. These included Gen Hossein Salami, top commander of IRGC, and two other Brigadier Generals. There was speculation that the Israeli strike was deliberately designed to provoke Iran into a rash action that would justify Israeli retaliation of far greater intensity at its nascent nuclear capability. If that was the plan, it had apparently worked.

Israeli Miscalculation?

However, subsequent events do not bear out this deliberate provocation narrative. Rather, it now seems that Israel miscalculated. It had assumed that Iran would not react to the consulate strike but evidentially, it was quite mistaken. The recent resignation of the Israel's Military Intelligence (Aman) chief on 22 April seems to confirm this. Though his resignation letter refers to the failure to predict/ forestall the 7 October strike, the timing of the resignation seems to suggest that the Iran strike was also a possible causative factor. Apparently, the intelligence chief had said Iran would not respond to an attack on its consulate. The timing of his resignation seems to confirm this major miscalculation thesis.

There was a great outrage and angst in Iran. Embassy is sovereign space and it was a direct affront to its sovereignty. Iran now considers itself a strong military power, courtesy its large arsenal of drones, cruise and over 3,000 missiles of various types.

Did Israel warn the US of this attack? It now emerges that this was done just minutes before the strike. In fact, it has been reported that US defense secretary Austin Lloyd called up the Israeli defense minister to complain that lack of adequate warning could have put US installations in Middle East at risk. US and Iran, meanwhile, stepped up backchannel negotiations to ensure that there would be no major flare up and escalation due to Iran's impending retaliation. But Iran was adamant that it would have to react because its sovereign territory had been hit.

US Dissuasion Efforts

The US now made significant efforts to dissuade Iran from any major escalatory step. It made all efforts to make Iran recalculate and limit its response. In fact, it sent in its massive carrier battle group of the Eisenhower to the Mediterranean. General Korella, Chief of US Central Command, personally went to Israel to coordinate defensive actions to face such a missile attack. The simple fact is that Iran refused to be deterred or cowed down with these menacing preparations. It was desperate to demonstrate that it had the will and resolve to respond in a way that would underline its significant military power. Yet, it took deliberate steps at the same time that would limit the success of its own missile strike. Its aim was to make a strong statement of will and intent and underline its capacity to do deterrent damage, without crossing a threshold that would invite a devastating US-Israeli response.

Iran's Missile Strike

Iran took 13 days to respond to the consulate provocation. When it did, Iran surprised the United States, Israel and the world with the scale and intensity of its response. This was a significant missile operation and deserves to be studied in detail for pertinent lessons. Unmanned missiles are rapidly overtaking manned air strikes as the weapon system of choice the world over. The Ukraine War bears ample testimony to this trend. The Iranian attack came in three distinct waves:-

- First Wave. The slower moving Shahid drones, (speed 185 kmph) were launched late at night on 13 April 2024. They were launched from multiple directions from Iran, Syria, Iraq and Yemen. These would take about 4 to 5 hours to reach Israeli airspace. US satellites picked up this swarm of drones and alerted Israel and the world. President Joe Biden rushed back to the White House to huddle with his National Security Council (NSC) staff and monitor the operations in real time. Some 200 US, British and French fighters were scrambled to shoot down these drones before they entered Israeli airspace. US naval assets in the Mediterranean and Red Sea provided the sensor data to monitor and shoot down this drone swarm. The Shahid drones were based on GPS guidance. The Israelis simply shut off GPS guidance over Israel to spoof these drones. It is noteworthy that all Shahid drones purchased by Russia and used so extensively in Ukraine, have been retrofitted with GLONASS Russian navigational system, precisely for this reason. The drone swarms seemed headed for Golan Heights, Dimona nuclear facility and Southern Israel, as per initial estimates.
- The Second Wave. A second wave of some 30 Paveh cruise subsonic cruise missiles with a flight time of 1 to 2 hours were launched by Iran. These had speeds varying between 500 to

Demonstrators wave Iran's and Palestinian flags as they gather in Tehran on April 14, 2024.

600, kmph and a range of some 1000-1500 kms. These had much heavier warheads. Reportedly, some did get through. They were timed to arrive along with the drones. These were designed to strike Israeli AD locating and fire control radars and weapon systems. It is reported that they did hit two Iron Dome launchers and possibly a SAM battery. These have not been confirmed by Israel.

- Third Wave. This third wave was the most lethal. It comprised of 120 Sahab Medium Range ballistic missiles (MRBMs) of 1500 km range. Their flight time to Israel was just 15 minutes. The Iranians claimed that the drones were largely inexpensive decoys designed to fool and overwhelm the Israeli defences. Most of the drones were based on GPS guidance systems. The Israelis simply switched off GPS guidance over their territory and the Americans spoofed the GPS guidance systems over Iraq and Syria. The Israeli's layered air defences now came into action. These included Arrow 2 and 3 ABM systems along with Thaad, Patriots, David Sling, MR SAMs and Iron Dome tactical systems. These achieved a formidable 97 to 98 percent kill rate. This is not surprising, as even Ukraine has claimed kill rates varying from 70 to 90 percent using combination of S-300 surface-to-air missiles, Patriots and Stingers.

Analysis of Strike

One fact that has been lost sight of in the hoopla over the near total kill rate of Israeli air defences is that despite their formidable nature, many Iranian ballistic missiles did get through and hit their targets. These targets, especially the Nevatim Air Base were hit. This is Israel's major air force base in southern Israel. It is claimed that F-35 and/or F-15E fighter jets from the base had carried out the air strike on the Iranian consulate in Syria on 1 April.

Nevatim Air Base is one of the most heavily defended locations on planet Earth. It has an X-band ANTP-Y-2 Over-the-Horizon (OTH) radar. This base is linked with the US Anti-Ballastic Missile (ABM) defense architecture with its HQ at Colorado. This in turn is linked to the US early warning satellite network that can pick up missile launches from anywhere around the globe. It is also linked to the US computational and communication systems as also the shooters.

A technical analysis indicates that these ballistic missiles had a booster rocket that propelled the warheads separately. Anti-ballistic missile systems then targeted the body of the missile permitting the explosives to get through. These also released decoys to fool the Iron Dome system. Iran claims that many of these ballistic surface-to-surface missiles (SSMs) got through. Video recordings do show seven major impacts and blast explosions. It is apparent that some more were perhaps able to penetrate Israel's formidable air defence system. This is a very significant development.

Overall Drones/Missiles Fired by Iran

Admiral Daniel Hagare, Israel's official military spokesman stated that Iran had fired a total of 320 drones/missiles. These included 170 drones, 30 cruise missiles and 120 surface-to-surface missiles. This was a formidable strike with huge number of drone swarms to overwhelm the Israeli air defence system and act as decoys. The amazing fact is Iran's SSM missiles were able to penetrate this formidable and very dense AD cover at all three military targets attacked. It is speculated that Iran's first wave of drones were designed to make Israel light up its detection and fire control radars. The second wave of cruise missiles then targeted these air defence batteries. It was stated that they were able to destroy two Iron Dome launchers. The third wave of ballistic missiles had separating booster propelled warheads and decoys that enabled the warheads to get through the Israeli air defences.

Iran's Main Targets

Let us now examine the impact at each of the three bases targeted by Iran.

Iran confined its counter-attacks to three primary military targets that had been involved in the attack on its consulate. A target analysis is essential. The three targets were:-

- Nevatim Air Base. This is Israel's major Air force base in southern Israel. Iran claims that F-35 jets from this air base had struck the Iranian Consulate in Damascus. It is one of the most heavily defended places on planet Earth, as mentioned earlier. It has the best layered AD system in the world with Arrow 2 & 3 ABMs, Thadd ABMs, Patriots, David Sling and Iron Dome. Despite this formidable air defence, the shock was that 5 out of 7 Iranian ballistic missiles got through to this most heavily defended target in the world. Two of the war heads hit the runway and caused huge craters. The others hit storage facilities. If some eight such war heads had hit the runway, the air base would have been out of commission for some time. The real surprise was that despite 72 hours warning to the densest air defence target on planet Earth, these missiles (five of them) had managed to hit the primary target. It was part of deterrence signaling by Iran. Yet the Iranians had done it skilfully by giving adequate warning and virtue signaling of their intent not to escalate any further. They deliberately curtailed the amount of physical damage to prevent escalation. There were reports in the media that 72 hours prior to the Iran missile strike, Director CIA Willam Burns had met senior Iranian officials in a third country to work out a kind of deal to prevent escalation spinning out of control.
- The Ramon Air Base. This is also the most heavily protected place on the planet with dense and layered air defences like at the Nevatim Air Base. Even here, some Iranian missiles were able to get through, leading to shock and concern in both US and Israel.
- The 8200 Signal Intelligence Collection Unit. This unit in the Golan Heights also has an X-band ANTP-Y2 OTH radar and elaborate signal intelligence equipment jointly manned by Israel and CIA operatives. Once again, this is closely networked with the American anti-ballistic missile defence architecture with its array of satellites, sensors on US Aegis class destroyers and heavily defended by layered air defence systems.

Iran-Israel Missile War (Part 1)

An Analysis of Israel's Response

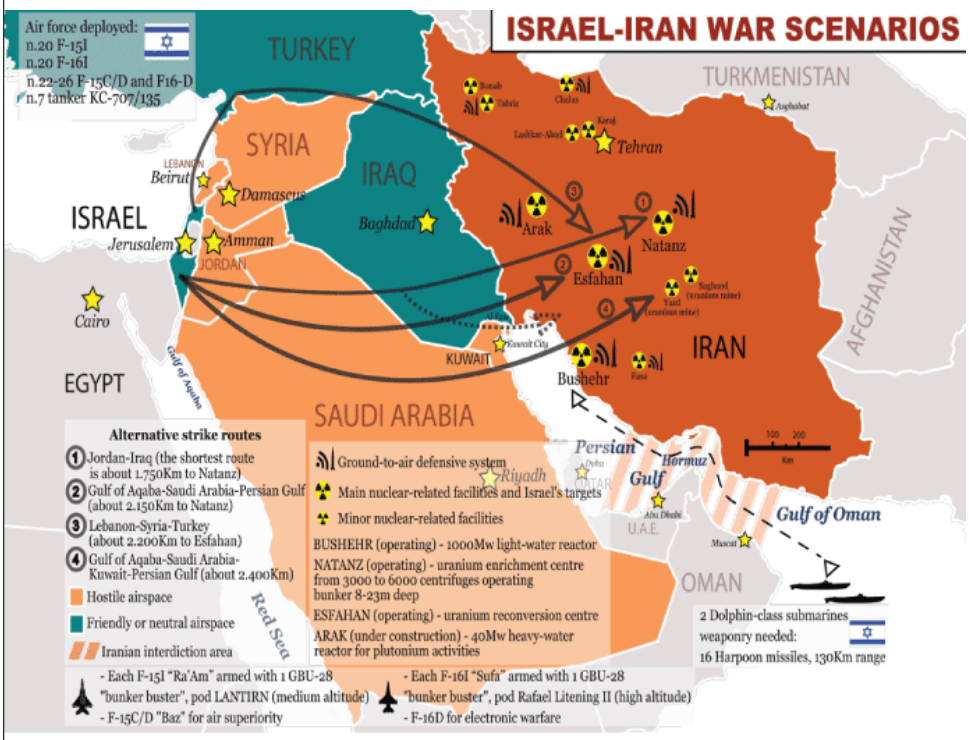
Maj Gen (Dr) GD Bakshi, SM

The US Central Command Chief General Korilla was present in Israel to coordinate their defensive measures. The main Israeli air bases were already networked with the theatre level US ABM defence architecture. As such, Israel had full access to America's satellite networks, computation and coordination facilities, sensors and shooters. Two Aegis-class destroyers, specifically equipped for ABM defence (which had OTH radars) were integrated into Israel's AD network. In addition, some 200 fighter jets from US, Britain and France had been scrambled to shoot down incoming missiles and drones. They specifically went for the 170-odd slow-moving drones as they noisily inched closer to Israeli air space. A majority of them were shot down before they could enter Israeli air space (mostly over Syria and Iraq and a few over Jordan). In any case, their aim was to act as decoys and swamp the AD EW systems and keep Western attention riveted to the slow flying drone swarms and, thus, enable some cruise and ballistic missiles to get through. It now appears that the drones did help to saturate the Israeli AD system. It is even speculated that a very few of the drones also managed to sneak through to their targets. The bulk however, were shot down outside Israeli air space by the US, UK and French fighters and missiles on US warships. The simple fact is that extensive ongoing ops against Houthi-fired drones and missiles against international shipping had forced the US to put in place an effective theatre level Ballistic Missile Defense (BMD) system that was active in the region already. Besides, Israel has a very robust layered air defence system consisting of Arrow 2 and Arrow 3 anti-ballistic missiles, Patriot, US missile defence batteries (which, since 1991 Gulf War have been used to shoot down SCUD missiles), the David Sling medium range SAMs and the Iron Dome for close-in protection within 10 to 15 kilometers. The amazing fact is that the Iranian ballistic missiles were still able to get through this most dense AD protection cover at all. Out of 7 Shahab missiles fired, some five missiles got through in the Navatim air base and created two craters on the runway and hit storage facilities. It is now being analyzed that the Iranian missiles had a booster rocket fitted to the warhead. When near the target, it separated the warhead from the missile and also fired out a couple of decoys. Most defence sensors and shooters focused on the larger carrier rocket, thus, enabling the warhead to get through and do damage. The anti-ballistic missiles fired to intercept, mostly hit the carrier rockets and missed the warheads. What is cause for concern is that the most heavily defended airspace in the world was actually penetrated. If some eight runway penetration retarder bombs had been fired on this airstrip, the base would have been out of commission for a while.

Israel's war cabinet, chaired by Prime Minister Benjamin Netanyahu (third from left), holds a meeting to discuss the drone attack launched by Iran in Tel Aviv, Israel, on April 14

Cost Ratios. The second aspect is the skewed ratio between cost to the attacker and defender. One Shahid drone costs about $10,000. Hence, Iran spent about $3.5 million on its attack, whereas, Israel had to fire off over $1.3 billion worth of anti-ballistic missiles, Patriots, MR SAMs and Iron Domes in just one night. This attack was with around 320 drones/ missiles. What if the next attack comes with 1,500 drones/ missiles and more? Iran claims that it has not yet used its hypersonic Fateh missiles in the last attack.

Iran's Escalation Management and Control. Viewed in hindsight, Iran has shown tremendous strategic patience and ability to exercise escalation control. It has delivered a potent, strategic message of deterrence. "Pile up all the layers of air defence, get the US, British and French to help you with 200



fighters, but the simple fact is, that we will get through." That was the essence of Iran's deterrence message. It is said that Iran had sent signals to USA via UAE and intelligence channels that it was not interested in any further escalation that would involve the United States. Its sovereignty had been blatantly violated and under Article 51 of the UN Charter, it would exercise its right to retaliate. Yet it gave adequate notice to prevent uncontrolled escalation. It took 13 days to respond. It hit only three military targets. There were no attacks on civilian targets or infrastructure. It virtually sabotaged the military success of its own attack by this virtue signaling, but that did enable escalation control and dominance. It sent a clear deterrent message via the missile strikes that got through the very dense and layered air defences. It sent a clear message that it could and would get through, and not tolerate any violation of its sovereignty.

American Escalation Control Measures. For its part, the United States seemed equally keen that the issue should not escalate to a regional war. There was no way Iran could prevail in any conflict with US and Israel. However, it was capable of inflicting serious damage and pain.

It could hit Israel and the oil fields in the Middle East, it could block the Strait of Hormuz and send oil prices skyrocketing giving a big hit to the global economy. The US was in an election year and President Biden could not afford a rise in price of oil that would affect transportation costs and increase not only prices of fuel but also increase prices of food triggering an inflationary spiral.

The US strategic reserve of oil itself was down to just 17 days. The US interest would not be served by any escalation in the Middle East. As such, the US efforts were to put psychological pressure on Iran.

It sent back a second carrier battle group to the Mediterranean. It sent in General Korella, Chief of the US Central Command to coordinate missile defense measures. It tried to force Iran to recalibrate costs and limit or scale down its options.

When all this dissuasion failed and Iran fired off three salvos of some 320 drones and missiles, both the US and Israel were surprised at the scale of this attack. However, due to ample warning and preparation time, the US theater ballistic missile defence grid and Israel's formidable air defences were able to shoot down 97 to 98 per cent of the incoming projectiles.

The US and Western media now tried to entirely play down effectiveness of the attack. The fact was that drones were just decoys. The ballistic missiles had successfully penetrated the three most well -defended targets on planet Earth.

The US and Israel tried to play down the attack as a damn squib. The US intentions seemed to be to stop Israel from escalating by any significant retaliation. Joe Biden even suggested that it was a defensive victory for Israel and they should leave it at that.

He even suggested that should Israel go for serious retaliation, it would have to do it alone and the US would not take part. However, it was evident that due to the pressure of domestic politics, Netanyahu would simply have to respond in some way. The US tried to find a way out by suggesting to Iran that Israel would just mount a token strike and it should not escalate further.

Iran's reaction was sharp. It was determined to react in a major way, whatever the scale of the provocation, it said. Attacks on its territory were simply not acceptable and Iran wanted no part in any dumb charade or fixed match. In many ways, the situation had closed parallels with the India-Pakistan post-Pulwama scenario. India simply had to retaliate to the terror strike but was keen to do it in a manner that would prevent a sharp escalation, maybe even to the nuclear level. Iran has rejected any suggestion that it permit Israel the luxury of a token strike. Netanyahu has been under major pressure from the United States and the Western allies not to escalate. However, the key factor was domestic political pressure that did force Netanyahu to do something, perhaps, more than tokenism.

Scott Ritter says it was a political and not a military decision. The Israeli war cabinet was split with three voting members against it while the hardliners were all for a massive response on Iran's nuclear facilities. Netenyahu was under tremendous pressure from US and other Western allies to eschew a response or go in for tokenism. It is said that for 48 hours he refused to take any calls.

So, what could have been Israel's response options and how would the escalatory spiral unfold? That was the key issue in the looming global crisis. Could an escalatory spiral be managed? What were the off-ramps for Iran?

Matrix of Israeli Response Options. Let us now examine what was the matrix of Israeli response options to Iran's very massive missiles strike. For a long time, Israel had viewed Iran's nascent nuclear capability as an existential threat. It was very keen to do an Osirak redux, that is, repeat its attack on Iraq's nuclear reactor with Iran. The problem in that was that to mount a credible and effective attack, it needed United States support in terms of satellite imagery, US air-to-air refueling aircraft, US help in getting permissions to overfly Iraq, Jordan and Saudi Arabia. It is doubtful if Iran could inflict any meaningful damage in a purely stand-alone mode. Even that was likely to provoke a regional war. As was evident, it is easy to start wars, far more difficult to end them.

So what then was the matrix of Israeli overt response options?

- Option One. Attack Nuclear Facilities of Iran. Iran has five major nuclear enrichment facilities at Natanz, Arak, Faradeh, Isfahan and Bordei. The main facility at Natanz is well dug in and is in a steep valley in the Zagros mountains,

which is very difficult to attack. Ishfahan is the main nuclear processing centre. Israel's options were to use the Jericho missiles or the F -35 or the F -15E fighters. These would of course need air-to-air refueling and they could possibly have attacked with stand-off cruise missiles and deep penetration retarder bombs that could pierce underground bunkers, (joint direct attack munitions). Iran had fairly good S-300 Russian SAMs based air defences and the F-35 or F-15E would definitely take some losses. Maj Gen Ahmed Hagatalab of the Iranian Revolutionary Guard Corps in charge of defending Iran's nuclear facilities, had publicly warned that if Israel hit these, Iran would retaliate and target Israel's nuclear facilities.

- Option Two. Attack Ballistic Missile Production Facilities. So far Israel regarded the nascent nuclear facilities of Iran as an existential threat. The Israeli military spokesman, Adm Daniel Hagare conceded that they had underestimated Iran's ballistic missiles capability. This was in fact a real and present danger. Their storage facilities are in deep underground bunkers that would be difficult to attack, but the production centers could be targeted and one of them was, in Isfahan.
- Option Three. IRGC Headquarters Bases. The most logical target system would be the IRGC, that is the Islamic Revolutionary Guard Corps Headquarters, barracks, bunkers and weapons storage facilities. It would be the most justifiable target system in Iran.
- Option Four. Iran's Petrochemical Facilities and Export Terminals. Iran's oil exports provided the financial support to build huge missile arsenals and fund a proxy war against Israel via the Hamas, Hezbollah, Houthis and the Shia militias in Iraq and Iran. Iran's war waging capabilities could be seriously hit if its oil export sector was targeted. There were the main ports at Bandar Abbas, etc, which could be primary targets in such an attack.

These were the main overt military options for Israel to strike in response to the Iranian military strike of 13 April. They could also use electromagnetic bombs to create EMP or electromagnetic pulses to fry up electronic circuits and destroy command control and communications in the critical areas. There were also media reports circulated that if Israel had to go it alone, it would seek air bases in Aizerbaijan to hit Iran from the north unexpected direction.

Covert Options. Given the tremendous US pressure on Israel to prevent escalation, Israel would most likely have to resort to a significant offensive against Hezbollah but confine the attacks in Iran to the covert level only. These would include possibly terrorist attacks by Baluch and Kurd insurgents, use of cyber warfare or (Stutnex redux) or use drones to strike these targets. Israel could also carry out covert action to destabilize and overthrow the Iran regime of the Ayatollahs but that would have to be a long-term covert action project in concert with the CIA. These could be the precise response options that could obviate Iranian retaliation and triggering a major escalatory spiral in the Middle East. Oil prices were already at $90 a barrel. A full-scale Iran-Israel war in the Middle East could send the oil prices skyrocketing through the roof and create a global economic crisis of major proportions That was in no one's interest.

Israel's Response Strike on 18 April. Israel mounted its counter-attack finally on 18 April, just five days after Iran's missile strike. There was a lot of ambiguity and disinformation let lose in the media. The Israelis did not announce that they had carried out an attack, but explosions were reported in the sky over Isfahan. The Iranians equally seemed keen to play down the scale of the Israeli attacks. They said that a number of drones, (hand-held quad-copters of very limited range) had been seen flying over Tabriz and over Isfahan. Why Isfahan? Isfahan is the home base of the Iranian F-14 Tomcat fighter-bomber squadrons. It is also the home base of an Iranian Revolutionary Guard Corps unit. It has an S-300 missile battery and reportedly also production facilities for missiles and drones. The targets that the Israelis actually struck was the S-300 missile battery and they claim to have damaged one of its radars that are used for fire control. Next day, pictures in the US media indicated that satellite surveillance had picked up the destruction of one of the Iranian radars in the S-300 missile battery which was struck by the drones. When Iran was quite clear that there had been no missile, oblique, cruise missile strikes or fighter-bomber attacks and it had been confined merely to hand-held drones, it seemed to relax and opened its air space which it had closed earlier. Similar small drone attacks had been done by the Ukrainian intelligence agents from the vicinity of Moscow with hand-held drones to strike some targets, largely for psychological impact. This was the precise, very limited nature of the Israeli response option and Iran seemed to be quite relieved. They played it down totally, and in fact, the Iranian foreign minister went to the extent of retorting to reporters, "What strike? What attack?" They said these were just infiltrators who had come in with handheld quadcopters and tried to launch them to create a media event. They understood that Israel was under tremendous pressure from the United States and the Western allies not to respond in a major way, and it had refrained from such a major provocation. So Iran has been very cautious and very pragmatic. It refused to get drawn in, refused to escalate, and for the time being, the crisis in the Middle East seems to have been averted. How long that will hold is a matter of conjecture and we will have to wait and watch.

India's Response Options. The simple fact is, what can India do? Like the rest of the world, a major conflict in the Middle East would considerably harm India's interests. Any oil shock can have a major negative impact on the Indian economy. India has very friendly relations with both Israel and Iran and as such it would be very well placed if it has to play a mediatory role. I am not sure what mediatory role has so far been played behind the scenes, but I do not see any overt evidence of India taking such an initiative, (though we did have talks with Iran to get our crew released from the ship that the Iranian Navy had hijacked in the Red Sea). We will have to keenly wait and watch as to how events unfold in the Middle East. For the time being the world has pulled back from the brink of a disaster. From a military analyst point of view, we have a new form of war which is now fairly well established in all the battles that we have seen recently, whether in the Russia-Ukraine war or in the Middle East. The emphasis is shifting primarily to missile and drone strikes rather than manned air strikes. I would again like to reiterate that China was first off the starter blocks to create a Rocket Force after Gulf War I and II. It had feverishly started the construction of its Strategic Rocket Force as far back as the 1990s. It now has the biggest rocket arsenal in the world. It has also invested very heavily in drones of all shape and sizes. Therefore, we will have to study in very great detail the Iran-Israel missile clash and draw very pertinent lessons for our own context. Specifically, we will have to re-examine how much emphasis is to be put on manned air forces and how much onto the unmanned drones and missiles. The balance increasingly seems to be shifting in favour of drone and ballistic missile arsenals coupled with cruise missiles. We will have to gear up our military-industrial complex to churn out these drones/missiles in very large numbers to cater for intensive firing rates in actual combat. The Iran missile strike had deliberately been pared down for minimal impact to tamp down chances of escalation. A purposeful and destructive strike would have required some 1,500 drones and missiles for a similar target set. The accuracy and lethality of such unmanned systems is rising exponentially and Iran has just demonstrated their ability to penetrate even the densest Ballistic Missile Defenses (BMD). We are living through a new Revolution in Military Affairs. Pakistan is still stuck largely with its F-16s for retaliation. It is China that we will have to watch closely and match in numbers, throw-weight, accuracy and ability to penetrate dense AD environments.

Israel's Air Defence System

Israel confirmed the use of its David's Sling air-defense system to intercept a Hamas rocket on 7 October, marking the first time since it declared war on Hamas that the country has turned to aerial protection beyond the Iron Dome.

Hamas launched at least one Ayyash 250 rocket — a two-year-old weapon believed to be the longest-range rocket that the militant group has with an operational range of 155 miles — at Israel from the Gaza Strip.

Unlike, the mobile Iron Dome, David's Sling is stationary and can protect the entirety of Israel from its permanent location. The IAF received the defense system from the Defense Ministry in July 2017.

David's Sling's advanced, multi-mission interceptor, also known as the Stunne or the SkyCeptor, a joint endeavor of Rafael & Raytheon, two world leaders in advanced weapons system development, offer interceptor as lethal, flexible and affordable hit to-kill to defeat mass raids of threats.

David's Sling system is modular, scalable, and flexible to tailor-fit the area and topology to be defended.

The David's Sling interceptor (Stunner/ SkyCeptor) delivers superior kinematics, maneuverability and lethality by combining novel innovative steering control, multi-pulse propulsion and a next-generation seeker into a lightweight airframe.

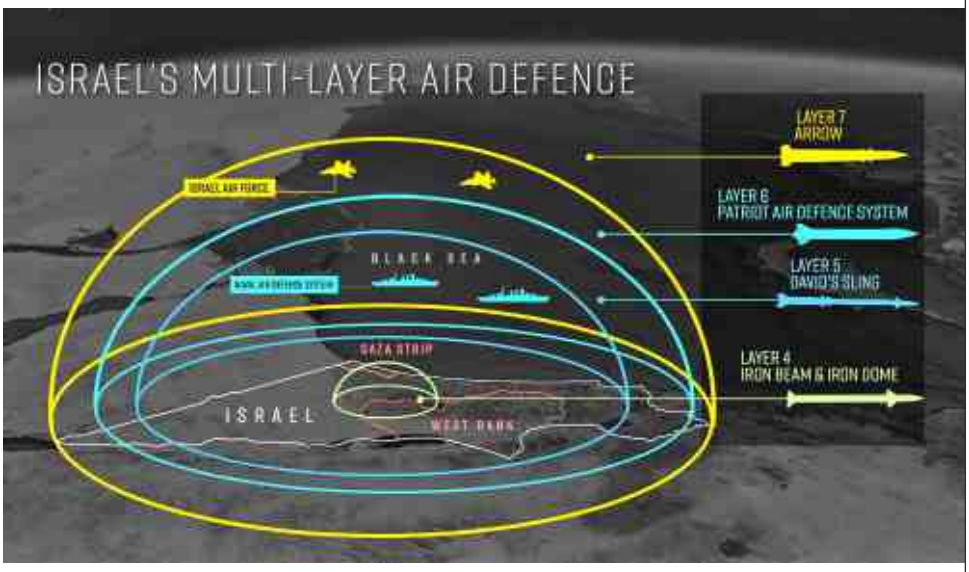
Benefits

It is designed for "plug and play" insertion into fielded air and missile defence systems with open architecture. It has a Next-gen multi-sensor seeker. With large interception envelope, it can effectively intercept threats during saturation attack.

The launcher carries up to 12 stunner interceptors, launched in a near-vertical orientation. It has multi-pulse propulsion and precision hit-to-kill aim point selection in the terminal phase.

Israel's Air Defence Architectutre

David's Sling is the middle part of Israel's sophisticated and multi-layer air-defense network. It strengthens the anti-missile defence already provided by the Iron Dome, Arrow 2, and Arrow 3.



Multi-layer-air-defence-scaled

> **"David's Sling is the middle part of Israel's sophisticated and multi-layer air-defense network. It strengthens the anti-missile defence already provided by the Iron Dome, Arrow 2, and Arrow 3."**

Israel's air defence systems are stationed throughout the country and are prepared to respond 24 hours a day, seven days a week.

David's Sling is the middle layer of Israel's sophisticated air-defense network and is complemented by the Iron Dome and the Arrow systems, for smaller and larger threats, respectively. Together, these protect Israel and its nearly 9,000 square miles of territory from artillery, drones, rockets, and missiles of all sorts.

According to Israel's foreign ministry, many of the initiatives that fall under the country's Missile Defense Organization (IMDO) operate in close collaboration with the US and receive joint funding. The three aforementioned weapons systems, for example, were developed as a result of cooperation between the two countries.

Iron Dome

First developed in 2011 and widely considered to be one of the most advanced air-defense systems in the world, the Iron Dome is designed to intercept short-range rockets and artillery.

It consists of batteries that have multiple launchers, each of which can hold up 20 Tamir interceptors. The batteries — consisting of a radar and a battle management system — are scattered around Israel and can defend nearly 60-square miles. Interceptors are capable of engaging projectiles from 40 miles away.

The Iron Dome is the most well-known of Israel's air-defense systems and has been put to serious work since fierce fighting broke out between Israel and Hamas over the weekend.

The IDF said that as of 13 October 2023, Hamas had fired over 6,000 rockets at Israel, keeping the Iron Dome busy as it works to

Isfahan air base in Iran struck by Israel

defend civilian the country's centers.

David's Sling

David's Sling is the next layer of Israel's air-defense network, and its deployment on Friday marks one of only a few times that the system has been used since it became operational in 2017. Also known as the Magic Wand, it fires an interceptor called the Stunner (which doesn't have a warhead) to defeat medium- to long-range rockets and missiles at a range of up to 185 miles.

The David's Sling system includes a missile firing unit, a fire control radar, a battle management station, and the interceptor.

Arrow

The upper layer of Israel's air-defense network consists of Arrow systems. According to the Center for Strategic and International Studies (CSIS), a Washington-based think tank, Arrow-2 was first deployed in 2000 and was later followed by Arrow-3 in 2017.

Both types of systems use two-stage solid-fueled interceptors to engage targets like short- and medium-range ballistic missiles in the upper atmosphere, and they each include a launcher, radar, and battle management system.

Arrow-3 serves as the top layer of Israel's defense array. Its interceptor is a world-class missile that, together with the Arrow-2, significantly expands the State of Israel's defense capabilities. The Arrow-3 system's capabilities enable longer range, higher altitude (exo-atmospheric), and more precise ballistic missile engagements.

Patriot

Outside of those defense systems, Israel is also one of nearly 20 countries that operates the MIM-104 Patriot missile defense battery, which is a US-made truck-mounted surface-to-air missile system.

The Patriot is a top US air and missile defense system and is capable of engaging ballistic missiles, cruise missiles, aircraft, drones, and loitering munitions. One battery consists of eight launchers that are armed with four interceptor missiles, each of which can eliminate targets at at altitude of nearly 80,000 feet.

MANPADS

The basic air defence system with the IDF are the notorious Stinger man-portable air defence systems (MANPADS). The Stinger, fired from the shoulders, is a battlefield short-range weapon system mainly for low-level and slow-moving threats like helicopters.

The missile had earned its notoriety in Afghanistan, when it was used by the Taliban to fight the Russian occupation. However, the latest variants of the Stinger can also target higher and fast-flying fixed wing aircraft within about 15,000 feet in air, besides cruise missiles and low-flying drones.

SHORADS

Israel also operates the Machbet short-range air defence system (SHORADS). This is a gun-and-missile system on a self-propelled tracked vehicle, based on the M113 armoured personnel carrier. The missiles on the vehicles are Stingers and can be used against incoming cruise missiles and drones. These vehicles usually travel with the mechanised forces to provide battlefield defences.

Spyder

The Spyder family of Short/Extended/ Medium/Long-Range Mobile Air Defence Systems (ADS) is used by Israel against a wide spectrum of threats, such as attack aircraft, helicopters, bombers, cruise missiles, UAVs and stand-off weapons.

Iron Beam

The Iron Beam is a new directed energy air defence system that is still being tested by Israel. This will not replace the Iron Dome, but will complement it.

The 100-kilowatt Iron Beam is designed to neutralise rockets, artillery and mortars (RAM), besides unmanned aerial systems (UAS), counter-unmanned aerial systems (C-UAS) and anti-tank missiles. It can function by itself or be integrated with other, broader defence systems. It uses a fibre laser to generate a laser beam to destroy an airborne target.

Each battery of the Iron Beam will consist of an air defence radar, a command and control (C2) unit, and two High Energy Laser (HEL) systems.

Naval AD System

While a naval air defence system is used usually to defend one's own assets, given the location and size of Israel, it is also used as an alternative counter-measure for missiles travelling over the sea.

Installed on board an Israeli Navy Sa'ar-class corvette is the C-Dome, the naval version of the Iron Dome.

These corvettes are armed with two C-Dome systems, each having 20 Tamirs besides Barak-8 surface-to-air missiles, which are launched from 32 vertical launch cells.

While Barak-8 is long range, C-Dome is designed to intercept and destroy lower-flying aircraft, anti-ship missiles, as well as short-range rockets and drones.

Israel Air Force

Fighter aircraft and attack helicopters are another less talked-about air defence capability of the Israeli Air Force, along with the surveillance and command-and-control assets operated by it. The Israeli fighter jet fleet of F-15, F-16, and F-35 fighters have the capability to intercept and destroy cruise missiles and drones.

Israel had in 2021 shot down at least two Iranian drones that, it says, were heading toward Israeli territory.

This was the first time that F-35s operated by any nation were confirmed to have destroyed airborne threats, which showed how Israel has expanded the use of these fighters.

Iron Dome's Operational Performance

On October 7, Hamas militants launched a barrage of rockets from the blockaded Gaza Strip towards Israel as part of a surprise attack that has reignited the Israeli-Palestinian conflict.

Key to repelling rockets on the Israeli side is the Iron Dome, a missile defence system that has become a cornerstone of the country's security since its initial deployment in 2011.

In the months since the Hamas attack and Israel's retaliatory military ground offensive, the Iron Dome has once again been tested with an attack by Iran on Saturday and Sunday (April 13 and 14).

Around 300 drones, ballistic and cruise missiles were launched by Tehran following a suspected Israeli strike on a Iranian consulate in Syria. Most of these were intercepted by the Iron Dome.

The system is the pivotal lower tier of a triad of systems in Israel's air defense system.

The "David's Sling" system covers the middle layer, while the "Arrow" missile system protects Israel from long-range projectiles.

Iron Dome engagement

How does the Iron Dome work?

The Iron Dome is a mobile defense system developed by Rafael Advanced Defense Systems and Israel Aerospace Industries developed, produced and fielded in 2011 to respond to the security threat posed by the bombings of rockets and projectiles shot into Israel, many of which landed in heavily populated areas.

The Iron Dome functions by detecting, analyzing and intercepting varieties of targets such as mortars, rockets, and artillery. It has all-weather capabilities and is able to function night or day and in all conditions, including fog, rain, dust storms and low clouds. It is able to launch a variety of interceptor missiles.

Israel is protected by 10 Iron Dome batteries, functioning to protect the country's infrastructure and citizens. Each battery is able to defend up to 60 square miles. They are strategically placed around Israel's cities in order to intercept projectiles headed towards these populated areas. Implementing artificial intelligence technology, the "Dome" system is able to discriminate whether the incoming threats will land in a populated or in an uninhabited area, ignoring them in the latter case, consequently reducing the cost of operation and keeping unnecessary defensive launches to a minimum. However, if the Dome determines that the rocket is projected to land in an inhabited area, the interceptor is fired towards the rocket.

"The Iron Dome functions by detecting, analyzing and intercepting varieties of targets such as mortars, rockets, and artillery. It has all-weather capabilities and is able to function night or day and in all conditions, including fog, rain, dust storms and low clouds. It is able to launch a variety of interceptor missiles."

A radar steers the missile until the target is acquired with an infrared sensor. The interceptor must be quickly maneuverable because it must intercept rudimentary rockets that are little more than a pipe with fins welded onto it, which makes them liable to follow unpredictable courses. It can be assumed that the launchers of the rockets know as little as the Israelis as to where the rockets would end up landing.

Israeli authorities have claimed that the military technology boasts a 90 per cent success rate at intercepting enemy rockets.

Each Iron Dome battery has three components. The first is a radar that detects incoming rockets. Then there is the Tamir interceptor missile that is launched to intercept the incoming rocket in the air.

Finally, there is a command and control centre which contains the software that creates and sends the message from the radar to the interceptor missile.

The system is designed to intercept rockets

Iron Dome missile leaves the launcher

with a range of between 4 km and 70 km.

How effective is the Iron Dome?

Iron Dome has proved to be particularly effective over the years.

Bombings into Israel intensified during the 2006 Second Lebanon War when Hezbollah? fired approximately 4,000 rockets from bases in the south of Lebanon. From Gaza to the South, an estimated 8,000 projectiles were launched between 2000 and 2008, mostly by Hamas??. To counter these threats, the Defense Ministry, in February 2007, decided on the development of the Dome to function as a mobile air defense system for Israel. After its period of development and testing, the system was declared operational and fielded in March 2011.

The Israeli government has said is that the effectiveness of Iron Dome is very high. The Iron Dome only intercepts or destroys rockets which are considered to threaten civilian urban areas. If a rocket is sent from Gaza to an unpopulated area in Israel, Iron Dome will not be activated.

Biut the Iron Dome system has not deterred Hamas or other Palestinian militant groups from launching rocket attacks targeting Israeli territory. The Iron Dome may be effective operationally, but strategically it does not really deter the Palestinian organisations.

The IDF (Israel Defense Force) claims an 85% - 90% success rate for the "Iron Dome" in intercepting incoming projectiles. Operational in March 2011, to date the Iron Dome has successfully destroyed approximately 1,500 rockets. The destruction of these incoming rockets has saved Israeli lives offering physical protection and shielding property and other assets. In addition, for the Israelis it serves as a psychological safeguard and comfort for the Israeli people.

Regarding the Dome as an asset for Israel's National Security Strategy, while standing as an undeniable asset, has had mixed results regarding its four major pillars of Deterrence, Early, Active Defense and Decisive Victory as well as some unintended challenges.

How is the Iron Dome financed?

Keeping the Iron Dome operational comes at a high price. Just one of the interceptor Tamir missiles is estimated to cost around $50,000.

Originally Iron Dome funding was undertaken by Israel, but because of the high cost of the system, the country has had to rely on its long-time ally, the United States.

A report from the US Congressional Research Service states that the US has contributed nearly $3 billion to Iron Dome batteries, interceptors, co-production costs, and general maintenance.

Fears of Escalation

In the early days of the current conflict, the sheer number of rockets that Hamas fired towards Israel, estimated to be between 2,200 and upwards of 3,000 (though Hamas claims to have fired 5,000), seemed to succeed in overwhelming the system. Perhaps the biggest concern with respect to Iron Dome's capability to continue protecting Israeli territory, is the prospect of a regional escalation in the current conflict.

Hezbollah has a much bigger firepower capability than than Hamas. It has hundreds of thousands of rockets. So Hezbollah could very quickly overwhelm Iron Dome.

Future Use

In addition, while the "Dome" suffices for now, it cannot be expected to continue this way forever. Despite the system's effectiveness, it is just a matter of time before the militants develop tactics or acquire the technology to overcome it.

As technologies develop and are implemented in operations, counter techniques can shift and new tactics can be developed, which is what the militias are only bound to do. Moreover, with the heavy funding available to the militias from their wealthy allies, acquiring more advanced technologies becomes more probable. This is a significant disadvantage for Israel. In order to preserve their upper hand, constant innovation and adaptation is a necessity.

Despite these drawbacks, however, in all the positive aspects that the system offers clearly outweighs the negative. The Iron Dome stands undeniably as a critical and outstanding military asset to Israel's National Security, even while Israel works to address and mitigate some of the unforeseen challenges related to the system.

IAF MODERNISATION

IAF Upgrades Bases and Tests Highway Landings

The Indian Air Force (IAF) in the last four years has been slowly, away from spotlight, upgrading its infrastructure facilities in at least 20 air bases focused on China-centric operations or on having a dual area of operation.

These upgrades include not just construction of new underground munition centres, hardened aircraft shelters and taxiways but also upgradation of navigational aids, besides setting up of new radars and base defence systems.

While the plans were already in motion, the military tensions with China since 2020 has led to a more faster and focussed approach. They explained that even as the tensions with China was just beginning in May 2020, the defence ministry had signed a Rs 1,200 crore contract with Tata Power SED (TPSED) for Modernisation of Air Field Infrastructure (MAFI) of 37 airfields for IAF, Indian Navy and Indian Coast Guard.

This was a follow-on program to MAFI Phase 1 that included upgradation of 30 airfields of IAF. The project included installation and commissioning of modern airfield equipment like Cat-II Instrument Landing System (ILS) and Cat II Air Field Lightning System (AFLS) among others, which were directly connected to Air Traffic Control (ATC).

There has also been an increase of infrastructure projects. These infrastructure projects were always on the cards, and work was initiated on some of these airfields prior to the stand-off with China. The work involved not just repair of runways and creation of additional taxi ways to enable better tempo of operations, the stand-off has led to increased need for storage of spare parts and munitions. Across air bases, the focus is to have hardened underground munition centres.

New radars have been set up at some bases close to the Line of Actual Control (LAC), besides increase in defensive capabilities. One of the reasons for new infrastructure building is also to cater to drones operations.

The Army has created integrated aviation Brigades which have seen a larger concentration of drones and helicopters in specific areas. They are based at IAF bases, which also cater to IAF's own set of drones.

An An-32 aircraft of the IAF carrying out overshoot over NH 16 near Addanki, Andhra Pradesh.

"The activation showcased the high level of synergy and liaison between civil agencies such as National Highways Authority of India (NHAI), district administration, state police and the IAF towards conduct of complex multifaceted activities."

ALG Upgrades

Following the approval from the Cabinet Committee on Security (CCS) in June 2009, the IAF took up a project to upgrade eight ALGs in Arunachal Pradesh at an estimated cost of Rs 1,000 crore which have since been operationalsied. The eight ALGs in Arunachal Pradesh include Tuting, Mechuka, Along, Tawang, Ziro, Pasighat, Walong and Vijaynagar. In addition, several new emergency landing strips were developed on national highways across the country. Further, the ALG Nyoma, located at an altitude of about 13,700 feet, is now being converted into a full runway of over 9,000 feet, making it capable of handling fighter jets. Work which commenced last August is expected to be ready by 2025. The ALG at Daulat Beg Oldi at an altitude of 16,700 feet, located very close to the LAC, is very critical for aerial connectivity to the Sub-Sector North.

Emergency Landing Facilities

On March 18, IAF fighter and transport aircraft carried out operations on an Emergency Landing Facility (ELF) airstrip on National Highway 16 near Addanki in Bapatla district of Andhra Pradesh.

Su-30 and Hawk fighters successfully carried out overshoots during the activation, while An-32 and Dornier transport aircraft landed and subsequently took off from the strip. The activation showcased the high level of synergy and liaison between civil agencies such as National Highways Authority of India (NHAI), district administration, state police and

An IAF C-130 makes night landing at Kargil Advanced Landing Ground on January 7, 2024.

the IAF towards conduct of complex multifaceted activities.

Previously, such an activation was conducted on December 29, 2022. The 4.1 km long and 33 metre wide concrete airstrip has been constructed by the NHAI as per specifications provided by the IAF. While other airstrips are already operational in various parts of the country, this ELF in Andhra Pradesh has been recently operationalised in peninsular India.

ELF highway airstrips enhance flexibility of air operations during contingencies and are invaluable assets during Humanitarian Assistance and Disaster Relief (HADR) operations in far flung areas. IAF, with Ministry of Road Transport and Highways (MoRTH) are working jointly for creation of ELFs at suitable locations.

Earlier on 1 April, the IAF conducted emergency landing trial runs of both fighter jets and helicopters on the newly constructed 3.5-kilometre emergency landing facility in Anantnag, South Kashmir. The exercise took place during the night time and aimed to test the facility's readiness and effectiveness in handling various emergency scenarios.

The emergency landing facility, constructed for Rs 119 crore, is strategically located on the Srinagar-Jammu national highway at Bijbehara. It is designed to support operations during times of war, natural disasters, and other emergencies, including relief material air drops and transportation of stranded individuals. The completion of this facility marks a crucial milestone in enhancing the region's emergency response capabilities.

Work on the project started in 2020 and was completed in late 2023 under a program

"Emergency landing strip boasts essential amenities tailored to cater to the needs of fighter aircraft. Among its features are designated parking slots ensuring swift and organized deployment, an air traffic control (ATC) tower."

carried out jointly by the IAF and the Ministry of Road Transport and Highways for the creation of ELFs at different locations across the country.

Situated along the bustling Srinagar-Jammu National Highway, this emergency landing strip boasts essential amenities tailored to cater to the needs of fighter aircraft. Among its features are designated parking slots ensuring swift and organized deployment, an air traffic control (ATC) tower to manage incoming and outgoing flights seamlessly, and two entry gates positioned at either end of the strip on the highway, facilitating efficient access and egress for aircraft operations.

The trial runs involved the participation of various aircraft, including Sukhoi fighter jets and Chinook and Mi-17 helicopters. The exercises showcased the precision and capability of these aircraft in utilizing the emergency landing facility, emphasising their readiness for emergencies.

Night Landing at Kargil

An IA C-130 Super Hercules tactical transport aircraft made a night landing at the Advanced Landing Ground (ALG) in Kargil on 7 January, employing terrain masking enroute, the exercise also dovetailed a training mission of the Garud special forces team.

This successful night landing at such a strategic location not only underscores the heightened capabilities of the Indian Air Force but also serves as a testament to their dedication to operational excellence and preparedness in challenging terrains.

Earlier the transport aircraft had been landing at Kargil during the day and this was the first night landing. Located at an altitude of around 10,000 feet, the ALG is a restricted airstrip with unidirectional approach surrounded by rough terrain. It also does not have night landing facilities. This demonstrates the capability to carry out specialised missions round the clock in this area.

As the only airstrip in this area, the Kargil ALG is significant and critical for any exigency. In Jammu and Kashmir, the IAF has full-fledged airfields at Srinagar, Awantipora, Udhampur and Jammu. In Ladakh, the IAF has airfields at Leh and Thoise and ALGs at Nyoma, Fukche and Daulat Beg Oldi (DBO). In the last decade, the Defence Ministry has reactivated a series of ALGs close to the border, especially along the Line of Actual Control (LAC) with China.

C-130J Super Hercules

The IAF's C-130J Super Hercules demonstrated its remarkable versatility in April 2023 during a daring night rescue mission in Sudan. Currently, the IAF operates 12 C-130J aircraft, stationed at the 77 Squadron at Hindan and the 87 'Wings of Valour' Squadron at Panagarh. The C-130J is a highly integrated and sophisticated airlifter designed to support India's special operations requirements. Equipped with an infrared detection set, it can perform precision low-level flying, airdrops, and landings in blackout conditions. Featuring self-protection systems and other advanced capabilities, the C-130J ensures survivability in hostile air defence environments. Additionally, the aircraft has air-to-air receiver refueling capability for extended-range operations. Beyond its role as a transport aircraft, the C-130J carries out a diverse range of missions, including special operations, aerial refueling, search and rescue, paradrop, electronic surveillance, and weather reconnaissance.

IAF MODERNISATION

Inaugural Flight of LCA Mk1A Successful

IAF to Buy 97 Additional Tejas Mk1A

The first Aircraft LA5033 of the indigenous Light Combat Aircraft 'Tejas' Mk1A Aircraft series successfully completed its inaugural flight at the Hindustan Aeronautics Limited's facility in Bengaluru.

The test and signifies a leap forward in India's aviation capabilities. Equipped with advanced electronic radar, warfare, communication systems, enhanced combat capability, and improved maintenance features, the Tejas Mk1A promises to bolster the country's defence capabilities.

With an advanced electronic radar, warfare, communication systems, smart multi-function displays (SMFD), advanced self-protection jammer, electronic warfare suite, additional combat capability and improved maintenance features, the Tejas Mk1A will also have an indigenous Digital Fly by Wire Flight Control Computer (DFCC), developed by the Aeronautical Development Establishment (ADE) in Bengaluru.

Planned to be deployed at Nal air base in Rajasthan's Bikaner near the Pakistan border, the first squadron of the Tejas Mk1A fighter aircraft can take care of the western adversary. The Indian Air Force (IAF) has got clearance to buy a total of 180 of these jets and is looking to get the first aircraft soon. The IAF already had 40 LCAs of the original IOC (initial operational clearance) and FOC (final operational clearance) version. And with this variant in the long run, it is expected that the strength of the IAF fighters will go up to 220 LCA Mark 1As. This means that IAF will have almost 10 squadrons of the indigenous fighter jets.

An ideal fit to fill in, given the phasing out of the MiG 21 and MiG 27, these light combat jets are designed, developed and manufactured indigenously and have more than 65 percent of indigenous components. In February 2021, the defence ministry sealed a Rs 48,000-crore deal with HAL for the procurement of 83 Tejas Mark 1A jets for the IAF.

The first Aircraft LA5033 of the indigenous Light Combat Aircraft 'Tejas' Mk1A Aircraft series successfully completed its inaugural flight

Tender to Buy 97 Tejas Mk-1A Issued

The defence ministry has issued a tender to Hindustan Aeronautics Limited for procurement of 97 more light combat aircraft (LCA Mk-1A) Tejas. The fighter jets are expected to cost around Rs 65,000 crore.

Last year in November, the Defence Acquisition Council (DAC) had cleared the project to acquire 97 more Tejas jets for the Indian Air Force (IAF). The Defence Acquisition Council also approved a proposal of the IAF to upgrade its Su-30 fighter fleet by Hindustan Aeronautics Ltd (HAL).

The tender, issued in August, will equip the IAF with 180 home-grown fighters to replace the MiG variants like MiG-21, MiG-23 and MiG-27 that are on their last leg after decades of service.

HAL has been given three months to respond to the new tender. It is set to be the largest ever order for indigenous military hardware to be placed by the Indian government. The new LCA Mk1A jets is expected to have more than 65 percent indigenous content. The Defence Ministry has already placed an order for 83 Tejas Mk1A jets in Feb 2021 worth Rs 47,500 crore and the first aircraft is expected to be delivered within a few weeks.

In March 2024, the first Tejas LCA Mk1A (LA 5033) took to the skies in Bengaluru and flew for 18 minutes. The aircraft will have an advanced electronic RADAR, warfare suite, communication systems, additional combat capability and improved maintenance features. In a statement, the state-owned aircraft manufacturer had said that "the country could look forward to early induction of the Tejas Mk1A by the IAF and more numbers through the three lines of production established at HAL."

After HAL completes the previous contract of delivering 83 similar aircraft, the delivery of the 97 combat jets will start. The features in these aircraft will be much more than what the first 40 Tejas LCA that the IAF has been flying. The Cabinet Committee on Security has also approved the design and development of a home-grown fifth generation fighter aircraft known as AMCA or Advanced Medium Combat Aircraft. Also in the works is a naval version of the LCA.

Army Gets Ready to Induct Apaches

The Indian Army has established a squadron for heavy-duty choppers at Jodhpur along the western front with Pakistan in preparation for the delivery of six Apache attack helicopters that are expected to start from May, 2024.

The squadron was raised in the presence of Army Aviation's director general Lt Gen Ajay Suri. The delivery, initially scheduled to begin in February, was delayed, with the first three Apaches now expected in May.

Under a Rs 13,952 crore deal signed with the US in September 2015, the Indian Air Force (IAF) has already inducted 22 Boeing-manufactured Apache helicopters. The Army, under a separate Rs 5,691 crore deal inked in February 2020, will receive six choppers.

Often referred to as "tanks in the air," the Apache helicopters are equipped with Stinger air-to-air missiles, Hellfire Longbow air-to-ground missiles, guns, and rockets. They are primarily intended to provide integrated combat aviation cover for the 'strike corps' of the Army.

In coming years, both the Army and the IAF are set to induct 156 indigenous Prachand light combat helicopters. These helicopters are capable of offensive operations in high-altitude areas such as the Siachen Glacier and eastern Ladakh. Fifteen such choppers (10 IAF and 5 Army) have already been inducted under the first Rs 3,887 crore contract for them.

Recognised as the world's most advanced combat helicopter, featuring an advanced night vision system and the capability to arm missiles that can strike 138 targets in a minute, the Apache AH-64E is a formidable force in the sky with a maximum speed of 280 km/h.

The Apache AH-64E, equipped with AGM 114 Hellfire anti-tank missiles and Stinger missiles, is prepared to handle both ground and aerial threats. The Hellfire missiles are particularly effective against armoured vehicles like tanks and BMPs, while the Stinger missiles are designed to neutralise airborne threats. Additionally, the helicopter is armed with Hydra-70 unguided missiles, which can effectively target ground-based threats.

Light Utility Helicopters

The Army has placed an order for the HAL Light Utility Helicopter under limited series production. The helicopter will replace the fleet of Cheetah and Chetak helicopters.[62] The Indian Army requires 394 light helicopters, which the Defence Ministry decided to meet in two purchases. To meet immediate requirements, 197 light helicopters would be procured on the international market; Hindustan Aeronautics Limited would develop and manufacture 187 HAL Light Utility Helicopter, of which 126 would be for the Indian Army.

The Indian Army has raised a squadron in preparation for the delivery of six Apache attack helicopters that are expected to start from May, 2024.

"Recognised as the world's most advanced combat helicopter, featuring an advanced night vision system and the capability to arm missiles that can strike 138 targets in a minute, the Apache AH-64E is a formidable force in the sky with a maximum speed of 280 km/h."

The Corps of Army Aviation holds a large number of ageing aircraft like the Cheetah and Chetak, which need replacement by modern helicopters. The role of the corps continues to remain reconnaissance and observation. The absence of medium and heavy lift helicopters, which continues to remain with the Air Force, results in a deficiency of the tactical lift capability. Lack of fixed wing aircraft, when the Indian Navy, Indian Coast Guard and paramilitary forces have them affects functions like command and control, staff transport, logistics, casualty evacuation and communication.

The Army Aviation Corps has several squadrons. In addition, there are several Reconnaissance and Observation (R&O) flights that operate independently and are not attached to any squadrons. These are equipped with Dhruv Utility helicopters, Rudra ALH-WSI helicopters, Prachand Light Combat helicopter, Chetak and Cheetah Utility Helicopters.

ARMY MODERNISATION

Army to Buy ASMI Pistol, T9 Submachine Guns

Gearing up to equip its Special Forces with indigenous small arms, Indian Army will procure ASMI pistol and T9 submachine guns. The contract to supply 550 units of the 9x19mm submachine pistol "ASMI" to the Special Forces of the Indian Army has been awarded to Lokesh Machine Limited.

The revolutionary pistol ASMI is the brainchild of Col Prasad Bansod from the Infantry School, Mhow and supported by the Defence Research and Development Organisation's (DRDO) Armament Research & Development Establishment (ARDE) in Pune.

Developed in a record time of just four months, ASMI is an impressive feat of engineering prowess, firing the in-service 9 mm ammunition. ASMI boasts an upper receiver crafted from aircraft-grade aluminium and a lower receiver made from carbon fiber, utilising cutting-edge 3D printing technology for components like the trigger.

ADMI sports an 8-inch barrel and a high-capacity 33-round magazine, weighs under 2 kgs when empty, offering versatility with its full-length integral Picatinny rail and M-Lok slots for accessories.

The potential applications of ASMI within the Armed Forces are vast, catering to various roles including personnel weapon for vehicle detachments, commanders, tank and aircraft crews, drivers, dispatch riders, radio/radar operators, close-quarters combat (CQB), counter-insurgency (CI), counter-terrorism (CT) operations, VIP protection, and policing duties.

The name "ASMI," symbolising pride, self-respect, and the diligent efforts behind its creation, resonates the significance of indigenous production. With an estimated production cost of under Rs 50,000 per unit, ASMI holds promise not only for domestic security forces but also for potential export markets, reflecting India's strides towards self-sufficiency in defence manufacturing.

Similarly, the JD Taurus joint venture formed by Brazilian company Taurus Armas SA in collaboration with Jindal Defence, is set to supply 550 T9 submachine guns to the Indian Army for the first time. The deal valued at approximately Rs 4.26 crore, marks a substantial advancement in bilateral relations, particularly within the defence sector.

The revolutionary pistol ASMI is the brainchild of Col Prasad Bansod from the Infantry School, Mhow and supported by the DRDO

The contract to supply T9 submachine gun will ensure timely and best of the technology being available to the Indian armed forces and the paramilitary forces. In the joint venture company JD Taurus, Taurus Armas SA holds a 49 percent stake and this partnership underscores the growing cooperation between India and Brazil in defence.

The Indian Army's acquisition of 550 advanced submachine guns signifies its commitment to modernising its arsenal and enhancing operational capabilities. At the same time, the intense competition from vendors like PLR Systems, Jindal Defence, and Lokesh Machine Limited, this procurement showcases India's indigenous defence manufacturing capabilities.

Jindal Defence's Taurus T-9 submachine gun has emerged as a formidable contender in India's defence market. Recently, Jindal Defence Systems Private Limited (JDSPL) inaugurated its state-of-the-art firearms manufacturing facility in Hisar marking a significant stride towards revolutionising India's domestic weapons production and reducing reliance on imports. The sprawling two-acre facility amalgamates global expertise with cutting-edge technology.

JD Taurus is strategically positioned to address the escalating demand within India with an annual production capacity of 250,000 weapons. In the upcoming fiscal year, the company targets a production output of 25,000 to 30,000 firearms, facilitated by rapid scalability and product diversification.

JD Taurus' facility boasts certifications for a diverse range of products, with substantial value addition in India for rifles, carbines, submachine guns, machine pistols, and revolvers.

While logistical challenges may arise, including maintenance and spare parts management, the decision to procure submachine guns from multiple suppliers underscores India's pressing defence needs and the strategy to diversify procurement channels. Moreover, this approach ensures timely delivery of critical firearms to bolster national security efforts.

FRCV and Light Tanks

Meeting Future War Requirements

Lt Gen AB Shivane, PVSM, AVSM, VSM

Introduction

The ongoing trials of the light tank, system upgrade cum overhaul of T72 and the recent RFP to produce Future Ready Combat Vehicle (FRCV) have raised many eyebrows. Those professing the obituary of tanks and the exaggerated discourse on its suspect role in future battlespace lie disappointed and professionally misplaced.

The utility of a tank lies in its deployability, employability and capability to be the decisive force. Its optimisation lies in its inclusive role as an agile, lethal, and survivable platform to lead the combined arms team and attain combat overmatch across all spectrums of conflict. Thus, the need to understand the role, desired capabilities, and fleet management perspective.

The operational requirement is essentially based on medium-category tanks with light tanks supplementing its capabilities for marginal terrain like Northern borders. This remains the foundation of future operational and equipment construct.

Scale model of a light tank by HVF Avadi

Modernisation Fundamentals and Upgradation Construct

Modernisation fundamentals are foundational to the GSPS 2032 and fleet management perspective which is holistic, realistic and time sensitive. It is also based on prioritised and tiered modernisation based on value, vulnerability, and risk analysis with judicious scaling to address critical operational imperatives. It also looks at a more holistic and contemporary model of "Lethality, Survivability, Agility, Sustainability, Connectivity, and Affordability" based on the commonality of base platform and technology convergence. The focus on indigenous solutions to Indian warfighting remains paramount.

The spiral approach to technology induction emphasizes prioritizing functional capabilities, combat effectiveness, and closing capability gaps with existing technologies. Balancing expansion, modernization and sustenance involves harmonising fiscal requirements, standardising platforms, and evaluating the cost-benefit of sustaining legacy equipment to decrease sustainment costs.

Planned upgrades and overhauls aim to extend tank life beyond 32 years, emphasising sub-system, system, and platform upgrades along with field fitment or medium repair or overall interventions. The emphasis is on a lead integrator and expanded facilities requiring careful planning of space, power, and weight (balance) management, during the design stage for ease of adaptability and timely cum short fitment cycle.

AFV Fleet Management Perspective - SUDRO Model

The endeavour to keep the tank fleet in a 30:40:30 profile guides the "Fleet Management Perspective". The framework accordingly focuses on a balanced approach of sustaining the present fleet, modernisation of legacy fleet to contemporary standards and induction of next-generation platform in a time sensitive domain. It also aims at balancing fleet expansion and fleet modernization within pragmatic resource availability.

The pillars of this perspective thus must rest on five key aspects; sustain the current fleet and address voids; upgrade legacy fleet to bridge technological gaps till replacement platforms; develop and induct next-generation state-of-the-art replacement platforms; replace obsolete and beyond service life equipment progressively; and optimize indigenous capability for induction through IDDM category.

Translating it entails life extension and periodic upgrades of T 72 to bring its technology capabilities as close to T90; T-90 medium repairs and modernisation upgrades to state-of-the-art technologies; and FRCV to replace beyond-life equipment which is negative to the cost-benefit of sustaining

The initial fleet of T72 tanks has been replaced by T90S tanks

them.

Future Ready Combat Vehicle (FRCV)

The FRCV program amplifies the Indian Army's push for a modern battle tank with a robust and flexible base platform that can be adopted into a multitude of specialised armoured fighting vehicles. FRCV will offer multiple options for rapid operational employment enabling the Indian Army to execute operations across the entire continuum of conflict against diverse threats of the adversaries.

The FRCV as the next generation main battle tank is to replace the vintage T-72 Tank Fleet (in service since 1979), which has progressively gone beyond its service life. While the initial fleet of T72 has been replaced by T90, the later production approx. 1770 tanks though upgraded, are not cost-effective to sustain and pose an operational risk due to obsolescence. Even if optimistically inducted in 2030, it will in all probability replace the balance T 72 fleet by around 2045. Thus, the time and operational expediency.

The FRCV was planned to be developed under the Make Project since 2008-09, however, its turbulent journey swayed from a de-novo three-stage turnkey project outside the DPP in 2015, to MAKE 1 under the new DPP 2016 evolved to SP (Strategic Partnership) model in 2017. Accordingly, commencing 2015 multiple RFI's were floated by Service Headquarters, the last one being in 2024. While the May 2021 RFI was issued and 'In Principle Approval' given, the grant of AoN (Acceptance of Necessity) by MoD is being expedited. The Indian Army is likely to issue a request for proposal (RFP) this year for a project of approximately Rs 57,000 crore to manufacture 1,770 future-ready combat vehicles (FRCVs) in India.

DGMF have listed broad technical parameters under the project brief. The FRCVs, with a weight categorization of 55+/-10% with a high power-to-weight ratio of 27:1 HP/Ton, will have a crew of four. It will be equipped with cutting-edge technologies such as artificial intelligence (AI), drone integration, survivability suites including active protection systems, state of art fire control system, battlefield management systems, beyond line-of-sight strike capability, advanced communication, state of art optoelectronics, vetronics and enhanced situational awareness. Additionally, features like manned-unmanned teaming capability and seamless integration into network-centric warfare environments will enhance the overall operational effectiveness index of the Indian Army (IA) by catering for emerging threats in varied terrain.

A main battle tank is a system of systems and is a fusion of apex technologies existing in the realm of land systems. Successful development under Make-I would result in acquisition, from a successful Development Agency (DA), through the 'Buy (Indian-IDDM)' category with indigenous design and Development and a minimum of 50% IC. The Ministry of Defence, GoI, intends to procure quantity 590 FRCV in the first phase.

The project for FRCV will provide a unique opportunity for the Indian Defence Industry to come together and help to build research and manufacturing capabilities to foster technological spinoffs benefitting a host of civil/dual-use applications.

The Light Tank

Recognizing the strategic importance of high-altitude operations, the Indian Army is acquiring an indigenous light tank engineered for agile manoeuvrability and high lethality with other state-of-the-art technologies dovetailed. It aims to counterbalance the capabilities demonstrated by the Chinese Type 15 'Black Panther', a third-generation tank currently operational along the LAC in the Northern borders where T72 or T90 may be terrain restricted.

The broad employment concept of the light tank thus revolves around its superior mobility (strategic, operational, and tactical), versatility, enhanced manoeuvrability (small turning radius, high power-to-weight ratio, and low nominal ground pressure), and lethal firepower especially high angle fire cum missile firing ability supported by state of art electro-optronics, communication and multilayered survivability packaging. Its air portability and desired amphibious capability add to its operational matrix. Its availability would add teeth to limited offensive or quid pro quo operations into enemy territory. Thus, light tanks would add to the credible deterrence posture and warfighting capability in the Northern Front.

Like FRCV light tanks too have had a turbulent history since the mid 1980's of its approval. The Indian Light Tank (ILT) based on RFI of Apr 2021 has been accorded 'Acceptance of Necessity (AoN)' in Sep 2022 to be progressed under two routes - one is the design and development route, in which the DRDO, alongside the industry partner, is working on 59 tanks, and there is another 295, which is under the 'Make I' category which will be partially funded by the government as well as development partners. Named 'Zorawar', the tank has emerged from a collaborative effort between the Defence Research and Development Organisation (DRDO) and the private entity Larsen & Toubro (L&T). The development technical trials by the developer are underway and likely to be handed over for user trials end of 2024 or early 2025.

Conclusion

The approach to future capability building must be inclusive and not exclusive, based on the larger intent of prevailing in today's war and generating indigenous capabilities to fight and win future wars. FRCV and Light Tank program are key strategic enablers, which will generate desired capabilities and bridge the future operational mismatch against escalating threats, particularly on the Northern borders.

Exercise Bharat Shakti

Indigenous Military Capability Displayed

The integrated tri-services exercise Bharat Shakti displayed the indigenous defence capability of the armed forces along with the integration and jointness that are being achieved in various aspects like communications, training, inter-operability and logistics by the three defence forces.

Exercise Bharat Shakti, a tri-service fire and manoeuvre exercise, was organised under the aegis of the Indian Army on March 12 in Pokhran. The synergised demonstration of indigenous defence capabilities is a testimony to its commitment towards modernisation through indigenisation.

Displaying an array of indigenous weapon systems and platforms as a demonstration of the prowess of the country, premised on the nation's Aatmanirbharata initiative, the 'Bharat Shakti' exercise simulated realistic, synergised, multi-domain operations displaying integrated operational capabilities of the Indian armed forces to counter threats across land, air, sea, cyber, and space domains.

Indigenous equipment display at Exercise Bharat Shakti

A static display of various equipment and weapons in the display arena gave a holistic view of the indigenous platforms of the Armed Forces. Equipment & weapons on display included various drones and counter-drone systems, simulators, and communication systems, including software-defined radio (SDR), radars, LCH Prachand, ALH, Akash Missile Systems, Jammers and electronic warfare systems from all three services.

The chief of the army staff, Gen Manoj Pande conducting Prime Minister Narendra Mod during the exercise

From the Army, Multi-Mode Hand Grenade (MMHG), Laser Dazzler, Thermal Imager Integrated Observation Equipment (TIIOE) and Night Sights, Canister Launched Anti-Armour Loiter Munition (CALM), Low Power Jammer Systems, Mini RPAs, Aerial Targeting Sys (ATS) ER, Unmanned Aerial Vehicle Launched Precision Guided Munition (ULPGM), 3D Printed Bunkers, Operation Theatre on Wheel (11xALS/HMV), Weapon Locating Radar Swathi, TATA Xenon & ALS Medical Ambulance with Critical Care Equipment, NAMIS (Tracked), Global Navigation Satellite System (GNSS)

Prime Minister Narendra Modi meeting the three Service Chiefs at Pokhran Ranges during Ex Bharat Shakti

A demonstration of an attack during Ex Bharat Shakti. Truck-mounted air defence guns in the foreground

Receiver, Artificial Intelligence Based Satellite Imagery Analysis System, Situational Awareness Module for Army (SAMA) were some of the prominent items on display.

Over a 50 minute duration, several top-line equipment development and license manufactured in India were put through paces, including T-90 (IM) tanks, Dhanush and Sarang artillery guns, Akash surface to air system, logistics drones, robotic mules, light combat aircraft and advanced light helicopter among others.

While the Indian Army showcased the advanced ground warfare and aerial surveillance capabilities, the Indian Navy highlighting maritime strength and technological sophistication, showcased naval anti-ship missiles, autonomous cargo carrying aerial vehicles, and expendable aerial targets. The Indian Air Force (IAF) showcased the indigenously developed light combat aircraft Tejas, light utility helicopters, and advanced light helicopters to demonstrate air superiority and versatility in air operations.

Prime Minister in Attendance

The first-ever exercise of such a high magnitude was witnessed by Prime Minister Narendra Modi. Witnessing the combined demonstration of indigenous defence equipment and live fire and manoeuvre exercises, he said that Aatmanirbharta for India's defence needs is the guarantee of self-confidence in the armed forces.

Prime Minister Modi said, "Roar of aircraft mid-air, valour displayed on ground during 'Bharat Shakti' exercise is the call of a New India.". Noting that the exercise was a step towards this resolution, he said that India is laying emphasis on aatmanirbharta from edible oils to fighter jets. The success of aatmanirbharta in defence can be seen with India's tanks, cannons, fighter jets, helicopters and missile systems which reflect India's strength, he added. "We are experiencing the flight of Made in India with arms and ammunition, communication devices, cyber and space. This is indeed Bharat Shakti," he stated.

The exercise 'Bharat Shakti' not only showcased the advanced operational capabilities of the Indian Armed Forces but also symbolized India's readiness to confront and overcome challenges with indigenous solutions. This event marks a pivotal moment in India's defence narrative, showcasing the resilience, innovation, and burgeoning strength of its domestic defence industry on a global stage.

Exercise Gaganshakti-2024

IAF Tests Preparedness Against Threats

Exercise Gaganshakti-2024, to test the Indian Air Force's its preparedness to counter potential threats from Pakistan and China simultaneously, was conducted over 10 days from April 1, 2024 and surpass the scale of the 2018 exercise, which saw the participation of nearly 1150 aircraft. The wargame sought to evaluate integrated war-fighting strategies and tactics in collaboration with the Indian Army and the Indian Navy.

The IAF has strengthened its arsenal with advanced weaponry, following the aftermath of Operation Balakot and subsequent skirmishes with the Pakistan Air Force (PAF). The induction of French Rafale fighter jets, indigenous Light Combat Helicopters (LCH) like Prachand, and C-295 transport aircraft, integration of BRAHMOS supersonic cruise missiles with Sukhoi fighter jets, along with the addition of Meteor beyond-visual-range air-to-air missiles (BVRAAM) to the Rafale fleet, has significantly enhanced the IAF's combat capabilities.

Additionally, the acquisition of Russian S-400 surface-to-air missiles and the indigenous Astra Beyond Visual Range (BVR) Air-to-air missile has augmented the IAF's air defence capabilities. The deployment of the LCA 'Tejas' aircraft, particularly along the western and northern frontiers, underscores India's commitment to leveraging indigenous technology for defence preparedness.

Demonstrating proactive stance in countering regional threats against the backdrop of strained relations with China, intensified by clashes in the Galwan Valley, the IAF's swift response and deployments such as the Light Combat Helicopter (LCH) in Eastern Ladakh, Rafale jets conducting long-duration flights in the Indian Ocean Region underscores the importance of readiness and preparedness in safeguarding national interests.

Gaganshakti-2024 followed in the footsteps of Vayu Shakti, a mega firepower demonstration conducted by the IAF in the Thar desert.

Serving as a testament to India's evolving defence capabilities and its resolve to meet emerging security challenges head-on, Gaganshakti-2024 highlighted network-centric operations, incorporating unmanned aerial vehicles (UAVs) and swarm drones, in line with evolving combat doctrines.

A Chinook helicopter of the IAF carrying an underslung artillery gun

As part of the ongoing exercise Gagan Shakti-24, IAF aircraft recently operated from the Emergency Landing Facility (ELF) in the northern sector in Kashmir valley. A large number of troops were airlifted and subsequently, air landed utilising Chinook, Mi-17 V5 and ALH Mk-III helicopters by night. IAF plans to practice similar drills in coordination with different state governments for the activation of ELFs in other sectors too.

The purpose of these exercises is to give a platform for various air forces to engage in the exchange of knowledge, the sharing of best practices, the accomplishment of joint training, and the formation of personal relationships, all of which serve as vital intangibles in the process of developing synergy during joint operations.

Last Exercise for MiG-21s

This was the last major exercise in which the MiG-21 Bisons participated ahead of their upcoming retirement. The MiG-21, India's first supersonic fighter whose induction began in 1963, will be pulled out of service by 2025. IAF currently operates only two MiG-21 squadrons — the No.3 or Cobras at Nal near Bikaner and No.23 or Panthers at Suratgarh, both in Rajasthan. A squadron consists of 16 to 18 fighter jets. Both squadrons operate the MiG-21 Bison, the last variant of the single-engine workhorse.

Despite the West's effort to malign MIG-21, it lasted 70 years. No other fighter plane can boast of that long life. As of the start of 2024, 14 nations operate a total of roughly 225 MiG-21s in service.

IAF has operated a raft of MiG-21 variants — Type 74 or MiG 21F, Type 76 or MiG 21PF, Type 77 or MiG 21FL, Type 96 or MiG 21M, Type 75 or MiG 21 Bis (upgraded Type 96) and the MiG-21 Bison.

DEFENCE COOPERATION

India-US Bilateral Tri-Service HADR Exercise

Ex Tiger Triumph–24 Held on Eastern Seaboard

In consonance with the established partnership between India and the US, a bilateral tri-Service Humanitarian Assistance and Disaster Relief (HADR) exercise Tiger Triumph-24 was hekd on 18-31 March on the Eastern seaboard.

The 14-day exercise was aimed at developing interoperability for conducting HADR operations and refine Standard Operating Procedures (SOPs) to enable rapid and smooth coordination between forces of both countries.

Indian Navy ships with integral helicopters and landing crafts embarked the Indian Navy aircraft. Indian Army personnel and vehicles and IAF aircraft and helicopters along with the Rapid Action Medical Team (RAMT) participated in the exercise. The US was represented by its navy ships with troops drawn from the US Marine Corps and the US Army.

The Harbour Phase was held from March 18 to 25. Personnel from both navies participated in training visits, subject matter expert exchanges, sports events and social interactions. On completion of the Harbour Phase, the ships, with the troops embarked, sailed for the Sea Phase and undertook maritime, amphibious and HADR operations following injected situations.

Indian soldiers practice beach landing in landing craft launched from USS Somerset during Ex Tiger Triumph

Beach landing during Ex Tiger Triumph

The closing ceremony of the exercise was held onboard USS Somerset on March 30, 2024.

Cross Deck helicopter operations involving UH3H, CH53 and MH60R helicopters were also undertaken between ships of the Indian Navy and the US Navy off Kakinada and Visakhapatnam.

The participating units from the Indian Navy included a landing platform dock, landing ship tanks (large) including their integral landing crafts and helicopters, guided missile frigate and long range maritime reconnaissance aircraft.

The Indian Army was represented by one Infantry Battalion Group including mechanised forces and the Indian Air Force had deployed one medium lift aircraft, transport helicopter and the rapid action medical team (RAMT).

The US Task Force comprised of a US Navy landing platform dock including its integral landing craft air cushions and helicopters, a destroyer, maritime reconnaissance and medium lift aircraft, and also, US Marines.

Special Ops Forces from all the three Services also participated in the exercise and jointly undertook combined operations with

INS Airavat Shardul-class amphibious warfare vessel lands a BMP shore during Ex Tiger Triumph

Cross Deck helicopter operations involving UH3H, CH53 and MH60R helicopters were undertaken

US Marines and Indian Navy MARCOS participated in Ex Tiger Triumph

the US counterparts at Visakhapatnam and Kakinada during the harbour and sea phase.

India's History of HADR

In the aftermath of the Indian Ocean tsunami in December 2004, when the Indian Navy provided holistic intervention in the form of rescue and relief operations, task disaggregation, reconnaissance, and rescue of survivors in Sri Lanka, the Maldives, and Indonesia. This humanitarian assistance initiative enabled India to project its soft power as it rejected foreign aid during the crisis to demonstrate that it had the prerequisite resources and manpower to manage the crisis. In fact, to navigate the crisis, India employed indigenous resources in the form of Indian naval ships, aircraft, and helicopters to provide relief and assistance to populations of different neighboring countries like Sri Lanka and the Maldives during the disaster.

Subsequently, India provided humanitarian assistance to its South Asian neighbors during natural calamities (Bhutan, Bangladesh, Nepal, and Sri Lanka) and security conflicts (Afghanistan, Myanmar, and Sri Lanka) over the last decade, cementing its position as a first responder in crisis.

Since 2015, under India's flagship maritime policy of "Security and Growth for All" (SAGAR), Indian Prime Minister Narendra Modi has constituted the Annual Joint HADR Exercise (AJHE), named Operation Chakravat, to demonstrate India's capabilities in disaster risk mitigation, and disaster risk response within the IOR. Similarly, Exercise Tiger Triumph with the United States has been instituted to foster triservices engagement between the two states while having the ability to conduct amphibious HADR operations in the advent of a natural calamity. India has also furthered HADR cooperation with the United States under the aegis of the Quadrilateral Security Dialogue (Quad). The Quad has deliberated on providing coordinated responses to climate disasters while expanding its capacity, capability, and interoperability within the Indo-Pacific. In fact, the Quad sherpas organized the first Quad HADR meeting to this effect in New Delhi in December 2022.

India should invest in suitable platforms to ameliorate its HADR missions through the acquisition of utility helicopters, Landing Platform Helicopters (LPHs), and Landing Platform Docks (LPDs) to ensure faster deployments. India should acquire Multi-Role Supply Ships (MRSS) with HADR contingency load-outs that include deployable shelter systems and relief supplies. Moreover, if economically feasible, India should acquire a hospital ship like China's Peace Ark to ameliorate Indian HADR operations.

Industry News

25T Bollard Pull Tug Launched

The third 25T Bollard Pull (BP) Tug, Bajrang was launched on March 14, 2024 at Shoft Shipyard Pvt Ltd, Bharuch, Gujarat. The contract for construction and delivery of three 25T BP Tug was concluded with Shoft Shipyard Pvt Ltd (SSPL), an MSME, in consonance with "Aatmanirbhar Bharat" initiative of the Government of India.

These Tugs are being built under the classification rules of Indian Register of Shipping (IRS).

The availability of Tugs will provide impetus to operational commitments of the Navy by facilitating Naval ships and submarines during berthing and un-berthing, turning and manoeuvring in confined waters. The Tugs will also provide afloat firefighting assistance to ships alongside, at anchorage and will have capability to conduct limited search and rescue operations.

The third 25T Bollard Pull (BP) Tug, Bajrang was launched on March 14, 2024 at Shoft Shipyard Pvt Ltd, Bharuch, Gujarat.

NewSpace Research Gets Contract For for HAPS UAS

NewSpace Research and Technologies (NRT) has been awarded a contract by iDEX – DIO for design and development of a stratospheric High Altitude Pseudo Satellite (HAPS) UAS for the Indian Navy.

NewSpace Research and Technologies has been awarded a contract for design and development of a stratospheric High Altitude Pseudo Satellite (HAPS) UAS for the Navy.

Largely geared towards the Indian naval needs in the IOR, this program is one of the path breaking contracts awarded under the Aatmanirbhar Bharat initiative and the DAP2020, with assured MOQs and a direct procurement post realisation of TRL 7-9. It is also one of the only few real world commitment for a HAPS class UAS product development effort across the world.

As one of the only two organisations in India carrying our indigenous development of a HAPS UAV from the ground up (arguably one of most difficult aerospace platform to realise); NRT will leverage its experience gained from successfully developing and flight testing the technology demonstrator as part of the previous iDEX – DIO sub scale aircraft development with the Indian Air Force.

NRT expects to develop this cutting edge dual use platform in the years ahead, focussing on persistent ISR, communication, ELINT missions of the Indian military and the communication needs, including beaming down of WiFi and 5G networks, as well as disaster monitoring applications from the stratosphere for civilian use cases.

HAL Awarded Contract for Mid-Life-Upgrade of Dorniers

The Ministry of Defence signed a contract with the Hindustan Aeronautics Limited (HAL) on March 15 for the mid-life upgrade (MLU) of 25 Dornier aircraft flying with the Indian Navy at a cost of Rs 2,890 crore. The contract also includes associated equipment for the Indian Navy.

The MLU for Dornier aircraft will include an upgrade to incorporate state-of-the art avionics systems and primary role sensors.

The project will be implemented within six and half years, the defence ministry said. The operational capability of the Dornier aircraft of the Indian Navy will be significantly enhanced with this upgrade. It will carry out the main roles of maritime surveillance, coastal surveillance, electronic intelligence and development of Maritime Domain Awareness (MDA).

In addition, this upgrade will enable Indian Navy Dornier aircraft to carry out secondary roles of search and rescue, medical/casualty evacuation and communication link, according to an official statement issued by the ministry.

The MLU of 25 Dorniers is expected to generate an employment of 1.8 Lakh man-days during its execution span of over 6.5 years. The indigenous upgrade entails supply of major systems and equipment from indigenous sources.

Defence Exports Cross Rs 21,000 Crore Mark

The country's defence exports have soared to unprecedented levels, crossing the milestone of Rs 21,000 crore for the first time in the history of Independent India, announced Defence Minister Rajnath Singh on social media X.

"Delighted to inform everyone that the Indian Defence Exports have scaled to unprecedented heights and crossed Rs 21,000 crore mark for the first time in the history of Independent India! India's defence exports have reached to the level of Rs 21,083 crore in the financial year 2023-24 which is a spectacular growth of 32.5 per cent over the previous fiscal," the Defence Minister posted on X.

The major defence items being exported include Personal Protective Items, Offshore Patrol Vehicles, ALH Helicopters, SU Avionics, Coastal Surveillance Systems, Light Engineering Mechanical Parts, Kavach MoD. Among others, these defence items have emerged as key contributors to India's defence export portfolio.

HAL Achieves Record-Breaking Revenue

In the financial year ending March 31, 2024, the performance of Hindustan Aeronautics Limited (HAL) soared to new heights as it reported an outstanding double-digit growth in revenue.

Achieving a record-breaking revenue of over Rs 29,810 crore, the aerospace giant HAL marked an impressive 11 percent increase compared to the previous fiscal year's 9 percent. This significant growth demonstrates HAL's resilience and adaptability in navigating through supply chain hurdles, particularly those stemming from geopolitical tensions.

HAL's performance surpassed expectations, despite facing considerable supply chain challenges. Reflecting its commitment to excellence and innovation, HAL secured manufacturing contracts exceeding Rs 19,000 crore and Repair and Overhaul (ROH) contracts surpassing Rs. 16,000 crore during FY 2023-24.

One notable achievement during the fiscal year was HAL's swift fulfilment of an export contract with the Guyana Defence Forces, supplying two Hindustan-228 aircraft within a month of contract signing. This rapid delivery underscored HAL's proactive approach and commitment to meeting customer needs efficiently.

Furthermore, HAL celebrated significant milestones, including the successful maiden flight of the first production series fighter of LCA Mk1A in March 2024.

The company's robust order book exceeds Rs 94,000 crore, with substantial new contracts anticipated for the upcoming fiscal year.

The defence ministry signed a contract with HAL on March 15 for the mid-life upgrade of 25 Dornier aircraft of the Indian Navy for Rs 2,890 crore.

GRSE Turnover Records YoY Growth of 33%

Garden Reach Shipbuilders & Engineers Limited (GRSE), one of the leading warship builders in the country, continues to maintain an upward financial growth and has achieved an annual turnover to the tune of Rs 3,400 crore (provisional & unaudited) for FY 2023-24, the highest ever in the history of the company.

The company had also declared an interim dividend @ 79% of paid-up share capital against 55% of previous year.

Mira Aerospace and VEDA Aeronautics to Collaborate for Advanced HAPS Solutions

UAE based Mira Aerospace and Indian start-up VEDA Aeronautics have collaborated to deliver the world's most advanced High Altitude Pseudo Satellite (HAPS) solutions designed for the Indian market.

Through this collaboration, Mira Aerospace will pair its cutting-edge ApusNeo HAPS technology with VEDA Aeronautics' local development capabilities. The offering will be available to both Indian Defence and civilian clients.

Under this agreement, the companies have committed to deliver a HAPS platform specific to the Indian market within the first half of 2024. Mira Aerospace and VEDA Aeronautics previously performed test flights in the Indian airspace, where the technology demonstrator HAPS unit flew in the Indian stratosphere. This test continues to be the only such flight in India to date.

VEDA Aeronautics has recently participated in the Make-1 project, an initiative launched and funded by the Indian Air Force, where the company looks to design and develop a HAPS solution capable of carrying a minimum 35KG payload and sustaining operations at 18,000m altitude for minimum of 30-45 days. Under the Make-1 project, the HAPS developed through the partnership with Mira Aerospace could potentially be used for strategic persistent monitoring of the Indian borders.

The project is being handheld by the Indian military and the HAPS has successfully carried out flights over the Pokhran Test Range at 12 km above the ground. Conducted in March last year, the test marked the only flight of an HAPS in the Indian stratosphere.

As part of a new genre of solar-powered platforms being designed across the world for persistent surveillance, communications, and scientific missions, The HAPS platform will fill a capability gap between satellites and HALE (High Altitude Long Endurance) UAVs and run purely on solar power, flying above the clouds at 16-20 km autonomously for months at a stretch.

On board with the project, both the IAF and the Navy are looking to acquire this capability for the short- and long-term. According to sources, the IAF is closely monitoring the project and handholding the players. Developed under the Ministry of Defence's Rs 1,000 crore 'Make-I project', which entails 90 percent of government funding, the HAPS would be used for strategic persistent monitoring of India's borders.

UAE-based Mira Aerospace and Indian start-up VEDA Aeronautics have collaborated to deliver High Altitude Pseudo Satellite (HAPS) solutions for India

DGQA Reorganised for Ease of Doing Business

The Department of Defence Production under the Ministry of Defence has issued notification for re-organisation of Directorate General of Quality Assurance (DGQA) in a major reform towards 'Ease of Doing Business' and to achieve Aatmnirbharta in Defence. This change is aimed at speeding up Quality Assurance processes and trials and reducing layers of decision-making and also factors change in the Quality Assurance methodology and revised role of DGQA post corporatisation of Ordnance Factory Board (OFB).

A need was felt to re-organise DGQA for an effective and efficient support to emerging defence manufacturing industry with the corporatisation of Ordnance Factories into new DPSUs, increased participation of private defence industry and impetus by the government towards indigenisation. DGQA has already been steering various organisational and functional reforms after active discussions with all stakeholders in the defence manufacturing ecosystem.

The new structure under implementation will enable single point technical support for complete equipment/ weapon platforms at all levels and also ensure uniformity in product-based QA, according to an official statement issued by the Ministry of Defence on March 28, 2024. The new structure also provides for a separate Directorate of Defence Testing and Evaluation Promotion to facilitate transparent allocation of Proof Ranges and testing facilities.

Coupled with automation and digitisation of standardised QA processes, this arrangement is likely to significantly improve the engagement of the Defence Industry with DGQA. The re-organised structure and ongoing functional reforms will give a push to indigenisation drive under 'Aatmanirbhar Bharat' with availability of Indian standards/ equivalent to guide manufacturers within the country and will also boost export of high Quality qualified defence products.

BEL Signs Contracts Worth Rs 3,102 Crore with MoD

BEL has signed two contracts worth Rs 3,102 crore with the Ministry of Defence (MoD) for supply of the Advanced Electronic Warfare (EW) suite for fighter aircraft of the Indian Air Force. The overall cost of the contract is estimated to be Rs 1,993 crore.

The MoD also signed a contract with BEL-Hyderabad for the Instrumented Electronic Warfare Range (IEWR) for the Indian Air Force. BEL also signed an MoU with the Army Design Bureau of the Indian Army for collaboration in the field of Artificial Intelligence (AI) for Defence applications. All these contracts assume immense significance especially when it comes to making India a self-reliant nation in terms of defence production and research.

As per BEL, the supply of advanced EW systems will significantly enhance the battle-survivability of the IAF fighter aircraft while undertaking operational missions against adversaries' ground-based as well as airborne fire control and surveillance radars. The EW suite has been indigenously designed and developed by the Defence Research and Development Organisation (DRDO).

At the same time, the contract regarding

the Instrumented Electronic Warfare Range (IEWR) for the Indian Air Force is being termed as a significant step towards enhancing the capabilities of the IAF to prepare for future warfare. The overall cost of the contract is estimated to be Rs 1,109 crores. The IEWR will be used to test and evaluate airborne Electronic Warfare (EW) equipment and validate their deployment in an operational scenario.

Similarly, the MoU with the Indian Army seeks to bring together the Army Design Bureau (ADB), and BEL under one roof to jointly carry out research activities for the development of innovative AI solutions for the Indian Army. BEL and ADB will co-develop AI-based projects for the Army. The MoU will be executed in a collaborative manner through a nodal organisation named Artificial Intelligence Incubation Hub (AIIH). The AIIH will be co-chaired by the ADG, ADB, and Director, R&D, BEL, with members from the Indian Army and BEL. The MoU also has the provision to co-opt representatives of academia and industry/start-ups.

Garuda Aerospace Launches Drone Trishul

Garuda Aerospace announced the launch of Border Patrol Surveillance Drone Trishul. The drone will empower forces in times of need for monitoring and analysis and people movement. Trishul can also be used in times of natural disasters, calamities and emergencies to gain access to real-time images and videos or to gain access to suspicious activities. The drones can also be used to assess traffic situations.

Trishul provides wide-angle visibility of on-ground activity thus empowering ground control teams to take critical and effective decisions promptly. In addition to providing information such as the density and direction of gathering as well as their movement patterns, Trishul makes way for teams to safely monitor extensive variables while being remotely stationed.

Equipped with a variety of sensors, such as high-definition cameras, infrared cameras, LIDAR, and radar, Trishul can also provide data regarding, speed, safety threats, crowd dynamics, and potential disturbances.

Garuda Aerospace has drones including Kisan Drones, Surya – Solar Panel Cleaning Drone, Vriksh Vihaan Seed Dropping Drone among others.

Garuda Aerospace has announced the launch of Border Patrol Surveillance Drone Trishul.

BEL Achieves Record Turnover of Rs 19,700 Crore

BEL has achieved a turnover of around Rs 19,700 crore (provisional & unaudited), during the financial year 2023-24, against the previous year's turnover of Rs 17,333 crore registering a growth of 13.65%.

In the fiscal year 2023-24, BEL successfully secured orders worth around Rs 35,000 crore. Among the notable defence orders obtained during the year were Electronic Fuzes, EW Systems, Communication Systems for naval warships, Fire Control Systems, Akash Prime Weapon System, Radars, Sonars, Software Defined Radios, Night Vision Devices, Tactical Communication Systems and other projects in Non-defence sector.

With this, the total order book of BEL as on April 1st, 2024, stands at around Rs 76,000 crore.

BEL also achieved export sales of around US$ 92.98 million during FY 2023-24, as against the previous year's export turnover of US$ 48.33 million, registering a growth of 92%. Major products exported include Transmit & Receive (TR) Modules, Compact Multi-Purpose Advanced Stabilisation System (CoMPASS), Radar & Electronic Warfare Systems, Medical Electronics, Communication equipment, etc.

As on April 1st, 2024, BEL's export order book stands at US$ 407 million, with export orders acquired during the fiscal year amounting to US$ 211 million.

HAL to Develop Refueling Probe for Tejas MkII

In a major push for self-reliance in India's defense sector, Hindustan Aeronautics Limited (HAL) is spearheading the development of a retractable inflight refueling probe in collaboration with private Indian companies. This crucial component is intended for the Tejas MkII fighter jet program.

The initiative marks a significant step towards reducing dependence on foreign original equipment manufacturers (OEMs) for critical Tejas MkII components. The current Tejas Mk1A variant utilizes a fixed inflight refueling probe supplied by Cobham Limited, a British aerospace company.

A retractable inflight refueling probe offers several advantages over a fixed design. When not in use, the retractable probe minimizes drag, resulting in improved fuel efficiency and overall aircraft performance.

Additionally, it provides better protection from potential damage when the aircraft is not actively refueling.

HAL's ambitions for the domestically developed retractable probe extend beyond the Tejas MkII program. The company aims to integrate this technology into its highly anticipated 5th-generation Advanced Medium Combat Aircraft (AMCA) project. This highlights a strategic move towards establishing a standardized, indigenous solution for future Indian fighter aircraft.

BEL's Sea Drone is Solar Powered

Bharat Electronics Limited (BEL) has made waves with the unveiling of its groundbreaking solar-powered Unmanned Surface Vehicle (USV). This innovative drone is designed for a wide range of missions, including hydrographic surveying, coastal surveillance, and potentially, even kamikaze attacks.

BEL's USV stands apart with its eco-conscious design. Powered by solar energy, this sea drone operates with zero emissions, making it an environmentally friendly alternative for maritime operations.

The USV's 30kg payload capacity allows it to carry specialized sensors to gather underwater data and map seabed features. This capability is crucial for creating accurate nautical charts and supporting safe navigation.

With remote control and waypoint navigation, the USV transforms into a vigilant coastal sentinel. It can patrol strategic areas, monitor maritime traffic, and enhance security by providing real-time situational awareness.

BEL emphasizes the potential for customization, hinting at future use in logistics operations for transporting supplies over water.

Intriguingly, the possibility of deploying this USV for "kamikaze applications" is also mentioned, though details on this role remain undisclosed.

BEL's solar-powered USV offers compelling advantages. Its unmanned nature reduces the risks faced by personnel in potentially hazardous environments. Additionally, its eco-friendly operations promise both cost savings and reduced environmental impact.

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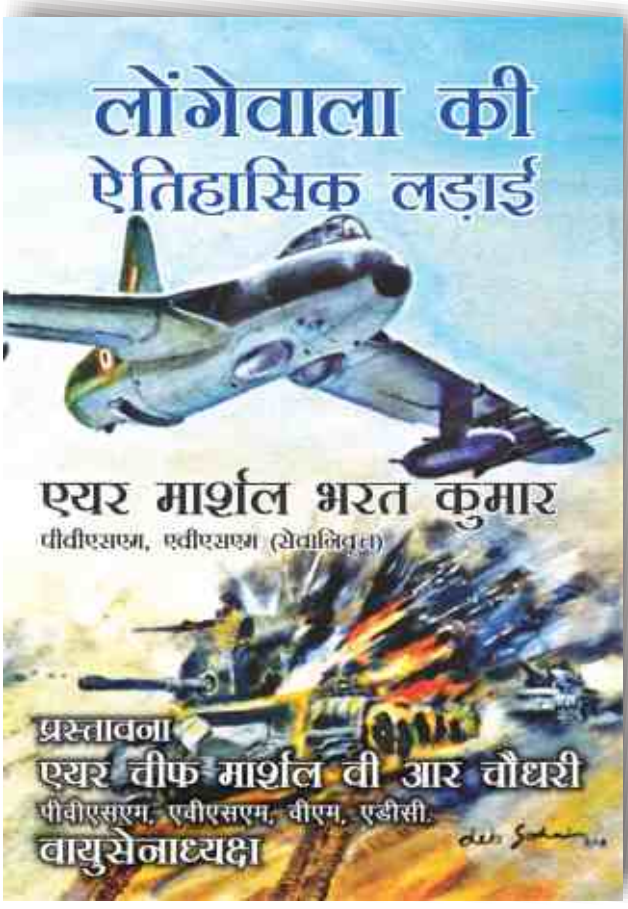

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भारतीय सेनाओं का तथ्यात्मक प्रदर्शन

लोंगेवाला की लड़ाई में भारतीय वायु सेना के तथ्यात्मक प्रदर्शन को सामने लाने की दिशा में यह पुस्तक एक महत्वपूर्ण कदम है। इस लड़ाई का मीडिया कवरेज तथ्यात्मक रूप से गलत सूचना पर आधारित है, जिसके कारण वायु सेना के प्रदर्शन को ठीक तरह से प्रस्तुत नहीं किया गया है।

एयर मार्शल भरत कुमार ने लोंगेवाला की लड़ाई के तथ्यों को स्थापित किया है और आगे किसी भी गलत सूचना के प्रसार से बचने के लिए उन्हें सार्वजनिक ज्ञानक्षेत्र में प्रस्तुत किया है। यह इसलिए आवश्यक था क्योंकि युद्ध का कोई पूरा विवरण इससे पहले न ही लिखा गया है और न ही प्रकाशित हुआ है।

लोंगेवाला की लड़ाई की सफलता का श्रेय उसके एक शानदार बेस कमांडर, एयर मार्शल एमएस बावा और नंबर 122 स्क्वाड्रन के अत्यधिक प्रेरित और कुशल पायलटों को जाता है। उनका प्रदर्शन भारतीय वायु सेना के इतिहास में एक सुनहरा पृष्ठ बन गया है और आनेवाली पीढ़ियों को हमेशा प्रेरित करेगा।

एयर चीफ़ मार्शल निर्मल चंद्र सूरी, PVSM, AVSM, VM, *(सेवानिवृत्त)*

Authored by a Scholar-Soldier

With every mission described in details, the author has accurately recorded the catastrophic rout of Pakistan's armour and infantry by the IAF with the clarity, accuracy and candour it deserves.

लेखक ने उन सभी मिशनों का विस्तार से वर्णन किया है जो उन विमानों ने लड़ाई के दौरान जो मिशन उड़ाए थे उनके और उनके दौरान जो नुकसान दुश्मन को हुआ था, उसके बारे में बताया है। महान विजय के उपलक्ष्य में बनाए गए विजय स्तंभ की कहानी का भी वर्णन किया गया है। अंतिम अध्याय में, जिसका शीर्षक 'पश्च दृष्टि' (इन हिंडसाइट) है, लेखक ने पूरे जमीनी और हवाई कार्रवाई का विश्लेषण किया है, विभिन्न निष्कर्ष और सबक निकाले हैं जो शायद आज भी लड़ाई के 50 साल बाद मान्य हैं, जैसे कि वे 1971 में थे।

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India Prepares To Buy 15 C295 Maritime Patrol Variants

BY GORDON ARTHUR

CHRISTCHURCH, New Zealand — India is moving closer to buying 15 maritime patrol variants of the Airbus C295 aircraft, following permission from the country's Defence Acquisition Council.

This initial approval from Feb. 16, called acceptance of necessity in Defence Ministry parlance, will see the Navy receive nine C295 medium-range maritime reconnaissance aircraft and the Coast Guard get six C295 multimission maritime aircraft.

Once a contract is signed, a joint venture between the French firm Airbus and the Indian business Tata Advanced Systems Ltd. would manufacture the aircraft in India.

The Air Force previously placed a contract for 56 C295 transport aircraft, of which the first 16 are under production in Spain and the remainder in Tata's final assembly line in the Indian city of Vadodara.

Although Airbus offers a maritime patrol version of the C295 — Spain ordered 16 in December — the Indian Navy and Coast Guard platforms will receive locally made sensors such as an active electronically scanned array radars, identification friend or foe systems, data links, and electro-optic/infrared technology. The Centre for Airborne Systems, a branch of the Defence Research and Development Organisation, is developing this equipment as part of the government's efforts toward greater self-sufficiency in defense production.

Medium-range maritime reconnaissance aircraft would help India monitor nearby waters as well as gather electronic and communications intelligence. The aircraft would supplement 12 P-8I aircraft used for anti-submarine warfare.

Airbus

The Indian Air Force received its first C295 transport aircraft in September 2023.

With around 11 hours of endurance, the variant would also provide longer-range capability than existing Dornier 228 aircraft. The Navy is also set to receive 15 MQ-9B SeaGuardian drones to boost maritime surveillance.

The Indian government has expressed concern about the Chinese military's activities in the Indian Ocean, and the Indian Navy has carried out anti-piracy operations in the nearby Gulf of Aden since 2008.

Meanwhile, the Coast Guard's C295 variants would conduct maritime surveillance, anti-piracy missions, pollution monitoring, search and rescue, disaster response, and fisheries protection.

The acceptance of necessity brings India's formal requirement for C295 aircraft to 71.

M. Matheswaran, a retired Indian Air Force air marshal and head of the India-based think tank The Peninsula Foundation, told Defense News that there's a potential for export opportunities.

"Joining hands with established majors like Airbus is not only [advantageous for] the domestic market, but [also helps it] become part of the global supply chain. Exports are extremely vital for that," Matheswaran said, predicting Tata could produce 300-400 C295 aircraft.

Pakistan Unveils Aircraft & Rocket Programs, Parades Military Tech

BY USMAN ANSARI

A Pakistan Air Force fighter jet flies during a military parade in Islamabad, Pakistan, on March 23, 2024. (AP)

ISLAMABAD — Pakistan's military showed off its wares and unveiled several defense program during the March 23 Pakistan Day Parade in the capital.

The country displayed new equipment including the Haider platform, the first locally produced, Chinese-designed VT-4 main battle tank. The tank in the parade itself was from the pilot production batch unveiled March 6 by state-owned armored fighting vehicles manufacturer Heavy Industries Taxila.

Pakistan received 300 VT-4 tanks from China under a 2017 deal that involved local production. The system's design originates from the Al-Khalid/VT-1A that is already in service and produced by Heavy Industries Taxila.

The long-range HQ-9/P surface-to-air missile system also made an appearance for the first time. And the military brought its Fatah 2 guided multiple-launch rocket system and its medium-range Ababeel ballistic missile that carries multiple independently targetable reentry vehicles.

The Chinese-supplied HQ-9/P entered service in 2021, with the parade announcer confirming it had a range of 125 kilometers (78 miles). That falls short of the 250-kilometer-range HQ-9 variants in Chinese service.

Pakistan has also announced new programs, including the PFX effort to replace the JF-17 combat aircraft. It's 450-kilometer-range Fatah 3 is set to soon enter service, with the 700-kilometer-range Fatah 4 under development.

Justin Bronk, an aerospace expert at the Royal United Services Institute think tank in London, said the HQ-9 offers "shorter effective ranges, but with superior sensor performance compared to the S-300PMU-2 family of Russian [surface-to-air missiles] that they were broadly derived from."

The weapon relies "on a family of missiles to cover various ranges," he told Defense News, noting that "the HQ-9/P range — compared to longer-range variants — relates less to the system itself and more to which of the larger interceptor missile versions China was willing to export to Pakistan."

Still, the military's media branch, Inter Services Public Relations Pakistan, has previously stated the HQ-9/P significantly enhances Pakistan's air defense architecture and is fully integrated via a digitized system.

Mansoor Ahmed, an expert on Pakistan's nonconventional weapons programs and delivery systems, said the Ababeel missile's presence was likely in response to India's March 11 test of its Agni-V missile and ballistic missile defense capabilities. The Agni-V is also equipped with a multiple independently targetable reentry vehicle.

The Ababeel missile was last tested in 2023, but its service entry was not announced.

Ahmed, who is now an academic at the Australian National University, told Defense News that Pakistan felt compelled "to demonstrate that it had the credibility and resolve to deter crisis and first-strike instabilities in South Asia."

He anticipates tests of India's K-5 and K-6 MIRV-equipped, submarine-launched ballistic missiles "will spur further development of the Ababeel as a series of canisterized and longer-range versions that could carry heavier payloads for possible deployment on submarines in the future, for achieving greater survivability and operational flexibility that covers all possible targets in India."

He noted this year there seems to be more nuclear-capable missiles on display, and Ababeel and its future developments have "become central to maintain a credible and dynamic full-spectrum deterrent."

Future fighter

Pakistan's PFX Program announcement came as a surprise, given existing plans to acquire the Chinese J-31 jet and the country's involvement in the Turkish Kaan figther aircraft program. A previous fifth-generation program, dubbed Project Azm, seems to have been quietly shelved.

Design work is underway for the PFX Program, but little other detail is known.

However, Trevor Taylor, who leads the RUSI think tank's Defence, Industries and Society Programme, said Pakistan's decision is in line with other programs in India and richer Indo-Pacific states.

Indeed, the costs "would be high, and judging from the experience of others, the development time would be extensive," Taylor told Defense News. He added there's a likelihood Pakistan will import key subsystems such as engines, radars and other avionics for the PFX Program.

Analyst and former Pakistan Air Force pilot Kaiser Tufail agreed. "How the cost of such a platform would be kept within affordable limits would be a challenge and would depend on the export potential of the PFX," he told Defense News.

Importantly, the extent of help from China "would be a key factor," Taylor noted, and "a basic issue that would have to be addressed would be reconciling an ability to carry weapons with low radar observability."

Cooperation appears certain, with Turkey as one option, according to aerospace expert Doug Barrie at the London-based International Institute for Strategic Studies think tank. Alongside the PFX Program, he cited Pakistan's February announcement to team up with Turkey to develop a beyond-visual-range air-to-air missile.

However, he said, "given the very close defense aerospace ties between Pakistan and China, I wouldn't discount that either."

As for its features, Pakistan would likely want the PFX aircraft to "have stealth capability, which should also entail conformal weapons carriage and enough internal fuel," Tufail said.

"A powerful [active electronically scanned array] radar and [beyond-visual-range] missiles that can outrange the Meteor of the Rafale should also be prime requisites," he added. "Seamless sensor fusion, alongside comprehensive [electronic counter-countermeasures] capability, would be equally important."

Fatah family

Pakistan's announcement of the Fatah 3 and Fatah 4 weapons indicates the government continues to develop systems to "both enable greater precision firepower from deep within the country against Indian front-line targets, and similar reach into valuable Indian rear-area bases and systems from Pakistani border areas," according to Frank O'Donnell, a nonresident fellow with the Stimson Center think tank's South Asia Program.

By focusing on the offensive capabilities of multiple launch rocket systems and drones, Pakistan is able to free up its Air Force from strike missions to higher-level air-to-air combat roles, O'Donnell said, citing the parade commentator who stated the Fatah 2 "can evade any enemy air defense system."

This "underlines how Pakistan is continuing to implement lessons from the Russia-Ukraine and Azerbaijan-Armenia wars," he added. Both of those conflicts have featured the heavy use of combat drones.

And notably, he said, "sophisticated Russian air and missile defense systems — such as the Russian S-400, which India is deploying against Pakistan — are still vulnerable to asymmetric missile barrages and drone strikes."

It Looks Like Pakistan Bought A Chinese Spy Ship. What Does It Do?

BY USMAN ANSARI

ISLAMABAD — It appears Pakistan's Navy has acquired a Chinese-built spy ship, according to open-source intelligence analyst Damien Symon, who reviewed commercially available satellite imagery.

The intelligence gathering platform, dubbed Rizwan, is described as an "offshore supply ship" by online shipping monitor MarineTraffic. Pakistan reportedly acquired the vessel from China last year with no fanfare, and the ship was spotted during a stopover in Jakarta, Indonesia, in June 2023, while sailing home.

It is a compact vessel some 87.2 meters long, with two large radar domes on the stern, which along with other sensors point to an intelligence gathering role.

Neither the Pakistan Navy nor the Ministry of Defence Production, which handles military acquisitions, would discuss the ship's role and capabilities when asked by Defense News.

However, a source with knowledge of Rizwan's operations, speaking on the condition of anonymity given the sensitivity of the topic, confirmed to Defense News it is an "information gathering ship." The source declined to provide further details.

Collin Koh, a senior fellow at the Singapore-based Institute of Defence and Strategic Studies think tank, said Rizwan appears to be an affordable and flexible design.

He told Defense News that the ship is based on the hull of an offshore support vessel, which makes "economical sense," and that "aside from the huge radome that should serve as the electronic intelligence array, the platform might be able to accept varying mission modules if necessary."

The ship looks to be dimensionally comparable to Norway's intelligence gathering vessels Eger and Marjata, Sweden's Artemis, or Germany's Oste class, he added.

But Koh doubts Rizwan "has the onboard power capacity for telemetry missile tracking, like those found on the Chinese Yuan Wang series." Instead, he explained, Rizwan is likely focused on gathering electronic and signals intelligence thanks to "onboard signals processing and analysis capabilities."

He also said Rizwan's modular configuration could support mission-specific equipment for hydrographic and oceanographic activities such as undersea gliders that can be launched from the stern deck.

Pakistan probably bought Rizwan in response to recent Indian acquisitions, as the two nations are archrivals, Koh added. And due to the relatively small size of Pakistan's Navy, a dedicated electronic and signals intelligence platform will reduce the intelligence gathering burden on the service's aircraft, ships and submarines, he

explained.

These platforms would have mainly used electronic sensory measures to capture electromagnetic emissions, but "would have little or no capacity at all to process and analyze the signals," he said. As a dedicated platform, Rizwan could therefore better monitor Indian naval activity "while freeing up the fleet combat assets for their primary duties."

Rizwan's acquisition should be seen in the broader context of Sino-Pakistani relations — specifically Beijing's support for Pakistan's military modernization efforts and attempts to keep India occupied in the Indian Ocean rather than beyond that area, said Pakistan analyst Mansoor Ahmed, an academic at Australian National University.

Alongside indigenous development as well as acquisition and production programs with the Dutch and Turkish governments, Chinese help is instrumental in advancing elements of Pakistan's naval modernization plan. Such support is seen in Pakistan's Hangor II submarines, long-range unmanned combat drones and anti-ship missiles.

"These and other projects will help plug gaps in fleet air defense, battle management, [electronic warfare], and [intelligence, surveillance and reconnaissance] for a potent [anti-access/area denial] capability through three surface task groups operating in the Arabian Sea," Ahmed said.

They will also transform Pakistan's Navy into a "regional maritime force and will significantly reduce the overall asymmetry with the Indian Navy," Ahmed added. It will also help keep India's Navy "effectively engaged in ways that it will not be able to spare a large part of its assets for deployment beyond the [Indian Ocean region]."

Ukrainian Officials See Ground Robots As 'Game Changer' In War

BY ELISABETH GOSSELIN-MALO

(Brave1 photo, via LinkedIn)

Ukrainian officials are scrambling to field new unmanned ground vehicles in their defense against Russian forces.

MILAN — Ukrainian officials are receiving an increasing amount of applications from robotics vendors who want their systems tested for utility in combat, a sign that unmanned ground capabilities are growing in importance amid the relative stalemate along the front line with Russia.

Officials at Brave1, a government defense-technology hub tasked with getting new capabilities field-ready, announced that more than 50 ground robotic systems and more 140 unmanned ground vehicles have been submitted for evaluation.

"Hundreds of them will be procured through United24 to strengthen the Ukrainian army on the battlefield in a few months – UGVs will become the next game changer in this war, [like] drones already have," a March 12 Brave1 statement circulated on the organization's social media channels said. United24 is Ukrainian government-run platform for collecting donations for the embattled country.

In the last year, an increasing number of these types of platforms have emerged on the battlefield, being used and tested for a widening array of missions. Ukrainian social media channels recently published footage reportedly showing a UGV capable of laying six anti-tank mines at a time.

In pictures posted online by Brave1, a variety of small-scale tracked and wheeled ground robots are seen on the move, armed with guns, evacuating injured dummies and equipped with what appears to be mine-detection equipment.

A trend emerging in Ukrainian unmanned robots is that the majority are rather small and lighter than many others offered on the international market.

"Using high-tech solutions ahead of the enemy in terms of efficiency, innovation and price gives Ukraine an advantage on the battlefield – such hardware and software products are asymmetric responses capable of changing the configuration in a confrontation with the overwhelming resources of the enemy," Nataliia Kushnerska, project lead at Brave1 told Defense News in an email statement.

"Ukraine has become a global defense tech hub, and the growth of this sector will play a critical role in Ukrainian defense policy for decades to come," she added.

A substantial number of munitions and explosives used by Russian and Ukrainian troops remain unexploded, posing a threat to soldiers and civilians. According to some estimates, approximately 174,000 square kilometers of Ukraine was estimated to be contaminated with landmines as of April 2023.

Part of the push to accelerate the development of UGVs has been the desire to send robots for the dangerous job of removing live munitions left on the battlefield.

DefenseNews

US Army Experiments With Human-machine Warfare

BY JEN JUDSON

FORT IRWIN, Calif. — Looking like a toy helicopter, a small black drone rose up over a cluster of adobe buildings in a quiet desert village, emitting a faint buzz.

The drone, an Anduril Industries' Ghost-X, paused and then rose higher, disappearing into the clouds. Another followed.

Seemingly small and unthreatening, the drones were serving as the eyes of an infantry company concealed by the surrounding mountains and readying to reclaim a village held by the enemy.

And those drones were not alone.

All at once, an overwhelming group of air- and ground-based machine fighters burst onto the scene. An "octocopter" lumbered through the sky with precision munitions and other robots attached to its belly, dropping three 60mm mortar rounds on a roof and other small, hand-held, cylindrical "throwbots" on the ground.

Robotic combat vehicles rolled into view, armed with .50-caliber and M240 machine guns, firing on enemy positions and providing cover for troops maneuvering into the village.

Meanwhile, a four-legged dog robot stepped out from a thick cloud of smoke, giving the soldiers monitoring from afar another view.

The scene was the culmination of a U.S. Army effort to understand how it can use humans and machines together on the battlefield. Service leaders descended on Fort Irwin, California — home to the National Training Center — in March for a large exercise known as Project Convergence.

The demonstration was a glimpse of the Army's future, according to top officials. Gen. James Rainey, who leads Army Futures Command, expects the service's future force to be so integrated with machines that humans will face a much lower risk.

"We will never again trade blood for first contact," he frequently says, promising to deploy robots instead.

(Staff Sgt. LaShic Patterson/U.S. Army)

U.S. Army Staff Sgt. Stetson Manuel assembles the Ghost-X drone during the human-machine integration experiment for Project Convergence in Fort Irwin, Calif., on March 11, 2024.

But getting these formations right won't be easy, leaders acknowledge. For human-machine integration to work, a functional and user-friendly network must underpin it, it requires protection from cyberattacks, and the systems must have the right amount of autonomy.

Leaders also say it's not technology that will prove the most difficult factor, but rather breaking from antiquated acquisition processes that prevent rapid purchases and slow down deliveries to soldiers.

"The pace of the threat and the pace of technology — the evolution is much faster, and there's no way that we're going to succeed if we continue to acquire technology or even choose to develop" it at the usual pace, Joseph Welch, the Army's C5ISR Center director, said at the March event.

Forward progress

The Project Convergence exercise followed months of effort focused on integrating humans and machines into service formations. It was a chance to see what works and what doesn't as the Army prepares for a fight against adversaries with advanced capabilities.

The service insists it's now ready to move forward with human-machine integrated formations.

The fiscal 2025 budget request marks the first time the Army has included funding for these formations, also called H-MIF. It's seeking $33 million for the first step, which provides an initial human-machine integration capability to infantry and armor formations. The Army was experimenting with both at Project Convergence.

The service wants machines in these new formations to "offload risk" and provide soldiers with "additional information for decision making,"

according to the service's budget documents.

The Army's Rapid Capabilities and Critical Technologies Office is spearheading the effort for Futures Command. The office is creating prototypes using existing air and ground robotic programs and payloads while incorporating common architecture, communications and network capabilities.

The FY25 funding, the Army has said, will fund the movement of concepts through prototyping as well as enable soldiers to evaluate them in exercises and experiments.

At the Project Convergence event, the Army flooded the battlefield with robots, sensors and other machines meant to help soldiers in complex flights. The experiment included air and ground robots with reconfigurable payloads, tethered drones, counter-drone systems, and a ventriloquist decoy emitter that emulates radio frequency traffic to confuse the enemy.

The service used more than 240 pieces of technology, including capabilities from allied militaries in the U.K., Canada, Australia, France and Japan.

The pressure to transform

The decision to rely more on robots isn't a choice, according to Alexander Miller, who is now serving as chief technology officer to Army Chief of Staff Gen. Randy George.

George and Miller both watched the experiment in March; Miller carried a cellphone with an app demonstrating the Army's new Tactical Assault Kit. The app superimposes the location of soldiers and robots as well as enemy positions in real time.

The service knows it has to do this, or "we will fall radically behind," Miller said of human-machine integration. "There are bad people who are willing to use robotics, and if we don't figure it out we will be behind the curve, we will put men and women in harm's way."

Integrating robots into formations is also accelerating because "there has been a cultural shift," Miller said. "It's been 12-18 months where we have stopped treating robots as a one-for-one augmentation for soldiers and started saying: 'What are the dull, dirty, dangerous, disruptive things that robots can really do that are not just combat power? How do we augment them without taking a single rifleman off or multiple riflemen off the line to control a robot?' "

At the March experiment, for instance, the Army sent a ground robot with a mine-clearing line charge to deploy along enemy lines. As it fights the Russian invasion, the Ukrainian military is using these to disarm enemy minefields and trenches, but transporting them in crewed vehicles.

At the experiment, the robot shot the line charge out of a small launcher. The line didn't explode as intended.

Army leaders said glitches are common and making this work would provide a much safer way for soldiers to clear mine fields.

Also enabling new models for human-machine integration is the progress of commercial technology, according to Welch. "That has accelerated tremendously across many different technical domains," he said.

Artificial intelligence is getting smarter; sensors are getting smaller, lighter and more versatile; connectivity solutions are more abundant; and air-, ground- and space-based capabilities are easier to use.

Obstacles ahead

Army leaders acknowledge there is plenty of work ahead to integrate robots and soldiers on the battlefield. The experiment itself illustrated "just how complicated it's going to be ... where we really proliferate lower-cost, cheaper options and we clutter the environment intentionally," Miller said.

At one point during Project Convergence, the Army jammed itself, causing a friendly drone swarm to fall out of the sky. The service fixed the problem by turning on a capability allowing smart routing management for its Wi-Fi, Miller said.

Beyond technical challenges, George said, the Army must convince Congress to alter the procurement process so the service can acquire or adapt capabilities within broader funding lines. The goal, he explained, is to be more responsive to what is working for soldiers and to be able to rapidly buy small amounts of that equipment.

He said he's working with Congress "so that we can move money a little bit."

"We want and need the oversight, [but] it's a matter of how we go back to them and tell them, 'Here's what we're going to buy inside that funding line, and here's how we're doing it,' and get feedback," George added.

Indeed, one focus is on marking sure the Army can change systems without needing reprogramming authorization or new funding.

The technical and operational ways the Army is going to employ human-machine integrated formations today "doesn't mean that's how we're going to employ it two years from now," said Mark Kitz, the service's program executive officer for command, control, communications-tactical.

"We don't historically treat robotics as a software program. It's really a software program," Kitz explained. "So how do we use some of our unique acquisition authorities then to build that flexibility upfront?"

Miller said another potential obstacle is ensuring sufficient U.S. production of components.

"We have to have components that are approved and valid and we aren't scared to employ because they were made by an adversary," he said. Welch noted the Army is working with U.S. government labs to address some of the component concerns.

The service is also working internally to revamp its approach to finding capabilities.

"There's a much tighter coupling ... not only externally with our industry partners and other key stakeholders, whether it be over on [Capitol] Hill or up in [the Office of the Secretary of Defense], but also internally," said Lt. Gen. John Morrison, the Army's deputy chief of staff in charge of command, control, communications, cyber operations and networks. "We've got requirements with acquisition, with testers, and they're all centered around soldiers, getting that direct feedback."

Benjamin Jensen, a senior fellow at the Center for Strategic and International Studies think tank where he focuses on wargaming, said he's "optimistic" about human-machine integration but that it may take longer than the service expects.

"Most people overestimate the speed at which you can develop new concepts of employment around even proven engineering," he said. "It often takes years outside of a major war to build entirely new formations and structures."

DefenseNews

To Reinvent Itself, The US Air Force Must Go Big On Small Drones

BY MAXIMILIAN K. BREMER AND KELLY A. GRIECO

(Photo by Paula Bronstein/Getty Images)

A Ukrainian drone operator lands his drone after a surveillance flight on July 16, 2023, near Bakhmut in the Donetsk region of Ukraine.

"The changing character of war is coming upon us," said Gen. David W. Allvin, the Chief of Staff of the US Air Force, warning, "The theater of war is going to require us to fight different. This will be part of the reinvention of our Air Force and airpower into the future."

That reinvention should include thinking smaller and embracing small drones. Other services employ airpower in support of land and sea operations, but it is only the Air Force that is charged with gaining air control as its primary focus. If the service is to accomplish this mission, it will need to operate in the air littoral — the airspace from the Earth's surface to about 15,000 feet, below the level where high-end fighters and bombers typically operate. Airpower has always had innate strengths — unmatched in its maneuverability, speed, and range. But it has also always faced limitations: air forces, unlike armies, cannot live in their primary domain, and the aircraft they fly are expensive, limiting the size of the fleet even for the wealthiest of nations. As a result, the occupation of the airspace could occur for a time, but it was ultimately ephemeral. Once friendly aircraft left the airspace, any surviving adversary aircraft could return to access and exploit it.

Today, continuing technological advancement and falling costs have opened new possibilities for occupying the air domain. Air forces can now operate large numbers of small, relatively cheap drones in the air littoral. A single system cannot persist indefinitely in this airspace, but large numbers of them can achieve persistence indirectly, by continually rotating in and out of the air littoral. To date, however, the Air Force has focused mainly on countering the small drone threat to its air bases, both at home and overseas. But this approach misses the broader point: the air littoral is becoming increasingly central to air warfare, and if the Air Force fails to prepare for this future, other services may fill the gap, but they lack what General Henry H. "Hap" Arnold called "airmindedness" — the specialist expertise and distinct perspective of airmen — to employ it to maximum effect.

Take the contest to control the air littoral in East Asia: China recognizes that air superiority is essential to a successful amphibious invasion. Saturating the air littoral over landing beaches and nearby waters with continuous waves of small sensing, decoy, and weaponized drones would deny China control of the air littoral and create numerous hard-to-solve and time-consuming dilemmas for the People's Liberation Army. Drones cycled fast enough into the airspace could overwhelm China's targeting process and in turn inflict significant losses on its invasion forces. Chinese commanders would have to decide how much "clearance" is needed in the air, and for how long, and risk depleting their anti-air missiles in the process. It would also put them on the losing end of the cost curve, as destroying enough of these cheap drones will only grow harder and costlier still as rotational persistence continues to increase in the air littoral.

As Gen. Allvin warns, the U.S. Air Force is not currently structured or equipped to make the air littoral a combat domain, but it should move quickly to close this gap. Both the Ukrainian and Russian military have established specialized drone units, with the Ukrainians even recently unveiling plans to create a separate drone service. Yet the entire Joint Force — including the United States Air Force — is still operating without small-drone units. The US Air Force ought to fill this gap and can bring an air-minded perspective to operating in the air littoral.

To start, the U.S. Air Force should create and incorporate low-end, close-in air occupation elements and capability in its restructuring for great power competition. In designing the Air Force for both deterrence and, if deterrence fails, defense against revisionist powers, the service should simultaneously embrace the concept of air denial, despite the historic cult of the offensive, and the small-drone revolution.

With no significant history of either at-scale, small-drone operations or air-denial tactics, the next critical step will be to cultivate innovation and creative new ideas and tactics. This will likely not come from today's legacy pilot force — instead, the Air Force needs a fresh dose of airminded

thinking from "digitally native" airmen, who are intuitively much more capable than senior pilots of understanding the non-linear, and one-to-many interactions of humans and machines. Development of that airmindedness, then, is the critical foundation, and one which should be laid from the ground up. From basic training onward, airmen should be as familiar with small drones as Marines are with their rifles.

Gen. Allvin is fond of quoting Maj. Gen. Hugh J. Knerr, one of the pioneers of American airpower: "Do not get trapped in paradigms of the past," Allvin recently reminded his service. "Whatever it is, we need to understand this is a unique capability, unique opportunity for us to understand how to best employ, deploy, and integrate this into the invention of the Air Force," he added. The US Air Force should take that spirit of invention to the air littoral.

South Korean Military Paves Way For Robotic Vehicles In Its Ranks

BY GORDON ARTHUR

CHRISTCHURCH, New Zealand — As its military looks to tap new technologies to compensate for a dwindling conscript force, South Korea has launched a tender to procure unmanned ground vehicles for the nation's Army and Marines Corps.

A tender published by the Defense Acquisition Program Administration earlier this month lists a budget of 49.63 billion won (U.S. $36.56 million) for multipurpose variants of the ground robots.

The vehicles will be purchased domestically, said the notice, via a competitive tender. After contract signature, production of an unspecified quantity will proceed till December 2026.

The bid marks the first major acquisition program for Seoul's ground troops to procure operational UGVs, Kim Jae Yeop, a senior researcher at the Sungkyun Institute for Global Strategy in Seoul, told Defense News. The vehicles are envisioned to carry out reconnaissance, transportation and lightly armed missions alongside manned ground formations.

According to Kim, there are two leading candidates for the bid: Hyundai Rotem and Hanwha Aerospace. "Both companies are important Korean defense contractors, especially for land systems, and have been proceeding with their own UGV development programs," he said.

Hyundai Rotem confirmed to Defense News that it will participate in the tender, though it declined to specify what platform it will offer.

As for its credentials, a spokesperson noted that the company "was the sole bidder selected for a rapid demonstration acquisition project after initially proposing it to the Korean Army" in November 2020.

(Hanwha Aerospace photo)

The U.S. military evaluated Hanwha Aerospace's Arion-SMET 6x6 unmanned ground vehicle in Hawaii in December 2023.

That $3.6 million project, a precursor to today's procurement effort, involved battery-powered HR-Sherpa-based 6x6 UGVs. "Hyundai Rotem's UGV is the only vehicle that has been in actual operation for more than two years in various terrains in Korea," the company spokesperson said.

Hanwha Aerospace also has been active in the UGV field, and the company can point to overseas experience. For example, the U.S. military chose Hanwha's Arion-SMET 6x6 UGV to participate in a Foreign Comparative Testing program that occurred in Hawaii last December. It was the first Korean UGV ever evaluated for potential adoption by the United States.

The Arion-SMET, its name standing for Small Multipurpose Equipment Transport, weighs 1.8 tons, and its batteries permit a road range of 100km. South Korea's army tested it in 2021, and it was demonstrated to U.S. Forces Korea the following year.

In separate news, the Defense Acquisition Program Administration approved a two-year pilot project, beginning in the third quarter of this year, for a UGV-based air defense system for the Marine Corps. A prototype is to be ready by the second half of 2026.

Armed with a 40mm weapon, the vehicle is meant to automatically detect, track and destroy intruding drones. The new platform is intended to replace existing manned antiaircraft systems, thus streamlining personnel numbers.

Nearby Japan is also adopting UGVs. According to a Rheinmetall press release issued April 8, the German company will supply three Mission Master SP vehicles. Japan is slated to receive these UGVs equipped with cargo, surveillance and remote weapon station payloads in January 2025.

Pre-2024 Elections Insight

Prospects for the US-India Relations

Dr Vandana Bhatia

Dr Vandana Bhatia is a Lecturer at the Sheridan College, Canada

With both the US and India set for national elections this year, there are speculations about the future of their bilateral relationship. Especially, during the Modi-Biden era, there has been a comprehensive multidimensional strengthening of the bilateral relationship, despite minor issues that could have halted the surge. There are several factors that account for the momentum in the US-India relations to persist irrespective of the occupants of the leadership positions.

In the case of India, there are strong projections for the Prime Minister Modi to occupy the office again. In India, the general elections are scheduled to be conducted in several phases between 19 April-1 June, 2024. Due to the enormity of the voter population, India's elections will be held in phases to ensure 970 million voters can cast their votes in a secure environment. In India, Prime Minister Modi is seeking a successive third term. The opposition coalition, INDI alliance, has faced significant turmoil even before it could take off. Rahul Gandhi, the leader of the Congress party attempted the *Bharat jodo yatra,* he is able to gather crowds but failed to project himself as a strong prime minister candidate. On the other hand, the incumbent prime minister with the country-wide infrastructure development, scientific advancements, economic restructuring with social development programs, is most likely assured victory in the elections.

The US is due for presidential elections in November 2024. In the US, it is a lengthy stretched process, over a period of two years, with several rounds of debates and elections, even within the parties themselves, for the selection of the presidential candidate. Towards the 2024 elections, after the Super Tuesday, President Trump has emerged as the Republican candidate, and President Biden is a leading Democrat candidate for the upcoming Presidential elections. Nonetheless, no matter who occupies the office in the US, its relationship with India stands on a solid foundation, and there has been bipartisan support for India.

Former US President Donald Trump, current President Joe Biden and Indian prime minister Narendra Modi

There are several factors, over couple of decades, that catapulted the current momentum for a multidimensional strategic partnership.

Shifting of Nuclear Goal Posts

The upward swing in the US-India relations can be traced to the Clinton administration. Especially, to the Strobe Talbott-Jaswant Singh talkathon, fourteen rounds of talks between 1998-2000, launched in the immediate aftermath of India's nuclear tests and the resultant sanctions. This unprecedented dialogue led to mutual understanding of the geopolitical concerns of India along with the circumstances caused the "shifting of the nuclear goal posts". Prior to the talks, Clinton was adamant on India to 'Cap, rollback and eliminate.' Later, in 1999, during the Kargil War, he came forth in outright support of India against Pakistan. This was in "stark contrast to the 1971 war, when Washington had situated its nuclear submarines in support of Pakistan."

Subsequently, in March 2000, Clinton during his state visit and addressing India's Parliament, affirmed that, "I say this with great respect. Only India can determine its interests." His visit marked the first visit of a US President in 17 years and "institutionalized a high-level, multi-tiered and multi-faceted dialogue with India."

Nuclear Agreement

His successor President Bush confronted with the post 9-11 challenges, recognized the dire urgency to engage India in the global counterterrorism and nonproliferation efforts. Bush coined the term 'Strategic Partnership,' with India, based on reciprocal obligations to deal with the "multitudinous and complex threats of the post 9/11 world." Viewed narrowly, in the Cold War perspective, the strategic partnership was mistaken as an alliance to maintain the Asian geopolitical balance of power, specifically directed against China. On the contrary, the Bush Administration wanted to enlist India's support

at a global level for the shaping of the future world order.

Alongside, the landmark US-India collaborative measures, the High Technology Cooperation Group (HTCG) and the Next Steps in Strategic Partnership (NSSP) overcame the nuclear disjuncture, hitherto plaguing the US-India relationship. This enabled the Bush Administration to uproot the nuclear barriers, and the offer of the civilian nuclear technologies based on reciprocal obligations. This helped US-India overcome decades of nuclear estrangement and launch partnership based on strategic interests. In 2010, Obama supported India's seat in the UNSC as a permanent member recognizing it as 'indispensable' partner for the coming century." Over successive administrations, this created space for the US-India relationship to emerge as "one of equal partners and equal strategic interest." Thus, in the last couple of decades, this change in approach towards India, can be greatly attributed to the change in Washington's approach to restructure its own security framework- from region focused to global level.

Modi Factor

This restructuring aligns with Modi's approach to (re)launch India at the global level to be recognized as a global stakeholder. Towards this, Modi based on his diplomatic craftsmanship with two Democrat and a Republican Presidents, yet three different personas (from Obama to Trump and now, Biden) ignited multi-sectoral comprehensive strategic partnership.

Initially, the Obama Administration seemed to be proceeding cautiously with the so-called Hindu nationalist Modi regime. However, subsequently, in an unprecedented move, recognized India as a "Major Defense Partner." In 2016, Obama and Modi signed the Logistics Exchange Memorandum of Agreement (LEMA), that allowed the militaries of both countries to use each other's facilities for refueling and strategic coordination. Especially for India, it was a significant development, as it enhanced India's maritime prowess and navigation in Indian Ocean, for humanitarian and strategic purposes.

In fact, the successive administration, headed by Trump, a Republican, exhibited 'bromance' with Modi. This was evident in the Howdy Modi event (Sept 2019), at the NRG stadium (Houston), a joint gathering of diverse groups of officials, businesses, along with gathering of 50,000 Indian diaspora. On the one hand, Trump focused on economic gains, removed India from special trade status from the preferential trade, called the Generalized System of Preferences. Yet, on the other hand, there was significant defense cooperation agreements along with the launching of the Tiger Triumph exercises with New Delhi. The Communications Compatibility and Security Agreement (COMCASA) agreement granted India access to the advanced communication technology and real time information sharing between the US and India defense agencies. Similarly, the Basic Exchange and Cooperation Agreement (BECA) enabled geospatial information sharing, critical for India to navigate the maritime domain, marks significant strategic cooperation.

Thus, during 2016-2020, the LEMOA, COMCASA and BECA sealed the foundational core for the US-India strategic defense partnership enabling India to obtain critical advanced technologies to strengthen its defense communications, navigation and targeting capabilities.

Modi-Biden

In 2020, with the onset of the Biden Presidency, there were speculations that the 'bromance' between US-India would be elusive. Nevertheless, the Biden Administration, moving beyond the narrow geopolitical confines, launched multi-sectoral cooperation with India. Probably because Biden, as former US Secretary of State during the Obama Administration, was aware of the necessity to harness India's engagement in Washington's global security framework, beyond the confines of South Asia. This aligned with the India's strategic vision under the Modi regime as well, as evident in intense collaboration in the varied sectors – ranging from defence (joint production of F414 jet engines), critical emerging technology (iCET,) space exploration (NISAR), cyberspace, semiconductor supply chain, AI and quantum technologies, and 5G/6G telecommunications. Modi and Biden, besides their intense bilateral dialogue, have proactively engaged in multiple triangular and multilateral fora, such as the QUAD, I2U2, G20, etc.

'Strategic Convergence' beyond China

Currently, there is a persistent hyper-linkage with the 'counter-China' factor. Regardless to say, India's and the US apprehensions of China's growing presence in the Indian Ocean have contributed to the "strategic convergence" and the urgency "to counter China in the Indo-Pacific Region." This is visible in the revival of the QUAD, and other Indo-Pacific arrangements. Yet, it is not restricted to this factor alone. Modi is focused on establishing India's military prowess as well as strategic positioning. This may deter China from military overtures, yet, India will be ready to successfully thwart such attempts, in case the situation arises.

US is clearly aware that India under Modi's astute leadership, a strong India will handle the China challenge. So, definitely there is a 'strategic convergence' of interests, but, this is not a conditional relationship, nor exclusively setting up India to counter China. As Washington is aware that New Delhi will uphold its strategic autonomy and not take dictates regarding its foreign or domestic issues.

It is crucial to overcome the persistent China 'hangover.' China is a lingering challenge to both India and the US, but to view their relationship in the narrow confines of the China factor is erroneous. Rather the engagement of India should be viewed as an attempt by Washington to restructuring its foreign and security policy at the global level. Especially, in view of the growing focus on the strategic issues related to Indo-Pacific or the entire Indian Ocean region (covering the Middle East) as well as non-military challenges related to climate change, health, quantum computing, space, clean energy, AI and so on.

Due to intense dialogue, since 1998, both official and informal (including policy community, Indian diaspora etc.) there is a greater multi-level, multi-dimensional sense of security partnership established between the two countries. This is the reason that regardless of the occupants of the political office, this symbiotic relationship will strengthen. There is possibility that at times, some issue(s) may emerge to create concerns regarding the internal or external issues related to India. For instance, US representatives expressed concerns on the alleged attacks on the Sikh activist Gurpatwant Singh Pannu, and the recent arrest of the Delhi Chief Minister, Arvind Kejriwal. There may be several reasons for the concerns being raised by Washington. India has handled these charges effectively.

However, besides political relations, multiple channels of communication and dialogue have been established that there may be some wavering but it will be difficult to derail the momentum. Moreover, the US recognizes India's strategic autonomy and has on several occasions has recognized India's exceptional stand on certain issues. For example, in 2014, the Obama Administration had categorically warned countries to prohibit trade with Iran. Yet, US realized India's reliance on oil import from Iran was crucial for the latter's energy security and simply advised to adhere to global obligations as well.

Thus, to conclude, India-US is a dynamic multidimensional strategic partnership, in several vital areas of defence, space, climate change, critical technologies. Regardless of the incumbents' post 2024 elections, the US-India relations will forge ahead. As President Biden enthusiastically acknowledged that the US-India relationship, "is among the most consequential in the world, that is stronger, closer, and more dynamic than any time in history."

Surveillance & Electro-optics India 2024

The Centre for Joint Warfare Studies (CENJOWS and Indian Military Review, organized Surveillance & Electro Optics India 2024 seminar and exhibition on 22 March 2024 at the Manekshaw Centre, New Delhi. The seminar offered a platform for the industry to interact with the armed forces to understand their Surveillance & Electro Optics requirements, business prospects, trends and latest developments.

Lt Gen DS Rana, DG
Defenece Intelligence Agency

Air Mshl Surat Singh,
DG Ops Air, Air HQ

Dr BK Das, DG Electronics &
Communications DRDO

Session 1: Inaugural Session

Maj Gen (Dr) Ashok Kumar, Director General CENJOWS, said that the deliverables are not fully visible in the Services as far as Surveillance & Electro Optics are concerned. Much more needs to be done. He further enumerated that the Surveillance & Electro Optics systems consist of one of the four components essential for warfighting and these are:

- Sensors -They are the eyes and ears that sense the situation in the air, land, and sea domain.
- Data and communication links through which sensor outputs are transmitted to the systems where it will be stored, analyzed, and acted upon.
- Command and Control Centre/ Data Fusion Centre, where the data will be processed and decisions are taken to respond.
- Shooter - is the final component which will react to the emerging situation.

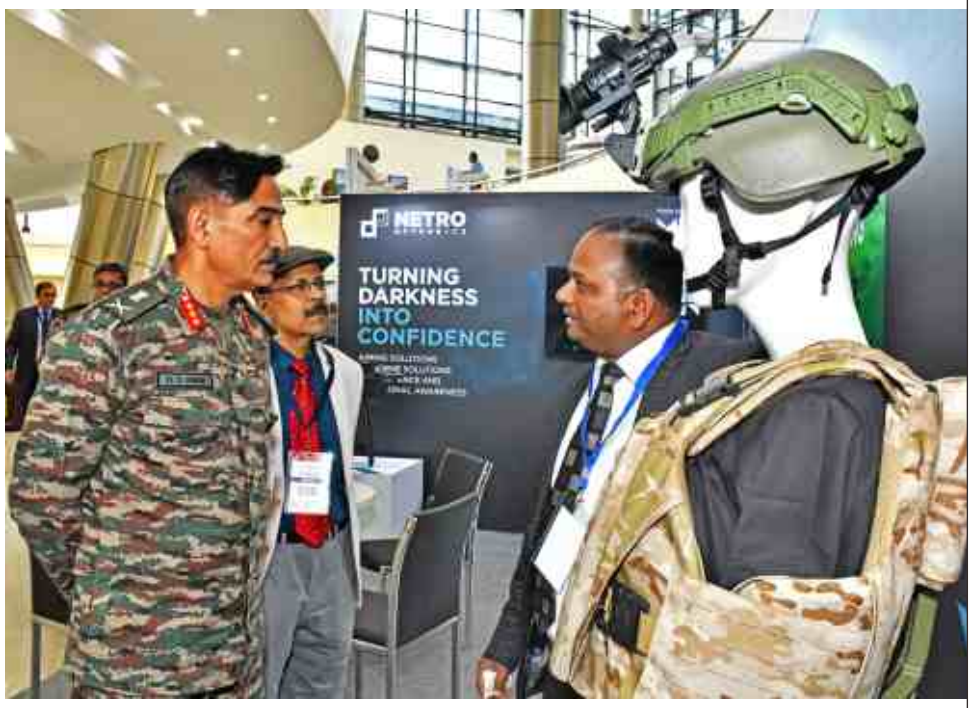
Col KV Kuber, Director Defence & Aerospace, Ernst & Young, Dr BK Das, DG Electronics & Communications, DRDO, Maj Gen (Dr) Ashok Kumar, DG CENJOWS, Tejaswi Singh, Manager Ernst & Young, Lt Gen DS Rana, DG Defence Intelligence Agency, and Air Mshl Surat Singh, DG Air Ops, Air HQ releasing the Knowledge Paper on Surveillance & Electro-optic Devices

The sensor is the most critical element of the loop, so surveillance using electro-optical sensors is the most important part of the chain. We need to investigate the spectrum and bandwidth the systems need to work upon efficiently. The systems must have the capacity to connect and work together with the three services, and the compatibility with the existing systems will improve their capabilities.

Lt Gen DS Rana, Director General Defence Intelligence Agency delivered the inaugural address stating that, electro-optical sensors harvest the capabilities of optics and electronics to analyze high-resolution visual images in real time. The current conflicts in Ukraine, the Red Sea situation, the South China Sea, the nuclear ambitions of Iran and firings by North Korea are driving the world into an unstable situation. In our neighbourhood, Pakistan is facing an economic crisis, and China, too, is increasing its footprints not only on land but at sea. The need for high-grade sensors onboard drones and space-based assets is proliferating. The role of commercial intelligence data by Maxar has helped Ukraine analyze the movement of Russian troops and counter the threat in time before the attack began. Ukraine has access to NATO-based intelligence, and Russia and Ukraine are continuously attacking the targets in depth using PNT. China has increased its space-based capabilities with EO imaging revisit of about fifteen minutes, two hours in SAR, near-

continuous coverage of ELINT in the Indian region. It has ISR capabilities in geosynchronous orbit for round-the-clock coverage in the Pacific and Indian Oceans. China is developing a ground-based system in Pakistan that will enhance BeiDou accuracy to 15cm based on PNT to enhance its regional precision strike capabilities. The unmanned drones can conduct ISRs and are equipped with high-definition IR and SAR sensors. Pakistan is building up its capabilities for coverage of its land borders along Iran, India and Afghanistan using high-definition EO sensors fitted drones. HAPS are solar-powered drones that fly above 20 km for persistent capabilities for many months with a resolution of 15cm. Ground-based sensors can sense the movement of troops using acoustic sensors, and China has operationalized an EO grid along the Line of Actual Control for all weather coverage. The maritime role relies on various sensors, such as long-range patrol aircraft and acoustic sensors fitted on undersea autonomous vehicles. All these developments in the sensors onboard space, air and sea-based platforms have resulted in a paradigm shift in how intelligence is gathered. There is no shortage of data, and the use of data analytics and machine learning algorithms using AI will only help in analyzing the spatial data from a variety of sensors. The use of GIS for the fusion and visualization of spatial data is a growing field many intelligence agencies have adopted. The growth of MASINT (measurement and signature intelligence) is where data from multiple sensors capable of sensing data like electromagnetic, electro-optical, acoustic, and chemical composition are fused. Only the US and Israelis have this technology and our efforts to shore up this technology is the need of the hour. The next challenge is to fuse the data and generate the information using network nodes. These data can be shared in a secure grid to seamlessly counter emerging threats in various domains. He concluded by mentioning that the current global conflicts and geopolitical situations are driving the need for high-grade sensors onboard drones and space-based assets. Both China & Pakistan are developing space-based capabilities, including imaging and coverage in the Indian region. Further, the use of data analytics, machine learning algorithms, and GIS for spatial data fusion and visualization is becoming increasingly important. The growth of MASINT technology, which combines data from multiple sensors, is a priority for many intelligence agencies. The next challenge is to effectively fuse and share data to counter emerging threats.

The Keynote Address was delivered by **Air Marshal Surat Singh, Director General Air Ops, Air HQ.** He defined the emerging warfighting using the sensors in the following roles:



Lt Gen DS Rana, DG Defenece Intelligence Agency visiting the MKU stand

- Superior Battlefield transparency.
- Networking of all sensors.
- Shortening of OODA loop using automated data support loop.
- Swift response using agile weapons.

They are being done at the HQ level to enable the standardized operation of data formats, protocols, and interfaces. The aerospace domain requires the exploitation of space, air and surface-based sensors. The commercialization of space and dual-use technology must be used optimally. In addition, identifying threats in space, air surface and maritime has to be done almost on a real-time basis using private and public assets. The requirements for space-based solutions that the Air Force has met, are, Stratospheric and persistent platforms assets, Low-cost and fast deployable and expendable assets, Interface with the existing networks like the IACCS system. It enhances the space segment and sensors' networking to provide sufficient early warning and intercept opportunities. He concluded by discussing the use of sensors in emerging warfighting strategies. These must be implemented for achieving superior battlefield transparency, shortening the OODA loop, integrating all sensors, through automated data support. The air and space domain requires the optimal use of space, air, and surface-based sensors, commercialization of space and dual-use technology. Real-time threat identification in various domains is crucial and can be achieved using both private and public assets. He concluded that the Air Force has successfully met the requirements for space-based solutions, including stratospheric and persistent platforms, low-cost and fast deployable assets, and interface with existing networks.

A Special Address was delivered by **Dr BK Das, DG Electronics and Communication Systems (ECS), DRDO.** He highlighted that DRDO was working on a comprehensive approach to monitoring warfare trends, both in the outer space and undersea domains. It will be a non-contact war with autonomous weapons with robotics and cyber playing an important role. The next engagement is characterized as zero physical touch, as it will involve use of autonomous weaponry, AI based robots and cyber warfare. Technology wars would require careful re-alignment between country's tech capabilities, weapon manufacturing, and industrial infrastructure to sustain them. Prioritizing development and maintenance of technological edge is crucial to come out of reliance on the other countries. DRDO is deliberating various options for services, to include SAR and LIDAR technology, advanced radar technologies, and the concept of a "Digital Soldier as a System." The Services will utilize AI-based electro-optic soldier, autonomous decision-making abilities, robotics capabilities, and its ability to network. Cognitive Warfare is using advanced technologies to disrupt or manipulate adversary's cognitive processes, while first-person drones will be resistant to EI & RF

Interference. He further spoke about how Quantum computing will be used for surveillance in multi-domain battlefields which will facilitate object detection and identification through data gathering, fusion, and analysis. In conclusion, he re-iterated that the DRDO is working towards a comprehensive approach to monitoring warfare, incorporating technologies like artificial intelligence, space warfare capabilities, nanotechnology, big data, and additive manufacturing.

Col K V Kuber, Director Defence & Aerospace, Ernst & Young gave the industry perspective. He said that interoperability was the key for a functional surveillance system with impunity. Indian industries must collaborate with global vendors to get competitive. To reduce Indian dependence on foreign countries, we have to pep up our industrial base and ecosystem. Investment in the indigenous industry is essential to reduce India's reliance on resources of the other countries. Strategic partnerships are the key. AI will be applied in almost all domains for crucial inputs on data. Sensors in all domains will be used to boost situational awareness and manage information overload. He concluded by re-iterating that data is crucial for intuitive design and industry must develop advance technology in sensors globally. We must ensure that India should be fully prepared indigenously for potential confrontations and early use of weapon systems based on sensors in all domains.

A view of the exhibition area

Session 2: Terrestrial Surveillance

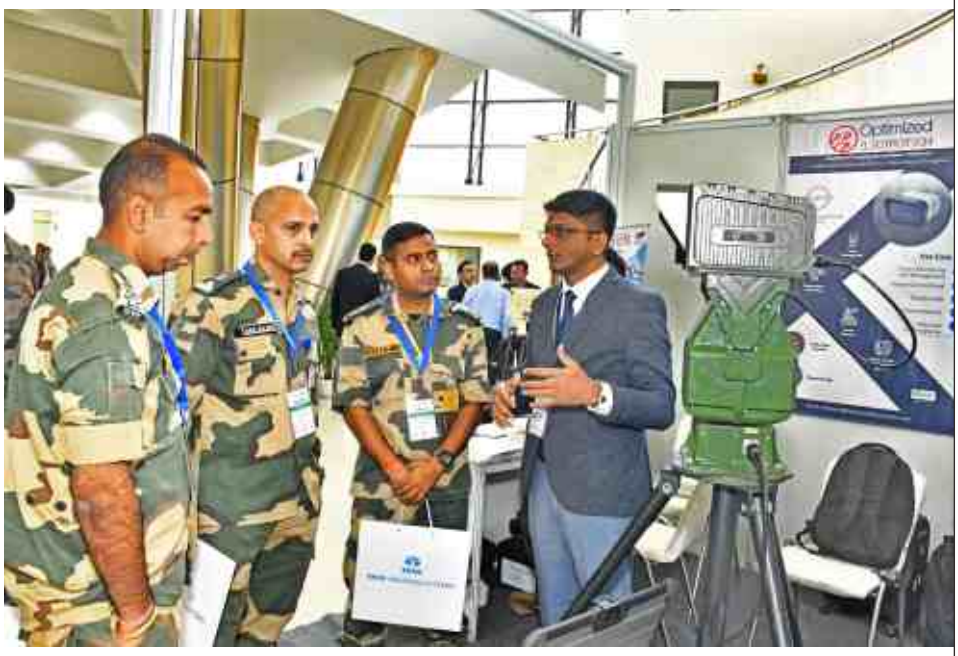
The session was chaired by **Brig Anurag Asthana, Brig Ops, Artillery Directorate, Army HQ.** He introduced the session by drawing inferences from present global scenarios and how countries are striving for military development. He referred to the 7 October 2023 attack launched by Hamas on Israel as an example of growing conventional and asymmetric warfare equipped with lethal weapons. Touching on the session theme 'Terrestrial Surveillance', he reiterated the significance of multi-sensors and how the Indian Army was continuously working to upgrade surveillance facilities. He said that future battlefields would be driven by miniaturized Unmanned Autonomous Systems (UAS) and Artificial Intelligence (AI), highlighting how AI was being used for reading huge data and had opened "new vistas." He flagged the requirement of surveillance through deployment of sensors that would allow sufficient time to process data. Passive surveillance would remain beneficial than active surveillance and that the surveillance grid needs to have full proof communication systems.

Panellists of Session 2, from left, Col Sameer Babu, Colonel (C&R), Army AD Directorate, Vinod Yadav, Tata Advanced Systems Ltd, Vaibhav Gupta, MKU Ltd, Sandeep Shah, Optimized Electrotech, Brig Anurag Asthana, Brig Ops, Artillery Directorate, Ram Biron, SCD, BSF, Israel, Ramakrishna Siddam, Optica, Abhinav Gupta, SES, and Madhukar, IG (Ops).

Shri Madhukar DIG (Ops) Force HQ BSF covered the challenges being faced by the Border Security Force in managing the borders at night. His presentation showcased an overview of the responsibilities of the BSF, present facilities related to surveillance and future challenges that requires to be addressed. Stressing on the dynamic terrain and climate of the Indian subcontinent, the speaker elucidated on the peace time and wartime responsibilities undertaken by the BSF for each of the geographical commands. The Western Sector revolves around the increased use of UAVs, tunnelling across international borders, low visibility during winters, poorly lit areas and non- effectiveness of Surveillance equipment during winters. Similarly, the challenges in the Eastern Sector are specific to altitude and temperature. The BSF has incubated several responses that include Hot Interception Team, Naka cum Ambush, Foot patrolling, Anti-drone operations and even Boat Naka. He further highlighted several projects undertaken by the BSF and comprise of 'Comprehensive

Integrated Border Management Systems' (CIBMS), 'Electronic Surveillance of vulnerable patches' (ESVP) and OCTS project. In the concluding remarks he reiterated continued collaborative measures between BSF with DRDO, IITs and agencies like NTRO for technical solutions with integrated security system at borders. Additionally, the introduction of smart fences will be a game changer with high tech surveillance devices such as sensors, ground-based radar systems, etc, to provide a holistic surveillance mechanism.

Col Sameer Babu, Colonel (C&R), Army AD Directorate, Army HQ, spoke on the Latest Developments in Tackling Threats and C&R for Air Defence, emphasized that Army AD was the largest user of radars amongst the three Services. He touched upon the threats emanating from various altitudes and speeds which call for a dynamic surveillance system in addition to the existing ones. He also highlighted the evolving air threat and the growing impact of air power with the need for an effective air defence capability for land operations. Advancements in radar technology was flagged. Development of passive radar technology will remain a game changer since it is highly cost-effective and compliments existing radar systems. Multiple Inputs, Multiple Output (MIMO) radar technology that has evolved from communications systems provides an edge by simultaneously radiating uncorrelated signals, improving coverage and signal quality. He also flagged the use of 'Digital Beam' technology that can be deployed to achieve higher angular resolution and wide coverage without mechanical moving parts. The usage of 'Active Electronically Steered Array Radar' and 'Radar Digital Signal Processing' were also discussed.



Visiting officers from BSF being briefed by Sandeep Shah, at the Optimized Electrotech stand.

The session also saw participation by several industry players and start-ups who making strides in surveillance and electro-optics equipment.

Panellists of Session 3, from left, Wg Cdr Aruna Singh, DIPAC, Defence Space Agency, Maj Gen Ravi Arora, Chief Editor Indian Military Review, Gp Capt Pradeep Arora, Air HQ, Maj Gen Ashok Kumar, DG CENJOWS, Air Vice Mshl Rajiva Ranjan, ACAS Ops (Space), Air Cmde Hrushikesh J Page, Air Cmde Int (Ops), Air HQ, and Col Jasbir Sing Mann, Army Aviation Directorate.

Vaibhav Gupta, Director, MKU Ltd, spoke on Electro-Optics: Shaping Modern Warfare & Defense Strategies – Learnings, Lessons & Implication In 2024. He spoke on how electro-optics was shaping warfare and defence strategies by drawing lessons from contemporary conflicts, which revealed larger and recurring requirement of equipment and night vision devices, enhanced role of sensor-based technologies, and the need for efficient solutions which deliver "first salvo effectiveness." This meant there was a need to be self sufficient in manufacturing and core technologies. He then presented MKU's Smart Soldier Solutions (Netro Soldier Optronics and Kavro Soldier Protection) and Smart Platform Solutions (Netro Platform Optronics and Kavro Platform Protection).He also gave details of MKU's facilities and reach of its products and clients around the world.

Ram Biron, Director of Marketing, SCD, Israel, spoke on Advanced integrated applications utilizing high definition format IR detectors. He gave details about SCD's credentials, facilities, core technologies in infrared detectors and video engines. He explained SCD's share of cooled 2nd-gen scanning and staring FPAs, InGaAs FPAs detectors and modules in the defence market. He covered key global trends in IR sensors which were driving SCD's road map. His presentation included SCD's cooled detectors and video engines (MW/LW), new-gen SWIR solutions, combined HD MWIR and 3rd-gen ALPD SWIR, and next-gen DAS for armoured fighting vehicles.

Sandeep Shah, Managing Director, Optimized Electrotech, spoke on Assisted &

Automated Surveillance. He gave details about the company and progress, patents, certifications, and clients. He cited challenges in surveillance - border conflicts, undemarcated borders, infiltration, and specific geopolitical and geographical challenges in India. He gave details about Optimized Electrotech products – NoctVision, InfiVision, ClearVision, and OmniVision. He also gave details and benefits of Autonomous AI based multi-spectral surveillance platforms.

Abhinav Gupta, Managing Director, SES, spoke on Rechargeable Li-Ion Batteries for Military Devices. He gave an overview of his company, products, present challenges in battery use, indigenous solutions, capabilities and in-house facilities. SES has worked for Indian and Israeli armed forces. SES solutions included smart chips and intelligent programming, intelligent electronics, advanced machining, novel materials and innovations.

Vinod Yadav, Head-Technical (Optronics & Computing Platforms), Tata Advanced Systems Ltd spoke on Products and Solutions in Electro-optics. He gave details about Tata Advanced Systems' business verticals, product portfolio (Weapons, Sensors, C4I systems), and particularly the portfolio in electro-optics (cooled TI systems, uncooled TI systems, II-tube based NVDs). He gave details about short-range observation systems, long range observation systems (Rajak ULR), modular long range surveillance platforms, weapons sights, crew vision systems. He also spelt out TASL's future technology focus areas.

Ramkrishna Siddam, General Manager, Optica spoke on Complete Solutions for Next-Generation Electro-Optical Systems. He overview of his company, capabilities, certifications, products, core expertise, testing facilities, and optics & electro-optical systems including Schlieren Systems, optics for TMT, Aerosol LIDAR, Cloud LIDAR, MIR LIDAR, FTIR System, Adoptive Optics BDOC System, Light Weight High Power Laser Mirror, IR panoramic camera and ongoing projects including Surya Tilak project for Ram Mandir at Ayodhya.

Session 3: Aerial In Space-based Surveillance

The session was chaired by **AVM Rajiva Ranjan, ACAS Ops (Space), Air HQ.** He said that military intelligence was the key to war. Space and air are the ultimate frontiers. In 1991, Space ISR became prominent. Aerial and SAR systems are very vital assets for military in multi-domain operations. Aerial SAR, integrated on aircraft, offers various advantage of fast deployment and flexibility, enabling real-time monitoring and target identification in various terrain and all domains. These systems provide crucial intelligence for mission planning, threat assessment, and battlefield situational awareness. On the other hand, SAR satellites provide persistent surveillance capabilities to monitor vast areas continuously for global coverage. They offer high-resolution capabilities that detect and track moving targets and assess changes in the environment. Both aerial and space-based SAR systems were integral components of military reconnaissance in providing invaluable support for operations, intelligence and decision-making processes in all domain.

Col Jasbir Mann, Col Aviation-10, Army Aviation Directorate spoke on UAV sensor payloads for persistent surveillance, and emphazied on the technologies for future warfare which could include three main types of technologies - Foundational, Strategic and Tactical. Examples included Artificial Intelligence, space technology and cyberwarfare. There is also a list of other advanced technologies like nanotechnology and robotics. He mentioning the need of all-weather aircraft and surveillance systems with capability of contemporary payload with high resolution.

Wg Cdr Aruna Singh, DIPAC, Def Space Agency spoke on Space-based ISR for early warning. Space Surveillance along with Military operations rely heavily on surveillance and reconnaissance, to perform strategic and tactical imaging over areas of interest with persistent surveillance. Geosynchronous satellites offer wider surveillance over wide areas particularly denied by other surveillance devices. The speaker highlighted the significance of gathering intelligence to effectively plan and carry out military operations, making well- informed decisions. She discussed the importance of adjusting military forces in response to shifts in an adversary's order of battle (ORBAT) and making necessary revisions to future actions. Regarding EW satellites, she mentioned that they are designed to specifically detect ballistic missile launches. It was later incorporated into missile defence systems and regulatory control systems for nuclear tests as these satellites have the capability to detect a missile launch right from the start of its trajectory. They utilize infrared sensors to detect missile engines based on the intense heat emitted by their flames. They possess a distinct advantage over radar in their ability to scan a significantly larger area. As on date, three nations-USA, Russia, and China possess constellations of these early warning satellites. Lastly, she emphasized the advantages of the Space-Based Infrared System (SBIRS). This system consists of a network of satellites in geosynchronous Earth orbit and payloads in highly elliptical orbit, all managed by ground processing and control systems. These systems are held by three countries only so far.

Air Cmde Hrushikesh J Page, Air Cmde Int (Ops), Air HQ spoke on Latest developments and requirements for Tactical Recce (EO, SAR, IR Search). Having a deep understanding of tactical reconnaissance is crucial for successful military operations. It allows for thorough analysis of the ever-changing dynamics of the battlefield, accurate identification and prioritization of targets, efficient management

Panelists of Session 4, from left, Cdr K Varun, Cdr (AW), ACNS (Air), Cmde Ashish Bhargava, Cmde Air Warfare & Flight Safety, Naval HQ, Maj Gen (Dr) Ashok Kumar, DG CENJOWS, and Comdt Banshidhar Singh, Jt Dir Communications, Indian Coast Guard.

of information dissemination, and effective communication. It is of utmost importance in dangerous environments such as nuclear, biological, and chemical. The equipment needs to possess a high level of agility, resilience, efficiency, and seamless integration with systems. Utilizing cutting-edge technology, such as face and text recognition, is crucial for precise identification. Security and compatibility are of utmost importance. Having equipment such as ELINT, SAR, and IR is crucial.

Dr Manvendra Singh, Scientist G, IRDE, DRDO spoke on Intelligence Gathering with EO Sensors for Today's Missions.

Session 4: Maritime Surveillance, Research & Development

The session was chaired by **Cmde Ashish Bhargava, Cmde Air Warfare & Flight Safety, Naval HQ.** He emphasized the importance of maritime surveillance in the Indian context owing to the long coastline. He said that maritime surveillance was an amalgamation of a lot of platforms with sensors with the inherent challenge of transporting the data due to absence of terrestrial network.

Comdt Banshidhar Singh, Joint Dir Communications, Indian Coast Guard spoke on Surveillance against Aerial, Surface and Underwater Threats. He highlighted the importance of surveillance in the maritime domain for ensuring an appropriate response to any developing situation relating to maritime safety and security. He defined the objectives of maritime surveillance to holistically understand, anticipate and administer all events and actions related to the maritime domain that could impact the maritime security. He said that it includes and relies on maritime law enforcement, maritime pollution and marine environment control, disaster response, search and rescue, anti-poaching, anti- smuggling, anti-human trafficking and safeguarding countries' trade and economic interests. So, the prime objective is to detect any suspicious or anomalous target that could subvert the national interest in the maritime zones. He acknowledged the need to upgrade capabilities by keeping in tune with the advancements in technologies and put forth some recommendations for the ICG which include adaptation of existing magnetron-based radars to solid-state radars, daylight CCD thermal imager with laser illumination, electro-optic system to HD thermal camera, CCD with short wave infrared technology to see through haze, fog, glass, and better ranges, and inclusion of satellite AIS for better coverage.

Cdr K Varun, Cdr AW, Naval HQ spoke on Integrating Assets for Maritime Surveillance. He talked about complexity of maritime surveillance of the IOR because of the amount of maritime traffic that transits this region which is further exacerbated by the thousands of fishing boats and the requirement of keeping an eye on the three domains of surface, sub-surface and air by the Indian Navy. He also mentioned the government's stance on India being the 'First Responder & Preferred Security Partner' and the role being played by the Indian Navy currently in the Gulf of Aden. He spotlighted the importance of Maritime Domain Awareness (MDA) and its centrality to the information, decision and action cycle. He mentioned the various fixed & rotary wing and manned & unmanned platforms and the surveillance sensors in service with IN for building the MDA. He also covered the various surface and sub- surface platforms, sensors and weapons utilized by the IN towards the task. He threw some light on how all this data from the IN's sensors and from other agencies including space is aggregated, correlated and disseminated by the Information Management and Analysis Centre (IMAC).

Maj Gen (Dr) Ashok Kumar, Director General CENJOWS gave the closing remarks, alluding to the rise of India as a leading economic power and the need for the defence forces to rise to the challenges towards which the three services are willing to state their needs in an open and upfront manner and there is much visible collaboration between the forces and the industry. He said that the defence forces are ready to hand-hold those who are willing to be partners in the growth of the defence forces and the nation.

Maj Gen Ravi Arora, Chief Editor, Indian Military Review, ended the seminar with a vote of thanks to the speakers, subject matter experts, sponsors, exhibitors, all attendees and CENJOWS for the success of the event.

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Battle Honours and Raising Day Anniversaries

Best wishes from IMR for anniversaries in May 2024

1 May
50 Armoured Regiment
52 Armoured Regiment
HQ 611 (I) AD Brigade
HQ 627 (I) Mech AD Brigade
HQ 715 (I) AD Brigade
HQ 769 (I) AD Brigade
48 AD Regiment
49 AD Regiment
50 Light AD Regt Composite
56 Light AD Missile Regiment
514 AD Regiment (SP)
666 Recce & Obsn Sqn
12 Maratha Light Infantry
15 Sikh Light Infantry

5 May
410 (I) Field Company
6 Mechanised Infantry
(1 Garhwal Rifles)
8 Mech Infantry (7 Punjab)

7 May
402 Light AD Regiment
Composite

8 May
4 Mahar
5/11 Gorkha Rifles

10 May
25 Recce & Obsn Flight
Dogra Scouts

11 May
871 Engineer Works Section

13 May
4/8 Gorkha Rifles (Tawngdaw)

14 May
28 AD Regiment
15 Field Regiment

15 May
2 Field Regiment (SP)
25 Punjab
15 Jat

16 May
45 Cavalry
27 Punjab

17 May
11 J & K Light Infantry

18 May
3 J & K Light Infantry
3 Garhwal Rifles (Tithwal Day)

20 May
881 Engineer Works Section
11 Corps HMB Det Engineers

22 May
16 Dogra
5/5 Gorkha Rifles (Regtl Day)
1/5 Gorkha Rifles

27 May
10 Mechanised Infantry
(20 Maratha Light Infantry)

30 May
7 Mech Infantry (1 Dogra)
4 Jammu & Kashmir Rifles




Indian Air Force

Squadron	Motto	Motto Translation	Raised on	First Type	Current Type
101 Squadron Falcons	Anwishyavedhi	Search and Destroy	1 May 1949	Spitfire	MiG-21M
106 SPR Squadron Lynx	Sarva Peshayami		1 May 1957	Canberra	HS-748
126 Helicopter Flight Featherweights			15 May 1986	Mi-26	Mi-26
223 Squadron Tridents	Vijayastra Amoghastra	Weapon for Victory	10 May 1982	MiG-23MF	MiG-29

Calling All Units & Formations for Battle Honour and Raising Day Anniversaries

Units and formations are welcome to send accounts of their Battle Honours and Raising Days two months before the commemorative days are due to IMR for publication.
Please send your material including high resolution images to editor@imrmedia.in

17 May 2024

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