

Newsletter July 2025



ZEN'S GROWING FOOTPRINT IN THE DRONE AND COUNTER-DRONE SPACE

Quick Summary

In this edition of the Newsletter, we present a two-part coverage – **Part 1** focuses on counter-drones, and **Part 2** on drones – highlighting Zen's growing footprint across both domains.

Part 1 (Counter-Drones) recounts Zen's journey from the early development of its fully indigenous Zen Anti-Drone System (Zen ADS or Zen C-UAS) to its battlefield-proven performance in Operation Sindoor. It outlines the system's core detection and kill capabilities, integration of advanced components like the Hawkeye long-range optical platform, and the evolution from soft-kill solutions to hybrid systems such as Vyomkavach. The narrative also covers major hard-kill integrations with L-70 and ZU-23 air defence guns, enabling layered defence against the full spectrum of drone threats.

Part 2 (Drones) turns the lens to Zen's parallel expansion into offensive UAV capabilities. It captures recent strategic acquisitions – Vector Technics, Bhairav Robotics, and TISA Aerospace – strengthening expertise in propulsion systems, autonomous robotics, loitering munitions, and next-generation UAV platforms. These moves position Zen to deliver fully indigenous and globally competitive drone solutions for both domestic and international markets.

In essence this Newsletter underscores Zen's dual-pronged strategy: to equip India's armed forces with world-class counter-drone systems while simultaneously advancing offensive drone capabilities to meet emerging operational needs.

Part 1 (Counter-Drones)

SETTING THE PERSPECTIVE

In a world riddled with wars and conflicts, one fact that is repeatedly validated is the **overarching dominance and centrality of drones and counter-drone technologies** in defining the outcomes of future wars.

Starting from their first-ever documented appearance in January 2018 at Russia's Khmeimim and Tartus air & naval bases, respectively, in the form of deadly swarm attacks, **the effectiveness of drones as potent air threat vehicles has grown phenomenally over time.**

Whether it was to turn the tables for Azerbaijan in the Nagorno-Karabakh conflict or score big in the Russia-Ukraine war, drones have arrived. The latest and **most apt depiction of the drone and counter-drone warfare was seen during the currently 'paused' Operation Sindoor.** India stood tall as its anti-drone shield, wielded by valiant warriors, sounded a death knell for the volleys of drones launched by our adversary.

In this, Zen is proud to have contributed its might in enabling our defence forces to thwart an entire spectrum of drone-based threats. **Our Anti-Drone System proved its worth** in giving a befitting reply to the drone onslaught from the adversary.

This newsletter chronicles Zen's journey in the counter-drone and drone space in India.

EARLY DAYS IN THE COUNTER-DRONE JOURNEY

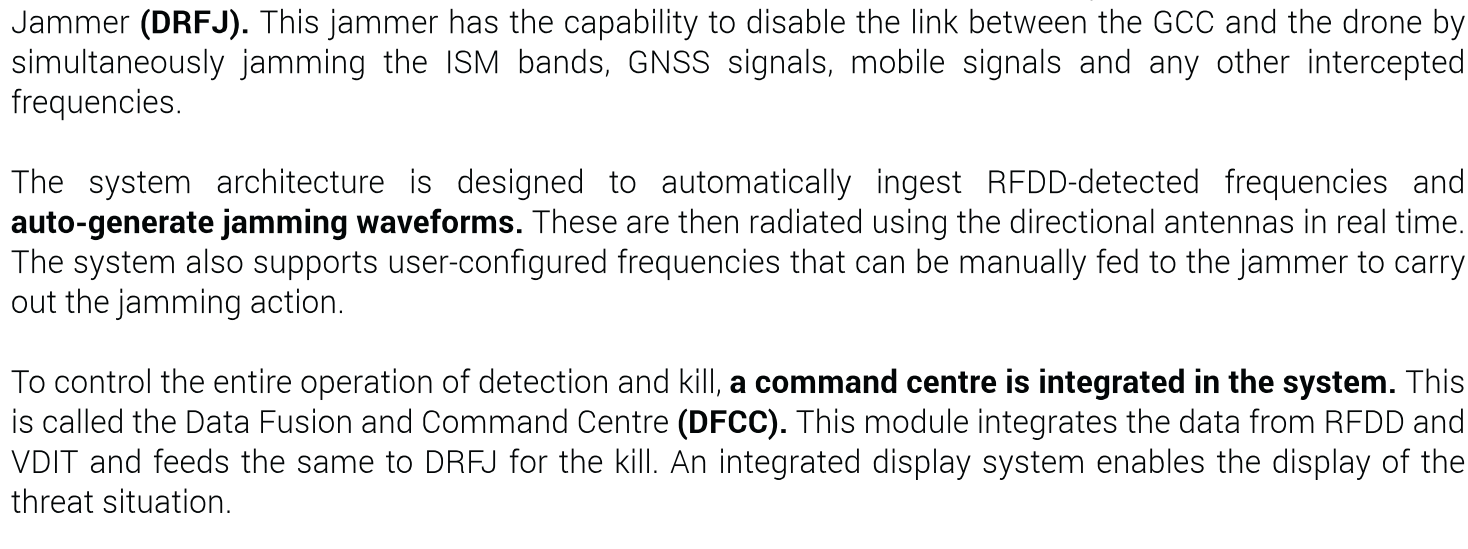
As early as 2018-19, when the Bayraktar and Harop drones of Azerbaijan were claiming disproportionate kills against Armenian forces generally bereft of tailor-made anti-drone weaponry, **we at Zen were seeing the need for an effective counter-drone system** in the wars of the future.

With a mission to address this operational requirement, our R&D teams took a deep dive and designed the Zen ADS over many months of tireless effort; with **100% ownership of the IP.**

The months that followed saw the Zen C-UAS take a concrete shape with all the cutting-edge technologies built therein to take on detection and neutralisation of drones.

INTO THE WORLD OF ZEN C-UAS

Let us take you through some salient features of Zen C-UAS.



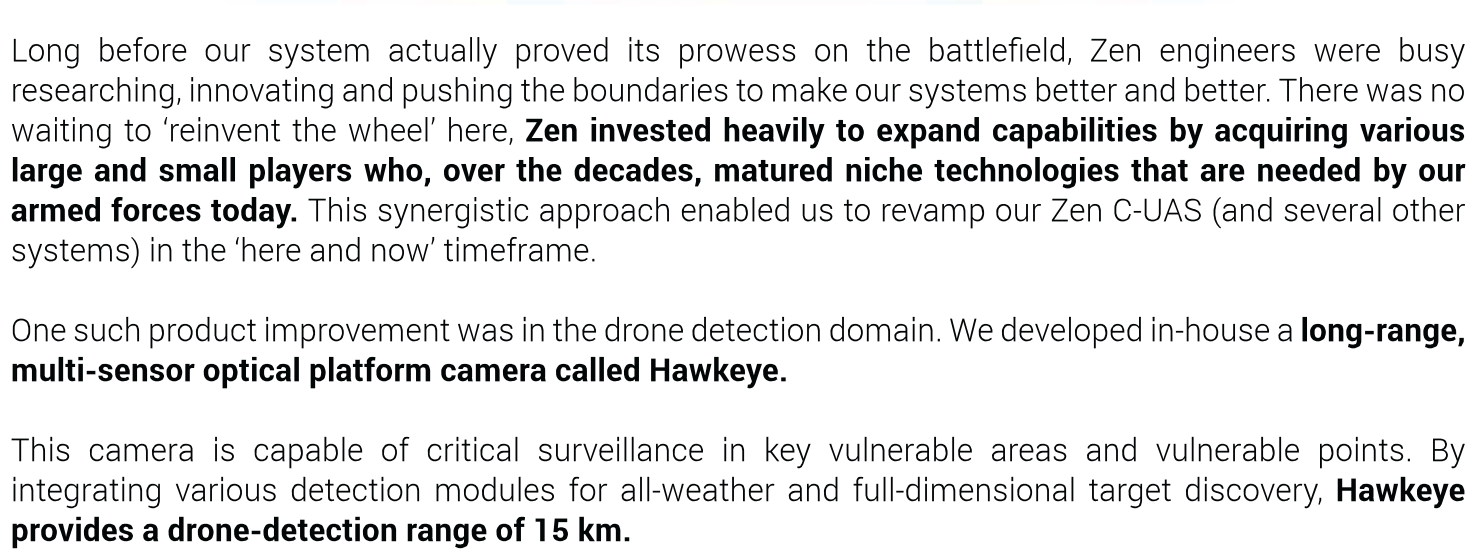
These features relate to the twin verticals of detection and kill. As to detection, since most of the drones use GPS both for navigation as well as operational control, the **RF-based detection** via a Radio Frequency Detection Device (RFDD) was chosen to be the first pillar in the detection arsenal. This was paired with **state-of-the-art electro-optical (EO) system** consisting of a full-HD, high-resolution day camera coupled with a FLIR-based night camera. This duo of cameras was configured as a Video-Based Drone Identification & Tracking System (VDIT).

For drones that are autonomous and do not use the GPS, the detection suite also has **an X-band 2D/3D Radar for precise data of target coordinates both in Azimuth and elevation.**

For the destruction of the drones, soft-kill mode was chosen. For this, our system includes a Drone RF Jammer (DRFJ). This jammer has the capability to disable the link between the GCC and the drone by simultaneously jamming the ISM bands, GNSS signals, mobile signals and any other intercepted frequencies.

The system architecture is designed to automatically ingest RFDD-detected frequencies and **auto-generate jamming waveforms.** These are then radiated using the directional antennas in real time. The system also supports user-configured frequencies that can be manually fed to the jammer to carry out the jamming action.

To control the entire operation of detection and kill, **a command centre is integrated in the system.** This is called the Data Fusion and Command Centre (DFCC). This module integrates the data from RFDD and VDIT and feeds the same to DRFJ for the kill. An integrated display system enables the display of the threat situation.



A screenshot of the Integrated Display System – Zen ADS

We knew early on that the adversary would not simply adhere to the mainstream frequency bands of 2.45 GHz (100 MHz bandwidth) and 5.8 GHz (150 MHz bandwidth) for data and video feeds but would get into non-traditional bands. We therefore designed Zen ADS to cover such bands (details classified). **This wide band detection and kill capability proved to be decisive during Operation Sindoor,** wherein as expected, most of the drone threat vehicles operated beyond the mainstream bands.

What set our system apart in its functioning during Operation Sindoor? Multiple factors, such as dual-band detection with tracking accuracy of up to 2" (RMS), ability to detect more than 100 drones at one time with a response time of less than 0.1 second, wide-band coverage, mobile, rugged configuration capable of withstanding extreme temperature conditions from deserts to high altitudes (-100 to +45°).

CONTINUOUS IMPROVEMENTS - THAT IS ZEN'S PASSION

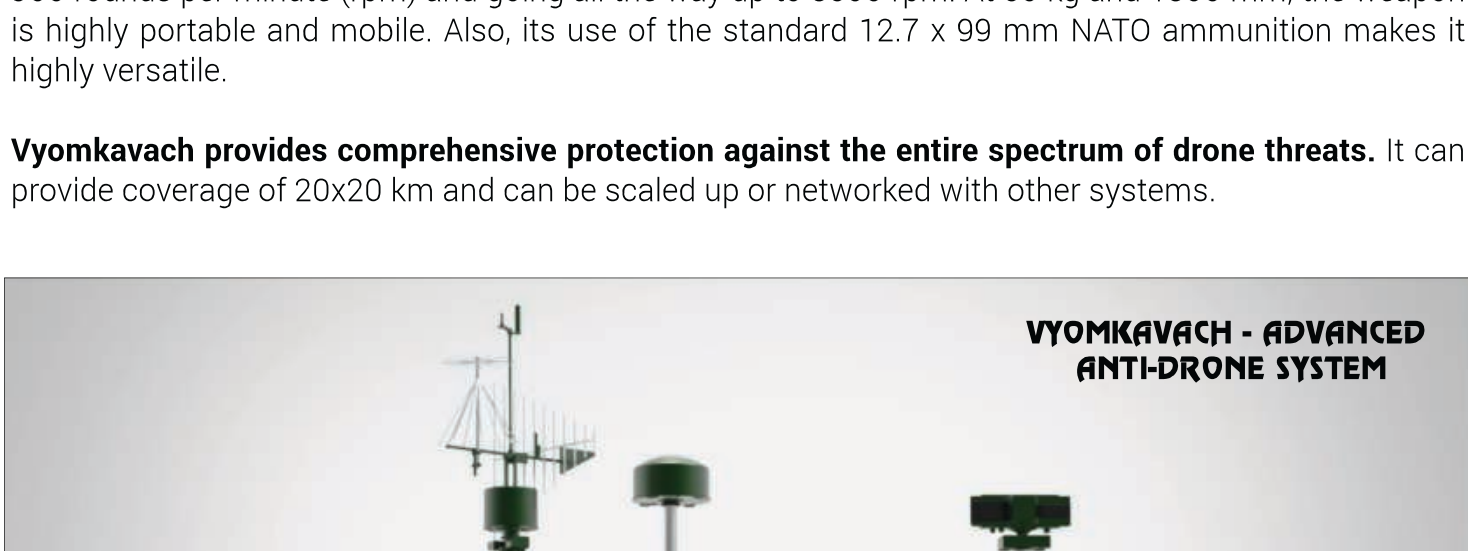
Long before our system actually proved its prowess on the battlefield, Zen engineers were busy researching, innovating and pushing the boundaries to make our systems better and better. There was no waiting to 'reinvent the wheel' here. **Zen invested heavily to expand capabilities by acquiring various large and small players who, over the decades, mastered niche technologies that are needed by our armed forces today.** This synergistic approach enabled us to revamp our Zen C-UAS (and several other systems) in the 'here and now' timeframe.

One such product improvement was in the drone detection domain. We developed in-house a **long-range, multi-sensor optical platform camera called Hawkeye.**

This camera is capable of critical surveillance in key vulnerable areas and vulnerable points. By integrating various detection modules for all-weather and full-dimensional target discovery, **Hawkeye provides a drone-detection range of 15 km.**

This is a huge jump as most of the C-UAS have a surveillance range of around 5-7 km. The **Hawkeye integration with Zen C-UAS produces performance improvement exceeding 100% which is a major jump** in capability. Not only that, but the surveillance outputs of the new camera are also of gold quality, with a positioning accuracy of 0.01" and tracking accuracy of ±0.5 mrad.

This, coupled with the MIL-grade design and IP66 protection, will ensure stable operation in harsh environments. Hawkeye can also be integrated with radar and spectrum-detection equipment to form an automatic UAV defence system, ensuring low-altitude detection in all-weather conditions.



Hawkeye: The Capability Multiplier

ZEN REVAMPS KILL OPTIONS

Driven by our conviction that the drone threat of tomorrow will demand solutions that go far beyond the soft-kill, **we started our efforts to integrate hard-kill solutions into our C-UAS system**

The fruits of our labour were on display at the Aero India 2025: **Zen Vyomkavach.** The special feature about Vyomkavach is its hybrid system that combined the power of soft-kill and the hard-kill.

Powered by AI, Vyomkavach featured cutting-edge technologies in drone detection and neutralisation against all types of drone-based threats. The system is effective not only against small drones, such as Bayraktar and Harop of the Armenia-Azerbaijan fame or the Shaheds and Orlans of the Ukraine war, but also against swarm-drone threats.

In Vyomkavach, the dual-mode surveillance suite combines the best electro-optical and radio-frequency technologies, coupled with the precision of radar-based detection. The soft-kill is provided through the RF jamming system, as in Zen C-UAS explained earlier, while the hard-kill is through the **four-barrel rotary machine gun.**

This 12.7 mm calibre weapon features a rotary four-barrel quad, with a variable rate of fire starting from 900 rounds per minute (rpm) and going all the way up to 3500 rpm. At 50 km and 1300 mm, the weapon is highly portable and mobile. Also, its use of the standard 12.7 x 99 mm NATO ammunition makes it highly versatile.

Vyomkavach provides comprehensive protection against the entire spectrum of drone threats. It can provide coverage of 20x20 km and can be scaled up or networked with other systems.



Vyom Kavach: The AI-Powered C-UAS System

EXPANDING THE KILL DOMAIN TO BIG GUNS

Experience shows that, when it comes to hard-kill of small RCS drones, the most effective solution is to saturate the target zone with a preponderance of accurate and guided fire. This requirement is **ideally addressed by the air defence guns in the arsenal of our Corps of Army Air Defence.**

Air defence guns have a very high rate of fire. For instance, the ZU-23 gun fires **1600 rounds per minute** from its twin barrels, while the Schilka weapon system can spew a whopping **3400 rounds every single minute** from its four barrels.

The L70 gun, though, has a lower rate of fire of only 300 rpm; however, its ammunition is much more warhead-heavy and is **'smart ammunition'.** It is called the Pre-Fragmented Formatted Cubes (PFFC) ammunition. Each round of PFFC warhead fragments into many small pieces, each of which is capable of destroying a small drone. Imagine a volley of PFFC rounds accurately guided at a swarm-drone threat. The kill effect will be lethal.

Zen always realised the great potential of air defence guns in the hard-kill domain. It delivered when the opportunity arose.

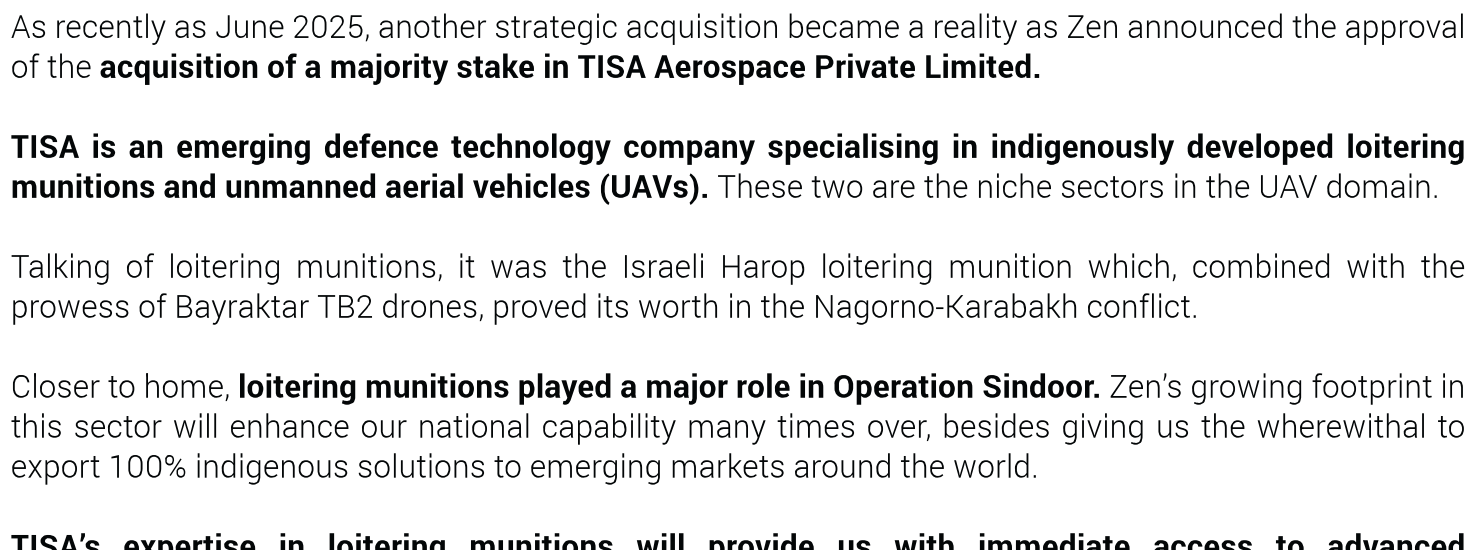
ZEN DELIVERS HARD KILL BASED ON L70 GUN

Towards the end of 2023, Zen was given a project by the Army Air Defence College. The task involved the **integration of the L70 gun as a hard-kill option into the C-UAS weaponry.**

The task was challenging for about 6-8 months in realising the system. By June 2024, the job was done. **The Zen Anti-Drone System with Hard Kill (Zen ADS HK) was born.**

This system was an effective hybrid solution that combined the best of soft and hard-kill. It retained the dual-mode surveillance and detection based on RF and EO, while for the kill it had the option of both RF jamming as well as, the kinetic kill using the L70 PFFC ammunition.

The challenge was to integrate the hard-kill on the ADS route while still retaining the original DNA of the L70 as a radar-controlled weapon in its primary mode, in which it operated with the Flycatcher Weapon Control System (FWCS) or the Air Defence Fire Control radar (ADFCR). Zen delivered.



L70 done, **the next target was to carry out similar integration by using the super-mobile and ageless ZU-23 gun.**

We got the opportunity to attempt this system at the Army Air Defence College towards the close of 2024.

The challenges in ZU-23 are of a different type. At the onset, the fair-weather gun is to be converted into an **all-weather weapon. It then needs to be seamlessly integrated with the Zen ADS for detection and kill.** A further challenge in the future will be to integrate the Target Data Receiver Console (TDRC), receiving inputs from a secondary Tactical Control Radar (TCR).

PART 2 - Drones

ON THE OTHER SIDE OF THE FENCE

While the C-UAS is all-important on one side of the fence, on the other is the challenge **of equipping our armed forces with the best drones as potent vehicles** to prosecute the air threats of tomorrow. With passion and commitment, Zen is moving ahead in this domain as well.

Our approach is guided by the same principles that we adopted in the C-UAS innovations. That is, not to reinvent the wheel, but **to expand capabilities through M&A, by acquiring niche technologies** and capabilities that have taken years – often decades, to mature, and use them here-and-now in our product range.

Here are the salient details.

STRENGTHENING MARKET LEADERSHIP WITH STRATEGIC ACQUISITIONS

It was in **February 2025** when Zen announced strategic investments in two companies – **Vector Technics Private Limited and Bhairav Robotics Private Limited.** These acquisitions reinforce Zen's commitment to innovation, indigenous defence manufacturing and technological advancement. Both companies operate in niche domains within robotics, aerospace and propulsion systems.

This will translate into enhancing our capabilities in **UAV propulsion, autonomous robotics, and aerospace components, driving self-reliance in defence manufacturing.** In a way, it will put us many notches up in producing **next-generation, advanced UAV-related components** and will **position us to compete globally** by catering to international markets with cutting-edge, Indian-made defence solutions.

The CMD summed up the essence of the acquisition by stating, **"These strategic acquisitions mark a significant step in our mission to build a self-reliant and globally competitive defence ecosystem."**

Surely, we are in exciting times as we ride the wave of 'things to come' with confidence and expertise.

ANOTHER STRATEGIC ACQUISITION BECOMES A REALITY

As recently as June 2025, another strategic acquisition became a reality as Zen announced the approval of the **acquisition of a majority stake in TISA Aerospace Private Limited.**

TISA is an emerging defence technology company specialising in indigenously developed loitering munitions and unmanned aerial vehicles (UAVs). These two are the niche sectors in the UAV domain.

Talking of loitering munitions, it was the Israeli Harop loitering munition which, combined with the prowess of Bayraktar TB2 drones, proved its worth in the Nagorno-Karabakh conflict.

Closer to home, **loitering munitions played a major role in Operation Sindoor.** Zen's growing footprint in this sector will enhance our national capability many times over, besides giving us the wherewithal to export 100% indigenous solutions to emerging markets around the world.

TISA's expertise in loitering munitions will provide us with immediate access to advanced technologies and platforms that align with the emerging operational requirements of the Armed Forces.

TISA has also achieved significant R&D milestones, including the successful execution of a project for DRDO with critical design assistance from IIT Madras. By integrating these capabilities with our existing strengths in anti-drone systems and propulsion technologies, **we will be able to build a broader and more future-ready defence portfolio in the UAV space.**

As we prepare to celebrate our 79th Independence Day, Zen's passion to take India forward on the route to self-reliance only grows stronger.

Up Up Zen !

Up Up India !

ZEN IN NEWS

■ Zen Technologies Protects Core IP – A Competing Patent Revoked in Landmark Win

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