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WORLD

Supporting Innovation Through Reformatory Frameworks

Jayesh Ranjan



**In Conversation With Rajesh Alla
Chairman & Managing Director
IIC Technologies**



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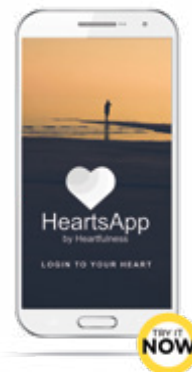
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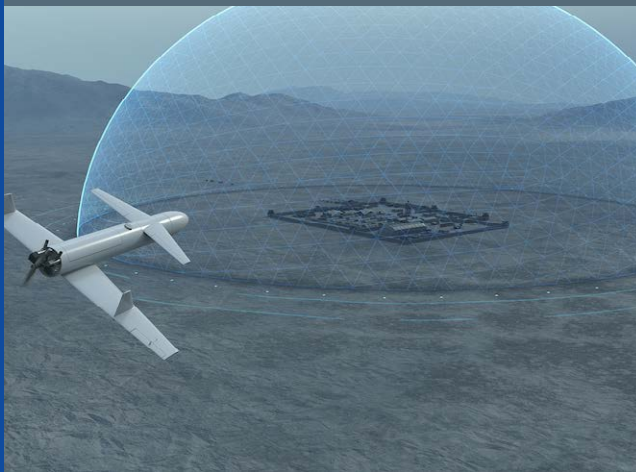
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Hello my dear readers,

High roads... High hopes... High fly into the sky... I`m **H**so high, of course with emotions. Hurrah! What an year it was, the 2021 despite the imperfections that we had to experience. With all my happiness and joy I wish you a very happy and prosperous New Year 2022.

Entering the New Year, as like ever, we brought you fantastic updates concerning our favourite industry which is now witnessing highly efficient and carbon neutral solutions and also happening cargo deliveries. Story this time gives you a detailed information on the Hyperspectral Remote Sensing and their applications in the Defenses. Our conversation with Vikram Thaploo, CEO of Apollo TeleHealth makes you understand how Drones will be an important part of last-mile delivery in the healthcare segment. Another conversation with Rajesh Alla, Chairman and MD of IIC Technologies takes you through a timelapse of IIC's journey towards becoming a prominent player in GIS. Saving it for the last, we brought you a special interview with Jayesh Ranjan, Principle Secretary IT&C of Telangana Government that elaborates on the kind of support Government of Telangana is providing for the startups through their recent policies and frameworks.

While you go through defense and acquisition sections, let me give you a hint on the eye grabbers from the product section; DJI Mavic 3 and Sony Airpeak S1. I believe that UTM pages will definitely keep you informed on the latest happenings in the Drone traffic space.

While we celebrate and anticipate for an amazing year, I can only ask you to be safe and act sensibly as the Covid scare is still around with many countries experiencing another wave of Omicron cases. Until you hear from me next time, you know what to do. Mask up, stay protected and practice hygiene. Good bye and stay blessed!

Thanks

B. Kartikeya
Editor

Percepto launches new drone and advanced AI-powered analytics for its 2022 Autonomous Inspection & Monitoring platform



Percepto, pioneering autonomous inspection with industrial robotics, announced the launch of its upgraded 2022 Autonomous Inspection & Monitoring (AIM) platform and its new Air Mobile drone. Recently listed in TIME magazine’s 100 Best Inventions of 2021, Percepto offers the only end-to-end solution powered by AI to collate and streamline all visual data for accurate actionable insights.

Percepto AIM 2022’s newly launched Insight Manager delivers AI-powered packaged solutions for sector-specific use cases, such as solar, mining, energy, oil & gas and other industries. By drawing upon tens of thousands of hours collected by autonomous robot missions at industrial facilities, Percepto’s AI change detection framework offers unified visual data and critical business insights for each of the sector-specific solutions. AIM 2022 can be integrated with autonomous drones and robots as well as other visual data collectors, now including DJI drones, and fixed cameras. Reports and insights are automatically generated based on the combined visual data. Disseminated to relevant stakeholders on any mobile device, issues and faults are geotagged and displayed on a map, enabling effective action before escalating into more serious problems.

The Drone-in-a-Box (DIB) market leader, Percepto also introduced

its new Percepto Air portfolio to support the enhanced platform, which will address the diverse needs and increasing demands of the market:

Percepto Air Max

- The next generation of Percepto Sparrow, the Percepto Air Max is a field-proven solution that operates in the largest mining, oil & gas, and energy companies on six continents. It has a top-grade, versatile payload for specific use-cases. Designed to inspect and map complex industrial environments where the highest accuracy and durability are critical, Air Max is also the only DIB with an Optical Gas Imaging (OGI) camera.

Percepto Air Mobile

- A new, more compact and lighter-weight model for smaller sites or organizations taking their first steps with a drone-in-box program, or larger sites that need greater deployment flexibility. It is ideal for linear inspections, such as pipelines and power lines, and can monitor short-term projects across multiple sites (e.g. construction).

Percepto Air Max and Air Mobile drones are stored permanently onsite within their respective Percepto Bases - the Air Mobile’s base is light and easy to relocate while maintaining the highest levels of durability. These encasements are designed for infrequent maintenance and protection against extreme environmental phenomena, such as hurricanes. Percepto’s drones are safe and regulation ready, and ensure all operational aspects meet corporate standards.

“Percepto AIM 2022 and the new Percepto Air line of drones, together with the most advanced change detection solution, alert and prevent failures and downtime within diverse use cases across many industries,” said Percepto CEO Dor Abuhasira. “Percepto AIM provides the most advanced and comprehensive enterprise

inspection software that offers a complete data workflow - from capture to insight. With Percepto Air Max and Percepto Air Mobile, companies have a range of options to choose from depending on the size of their facilities and the flexibility needed to deploy drones.”

“The real power of Percepto’s system is how data collection and analytics are integrated for a holistic view from both a technical and management perspective,” said Tim Shanfelt, Director of Operations Transformation, Koch Ag and Energy. “Our workers are connected to high-level information that helps them make the right decisions while keeping them safe and free to pursue higher value activities. Our goal is to eliminate hazardous, wasteful, and mundane tasks from our operators’ day. For example, instead of an employee climbing an icy ladder in the winter, a robot or drone can perform the same task while still obtaining accurate measurements. We see Percepto playing a significant role in helping make our facilities more safe, secure, efficient, and profitable.”

AeroVironment’s New Mantis i45 N multi-sensor imaging payload delivers advanced ISR for night time operations



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AeroVironment, Inc. a global leader in intelligent, multi-domain robotic systems, introduced the Mantis™ i45 N, a multi-sensor night time imaging payload compatible with Puma™ 2 AE, Puma™ 3 AE and Puma™ LE small unmanned aircraft systems (UAS). Lightweight (905 g) and

compact, the new Mantis i45 N joins AeroVironment's expansive Mantis product line of micro-gimbals delivering high-quality video and imagery downlink to UAS operators.

Mantis i45 N is a dual-axis, gyro-stabilized, multi-sensor night time imaging payload designed for maximum visibility during low-light or night time intelligence, surveillance and reconnaissance (ISR) operations. The next-generation imaging system features improved long-wave IR (LWIR) thermal cameras with narrow-angle 32 mm and wide-angle 9.2 mm IR with 7.6x electronic zoom, allowing operators to capture high-resolution video at extended range. Designed for both superior night and low-light performance, the new imaging system also includes an upgraded 5-megapixel monochrome low-light camera sensor and high-powered 860 nm laser illuminator. Through its advanced suite of sensors, the Mantis i45 N payload allows Puma UAS operators to extend aircraft standoff distance for covert operations.

"Today's battlefield is dynamic and UAS operators increasingly rely on multiple payloads to successfully complete their missions," said Charles Dean, AeroVironment vice president for global business development and sales of UAS. "The new Mantis i45 N is a game changer during low-light or nighttime ISR operations, delivering increased situational awareness and advanced threat detection in any environment."

Built on the trusted and battlefield proven Mantis i45, the enhanced night variant Mantis i45 N maintains the same housing form-factor, allowing for a quick and simple change-out of payloads between day and night operations. Plug and play operational, no software updates are required for Puma UAS avionics or ground control stations for legacy system compatibility. Mantis i45 N is also natively compatible with

AeroVironment's Crystals™ next generation ground control solution. To learn more, visit: <https://www.avinc.com/uas/payloads>

Drone Delivery Canada Announces Opening of Commercialization Centre



Drone Delivery Canada Corp is pleased to announce it has opened a new Commercialization Centre to augment its main facility and test range. The Commercialization Centre is on approximately 100 acres west of the Company's main office and will be operational in November. DDC will maintain a permanent facility there with dedicated staff and will scale with Company growth.

The Condor is currently the Company's largest drone with an expected range of 200km (124mi) and a payload capacity of 180kg (396lb) and is fully integrated with the Company's patented and award-winning FLYTE software system.

"With the ongoing successful testing of our Condor delivery drone and as we work towards its commercialization, this location will facilitate engineering testing, pre customer delivery verification, customer demonstrations, customer & employee training, and maintenance of Condor drones, as well as for future drone platform enhancements and modifications for an anticipated diverse range of future applications, potentially to include inspection and data collection services. The new Commercialization Center will bring lasting commercial benefits

across the whole organization," said Michael Zahra, President & CEO of DDC.

Additionally, first test flights of the next generation Sparrow drone are expected to commence in November. It is expected to have a range of 30km and a payload capacity of 4.5kg, along with next generation motor technology, next generation battery technology, touchless cargo drop functionality, an optional public announcement system and an optional aircraft parachute. This new functionality is expected to further unlock potential customer use-cases and facilitate future flights over people to open up new, commercially addressable future markets in urban and residential areas for B2B and also B2C retail residential deliveries.

The current version Sparrow continues to commercially operate successfully at current customer projects and will continue to be available to future customers. As previously announced, the Company will look to complete the Robin XL commercialization as future market demands may indicate. The Company's turnkey logistics solution is marketed in a managed service SaaS business model in Canada and as a licensed managed service internationally.

Ascent AeroSystems and Autonodyne Partner to Deliver Next-Generation UAV Autonomy



Ascent AeroSystems and Autonodyne have collaborated to create the

next generation of comprehensive autonomous drone solutions. Both industry leaders were recently announced as finalists for the AUVSI 2021 XCELLENCE Awards - Ascent AeroSystems for Hardware and Systems Design and Autonomy for Software Design and Coding. The partnership will usher in a new era of autonomous functionality for mission-critical UAVs.

Ascent AeroSystems' Spirit coaxial Unmanned Aerial System (UAS) offers the most versatile and durable system in its class for mission-critical operations. Combined with a fully modular, plug-and-play payload design, the Spirit's open architecture design allows operators to easily add or upgrade software to unlock entirely new operating capabilities without the need to design or develop a new aircraft.

"Sensor and autonomy technologies are evolving very rapidly, so it's critical to build on an aircraft platform that can quickly accommodate new payloads and software. A complex unmanned aerial system is only as strong as its weakest component, and even the best operators can't scale in the real world without a truly dependable, all-weather airframe," said Paul Fermo, VP of Business Development at Ascent AeroSystems. "That is our focus. We deliver aircraft platforms that can fly twice as far, twice as fast, twice as long and carry twice as much in any weather, while partnering with best-in-class domain experts like Autonomy to deliver unmanned systems with unparalleled performance."

Easily added to the Spirit for enhanced autonomous capability, Autonomy's software solution provides unmatched capability that allows the Spirit to perform autonomous tasks either individually, or as a team with multiple vehicles, all from a single operator and control station.

"Autonomy brings next generation autonomy to the small UAS domain," said Steve Jacobson, Chief Executive Officer at Autonomy, "The addition of Autonomy's software package with the Spirit airframe from Ascent AeroSystems unlocks new possibilities for tactical control of one or more vehicles across a wide spectrum of use cases and customers."

H3 Dynamics-Powered Hydrogen Drone, Now Certified in Japan



A hydrogen drone equipped with H3 Dynamics' AEROSTAK hydrogen fuel cell system, developed by Drone Works and with integration support by Nexty Electronics Co. Ltd., received official approval from the Japanese Minister of Economy, Trade and Industry (MITI) on November 28, 2021. The cooperation has led to the first certified hydrogen fuel cell multi-rotor drone test flight in Japan.

The new generation hydrogen drone is equipped with a small composite container for high-pressure hydrogen developed by JFE Container Co. Ltd. The special drone-compatible hydrogen fuel cell system is manufactured by H3 Dynamics, who has begun working with Toyota Group member, Toyota Tsusho Nexty Electronics for technical integration in Japan.

Setting up its offices in Tokyo, H3 Dynamics is a global company with locations in Singapore, Paris, Toulouse and Austin that works on decarbonization of flight from small drones to large aircraft. The Company has recently closed a \$26M series B financing, led by Mirai Creation Fund, managed by SPARX Group and representing the

interests of Toyota Corporation and Sumitomo Banking Corporation (SMBC). The specialist fund specializes in investments relating to intelligent technologies, robotics, and hydrogen technologies.

By using lightweight hydrogen as the energy source of the drone, it is possible to fly for a much longer time than with lithium batteries, In addition. In increasingly large applications, hydrogen offers a stronger environmental solution to support decarbonization, especially as hydrogen can be produced from renewable energy or municipal waste.

Leveraging on hydrogen energy further contributes to solving social issues in line with the government's goal of "realizing carbon neutrality by 2050". The partner companies believe that the success of this demonstration in Japan opens the way towards wider adoption of hydrogen in air mobility applications.

Nexty Electronics will continue to strengthen its collaboration with H3 Dynamics in the Japan market. H3 Dynamics has developed world-leading aerial mobility fuel cell systems for the past 15 years, has launched its first hydrogen powered drones, with several air cargo platforms including fixed-wing, VTOL and hydrogen refueling accessories to support zero emission air mobility around the world. H3 Dynamics was recently chosen by one of the world's largest airport operators Groupe ADP in Paris to form part of the Paris air mobility ecosystem and plans to fly a first hydrogen cargo aircraft in the Paris region in the early part of 2021.

NEOM and Volocopter establish joint venture to create the world's first bespoke public eVTOL mobility system



NEOM, the smart and sustainable regional development in northwest Saudi Arabia and Volocopter, the pioneer of urban air mobility, have established a joint venture (JV) company to design, implement, and operate the world's first bespoke public vertical mobility system in NEOM. Air taxi and vertical logistics services will be fully integrated with the overall multi-modal and zero-emission public transit system in NEOM. The JV will be the sole operator of initial public transit routes across NEOM, while enabling an open eVTOL (electric Vertical Take-Off and Landing) ecosystem for vertical mobility services including logistics, emergency response, and tourism. NEOM has placed a confirmed order of 15 Volocopter aircraft to commence initial flight operations within the next 2-3 years.

Nadhmi Al-Nasr, Chief Executive Officer at NEOM, said: «In designing cities and urban infrastructure for the 21st century, mobility is at the center of the equation. Through this joint venture with Volocopter, we are demonstrating to the world that NEOM is the ideal region to implement urban air mobility rapidly and create a fully integrated vertical mobility ecosystem. NEOM is on a mission to become a global living lab for future mobility, and we are very excited to see what the future holds as we grow.»

The collaboration between NEOM and Volocopter will lead the design and development of a truly three-dimensional public transportation system, advancing the technical, regulatory, and infrastructure solutions for eVTOL operations

across NEOM. The JV will offer vertical mobility services as an integral part of NEOM's multi-modal and zero-emissions public mobility system, providing seamless connectivity for passengers and goods.

Volocopter and NEOM have agreed an initial order of 10 VoloCity passenger and 5 VoloDrone logistics aircraft to support early activation of flight operations. The JV will scale-up its activities from the beginning of 2022 to incubate urban air mobility (UAM) in the region and seed a vertical mobility ecosystem. The partnership delivers on NEOM's mission to be a global living lab for future mobility and a center of excellence for eVTOL innovation and industry.

On this new partnership, Christian Bauer, Chief Commercial Officer at Volocopter, stated: "The partnership with NEOM and the new JV we are creating together is going to be an exciting journey. It is a once in a lifetime opportunity to be an essential part of designing and operating a completely new UAM ecosystem from the ground up without the constraint of legacy infrastructure or regulation, and as pioneers in the industry, Volocopter is honored to be the trusted partner to contribute to NEOM's ambitious vision."

Zero-Emissions Drone Powered by Cube Autopilot



CubePilot and Doosan Mobility Innovation have released new concept artwork for a new zero-emissions UAV (unmanned aerial vehicle) powered by the CubePilot ecosystem. This ecosystem currently features the Cube autopilot range at the core,

with a variety of accessories and carrier boards developed with support from the drone community and industry.

In 2019, Doosan Mobility Innovation successfully developed and commercialized fuel cells for aerial applications such as hydrogen-powered drones. Continuing with the theme of eco-friendly technology, Doosan has now updated its DS30W drone with a Cube Orange flight controller. The drone is powered by DP30M2S, a 100% zero-emission and long-endurance hydrogen fuel cell.

The limited flight time offered by regular batteries is recognised as one of the main challenges in the drone industry. Doosan Mobility Innovation provides an optimal, all-in-one solution that incorporates hydrogen PEMFC (Proton-exchange Membrane Fuel Cell) technology that provides up to 4 times more energy than batteries, enabling 2+ hours of autonomous mission flight.

In a hydrogen fuel cell, hydrogen molecules are separated by a catalyst into protons and electrons, taking a different path to the cathode. The electrons go through an external circuit and generate a flow of electricity. Finally, the protons migrate through the electrolyte to the cathode, where they unite with oxygen and the electrons into water and heat.

As climate change accelerates, renewable energy and sustainability are becoming more important. Since hydrogen-powered drones generate only pure water as an emission, they are 100% eco-friendly. They can also be used for the inspection and operation of renewable energy plants, which will soon lead to the growth of the entire renewable energy industry.

The hydrogen fuel cell-powered drone with the built-in Cube Orange autopilot allows pilots to get more done per flight and also expands sensor compatibility.



Israel Innovation Authority Approves the Establishment of a Consortium Led by Elbit Systems to Develop Human-Robot Interaction Technologies

Israel Innovation Authority has recently approved the establishment of a new innovation consortium, led by Elbit Systems C4I and Cyber, for Human-Robot Interaction (HRI) technologies research and development.

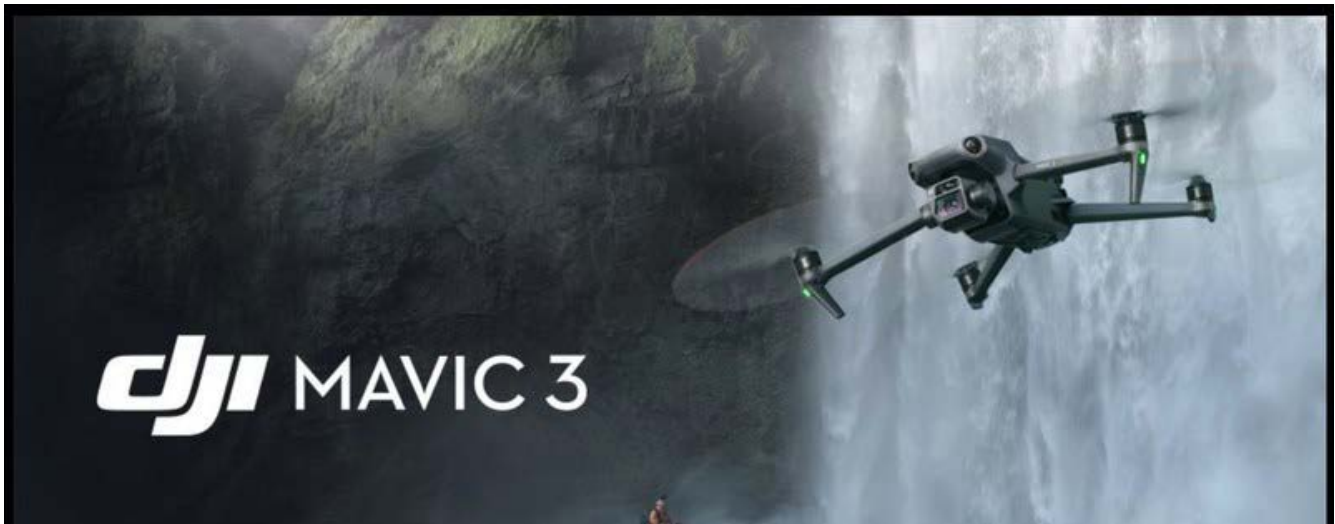
The new consortium includes leading robotics companies and academic researchers in the fields of Artificial Intelligence, computer science and behavioral sciences, with the goal of developing an innovative HRI infrastructure, addressing the need for close interaction between robotic systems and human users natural communications (verbal & gestures) technologies, according to relevant social codes, robotic platforms level of autonomy methodologies, and more.

Today, autonomous robotic platforms (those not continuously controlled by a human operator) operate in a “sterile” human-free environment, such as logistics centers and automated production and assembly lines. Integrating robots in a shared workspace environment with human teams will allow the transfer of routine, dull and burnout-inducing tasks to robots and reduce workloads on human teams, thereby increasing crew productivity and reducing their rotation. Such integration will only be possible when human crews feel confident and able to communicate naturally with robots, operating in their close environment.

Yossi Cohen, Elbit Systems C4I and Cyber Chief Technology

Officer, commented: “Our selection by the Israel Innovation Authority, to lead a Human-Robot Interaction consortium reflects our expertise in the fields of autonomous systems and manned-unmanned teaming. We are looking forward to collaborating with additional industry partners that specialize in these fields, that will join us in the consortium”.

Dr. Aviv Zeevi, VP Technological Infrastructure at the Israel Innovation Authority, commented: “The Israel Innovation Authority is working to close technology gaps in the field of robotics using various tools as well as by promoting knowledge transfer from the defense sector and academia to the wider industry.”



DJI Announces Mavic 3 Drone with Advanced Cine Features

B&H Photo is excited to share the announcement of the highly anticipated DJI Mavic 3. Credited with putting “Imaging above everything,” the Mavic 3 features a dual-camera setup that includes a massive 20MP 4/3” Hasselblad sensor capable of shooting up to 5.1K video, as well as a 12MP tele lens that shoots 4K video and offers up to 4x digital zoom. Those impressive camera stats, combined with an overabundance of flight features and modes, hint that DJI’s newest flagship might just be the greatest prosumer drone ever made.

Key Features

- 3-Axis Gimbal with Dual Cameras
- 20MP 5.1K Wide-Angle 4/3 CMOS Hasselblad
- 12MP Telephoto with 28x Hybrid Zoom
- Up to 46 Minutes of Flight Time
- Up to 9.3-Mile Transmission Range
- 360° Obstacle Avoidance System
- 10-Bit D-Log Color Profile & HNCs

- 1080p60 Live View Video Stream
- 8GB of Storage Space
- RC-N1 OcuSync 2.0 Remote Included

Like its predecessor, the Mavic 2, the new Mavic 3 comes in two different flavors: a base model and a “Cine” version. However, unlike the Mavic 2, which made users choose between two distinct models, the differences between the Mavic 3 variants aren’t near as dramatic—no flight FOMO here. In fact, the only conspicuous distinctions between the two models are that the Cine supports an additional video format, Apple ProRes 422 HQ, and comes with 1TB of internal storage, versus the base model’s 8GB.

Although the Mavic 3 boasts some of the most impressive performance specs we’ve ever seen in a consumer flyer, there’s no question its most eye-catching feature is the camera. Sorry, make that cameras—plural. The Mavic 3 is the first Mavic drone to feature not one, but two cameras. The primary shooter is a 20MP 4/3” Hasselblad

sensor, with an adjustable aperture and the ability to capture video up to 5.1K/50 fps. The secondary camera is a 12MP telephoto that shoots in 4K/30 fps and supports up to 4x digital zoom and 28x “hybrid” zoom.

Now, the fact that the Mavic 3 features two cameras instead of one is a big bombshell. However, what really has us excited is the size of the Mavic 3’s primary sensor. In 2018, when we first tried the Mavic 2 Pro, we were blown away by the footage we captured using its excellent 1” CMOS sensor. The Mavic 3’s 4/3” CMOS is bigger and presumably better—a prospect that has us dying to test it.

Along with the new camera setup, the Mavic 3 also features several software and design enhancements that boost its performance capabilities across the board. Included in those enhancements is the Mavic 3’s omnidirectional sensor array, which allows the Mavic 3 to better see its environment and ensure a collision- and crash-free flight—even in environments with lots of obstacles.



Sony Electronics' Airpeak S1 Professional Drone Now Available to Order

Sony Electronics Inc. announced the availability timing of the company's first-ever professional drone, "Airpeak S1." The introductory model in the new Airpeak line, the S1 is the world's smallest drone that can be equipped with a full-size mirrorless interchangeable-lens Alpha camera, opening up a new world of creative possibilities for cinematographers and other visual storytelling professionals. Pre-sale opens today, December 1, 2021, with an expected customer ship date of December 24, 2021.

Introduced to the public for the first time earlier this year, Airpeak S1 drone is designed for the professional user, and is compatible with a wide range of Sony's camera bodies including the Alpha 1, Alpha 7S series, the Alpha 7R series, the Alpha 9 series, FX3 and others. It leverages proprietary technology and delivers for smooth maneuverability at high speeds with highly stable wind resistance,

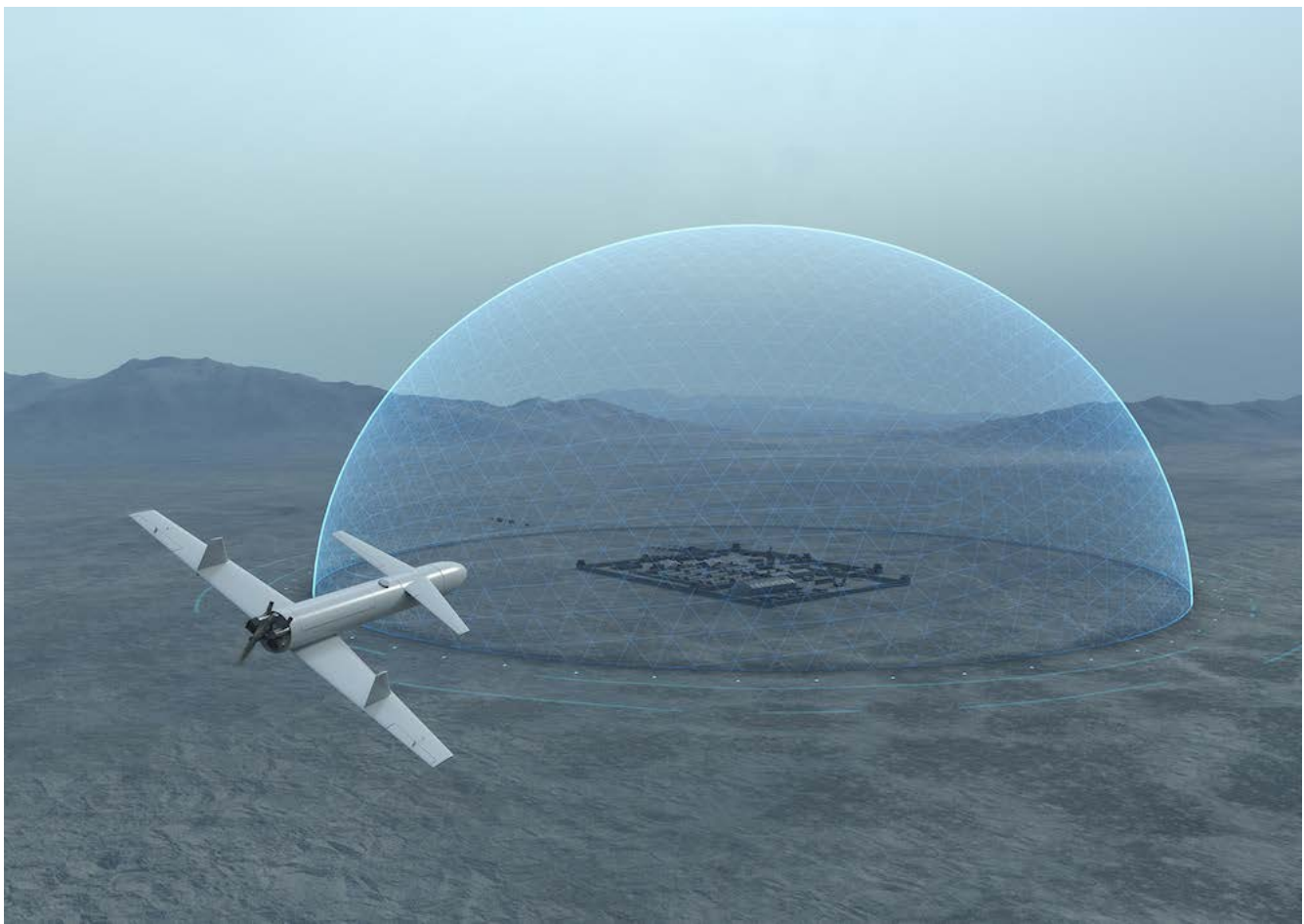
enabling high-quality aerial images and video content.

"We're excited to now make the new Airpeak S1 drone available for purchase, and for the amazing set of possibilities this drone opens for cinematographers," said Yang Cheng, Vice President, Imaging Solutions, Sony Electronics Inc. "The drone's compact size, new software features and advanced imaging, sensing, AI and robotics reflect the high quality the industry respects Sony for, and enables content creators and commercial professionals to capture images and video not possible before."

The drone includes "Airpeak Flight"ii iOS®-based application which integrates and monitors all hardware related to the drone, giving the operator real-time status display and updates on screen. "Airpeak Base"ii web application is also available, allowing the operator to manage the equipment, create advanced flight plans, run the same pattern repeatedly, and

fully manage and troubleshoot flight logs. For multiple operators, Airpeak S1 also includes a dual operation mode so one user can operate the drone as another operates the gimbal and camera, while each can monitor the content being recorded. An optional cloud service, "Airpeak Plus"ii is available by paid subscription and provides additional data storage, advanced geofencing options, and import/export of flight logs.

Airpeak S1 suggested retail price is around \$9,000.00 and will ship with two (2) pairs of propellers, a remote controller, two (2) batteries and a battery charger. A third-party gimbal made specifically for Airpeak S1 will be sold separately. Pricing for Airpeak S1 accessories can be found <https://electronics.sony.com/more/c/airpeak>. The optional "Airpeak Plus" subscription service will retail for around \$300.00 for a 12-month period, with the optional «Protect Plan» coverage also available.



MARSS and Thales Collaborate on Counter UAS Technology

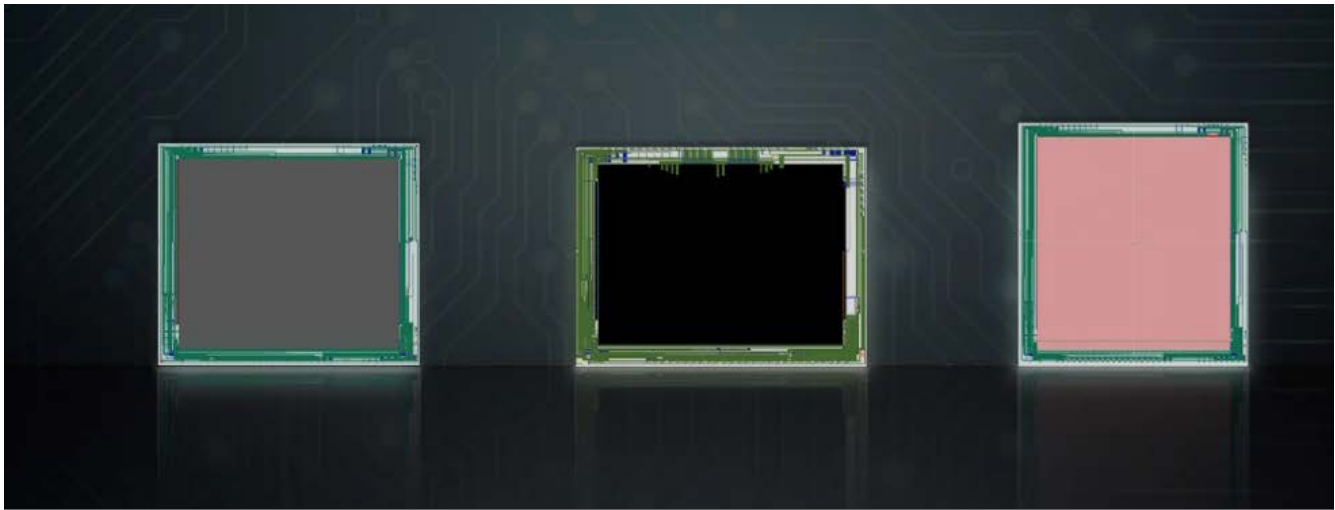
Thales has announced a collaboration with MARSS for the delivery of system solutions to provide protection of critical infrastructures against multiple threats. This collaboration will focus on the integration of the MARSS' NiDAR C2 security platform and Thales' leading drone neutralisation systems. The partnership will focus on taking proven and scalable smart systems and deploying them to face current and new threats in accordance with laws and regulations. The Thales-MARSS' platform aims at providing an enhanced understanding of UAS situational awareness and safely defeat threats, including emerging one's.

Phil McBride Managing Director Integrated Airspace Protection Systems at Thales in the UK states, "Customers needed to augment their C2 security systems with C-UAS neutralisation means, to combat a vast variety of threats over their facilities. Collaborating with MARSS gives Thales a further opportunity to deploy C-UAS neutralisation solutions, over a wider range of infrastructure protection missions."

Rob Balloch, MARSS vice president of sales, said, "The neutralisation phase in C-UAS is a critical step. NiDAR finds and verifies the threat. We wanted an equally credible solution to help

defeat this threat. Therefore, it was important we worked with an established partner with years of experience in the provision of Air Defence Systems and effectors. This Thales-MARSS partnership creates a formidable force for security missions including C-UAS, not only for today, but the future of this capability."

Deployment of operational systems are due to commence within the next few months. The relationship between both parties will help to further develop UK Defence industry and its export potential.



Teledyne FLIR Introduces New ROIC Devices

Teledyne FLIR has launched a new line of 10-micron pitch readout integrated circuit (ROIC) devices for infrared imaging. The ISC1504, ISC1901, and ISC1902 join the lineup of near-infrared (NIR), mid-wavelength infrared (MWIR), and long-wavelength infrared (LWIR) devices in off-the-shelf ROIC solutions designed for wide range of applications ranging from academic research to military infrared systems in UAVs (unmanned aerial vehicles) and unmanned systems.

At 1920 x 1080 resolution, the ISC1504 is the largest format ROIC offered by Teledyne FLIR optimized for InGaAs/VisGaAs detectors and uses a capacitive trans-impedance amplifier (CTIA) input circuit for P-on-N detectors. The ISC1504 supports anti-blooming, input skimming, multiple integration modes, and selectable output modes. A simple user interface with analog outputs allows for easy integration into high-resolution systems.

The ISC1901 (2048 x 1536 resolution) and the ISC1902 (2048 x 2048 resolution) are designed for P-on-N detectors with a direct injection input circuit. Both support single sample or sub-frame averaging for effective well fill of 3M to 19M electrons, respectively. The setting selections allow the user to control various modes such as 2 x 2 binning, 8 or 16 output channels, and additional reverse bias for Quantum Well Infrared Photodetector (QWIP) detectors. The familiar user interface makes system integration straightforward.

All ROIC devices are probe tested and delivered in wafer form with test data, a user's guide describing all electrical interfaces, and a mechanical interface database providing the layout information for bump and detector interfaces. With low noise, variable charge storage capacitance, selectable integration times, adjustable gain and power settings, and a simple user interface, the mixed-signal ROICs offer a proven design that does not sacrifice performance or flexibility. Additionally, Teledyne FLIR offers full custom ROIC design services covering trade study, specification, design, testing, and fabrication of wafers.

New Robust Fiber Optic Gyro in Production



A new robust fiber optic gyroscope has been added to our VG103S Series. The VG2103 inherits exceptional parameters of VG103S gyros such as high accuracy performance, compact and lightweight design, and low power consumption.

However, unlike all previous series models, the VG2103S features aluminum housing with four flanges for screw mounting.

0.02 °/√h ARW ø55x17 mm 70 gr 0.5 Watt



Drones will be an important part of last-mile delivery of healthcare
Vikram Thaploo, CEO - TeleHealth, Apollo Hospitals

Before we start, we would be happy to share your story to our readers. Wouldn't it be a great way if they can hear it from you?

Sure, I completed my Healthcare Management Programme from the Indian School of Business (ISB) and PGDBM from Symbiosis, Pune after Hotel Management. I briefly worked in the hospitality and retail industry before moving to the healthcare segment. I have had my fair share of setbacks that life offers to nearly everyone in this world. From living a happy childhood in Kashmir to being ousted and surviving as a refugee but, adversity has played a great role in transforming my outlook towards life and giving me the ability to think big and outside the box. When I joined Apollo Hospitals to set up Apollo TeleHealth as Chief Executive Officer in 2010, it was clear as day that some of the challenges that bedevil the healthcare system in India needed fresh approaches and alternate delivery channels that had never been conceived before. And innovations in Healthcare IT were to form the cornerstone of that approach. I have been associated

with Telehealth for the past decade and our initiative has touched more than 13 million lives by now. I share a common vision with our Chairman and our JMD, and that is to bridge the still-existing yawning gap between the number of doctors and the number of patients by way of deploying reliable and high-speed technology. I chose to be a missionary in telehealth. It was through persistence and the vision of providing healthcare services to rural and remote locations across India, which led us to initiate Apollo's "Rural Connect" initiative. Today, our PPP projects have been providing telemedicine access to 350,000 CSCs across India under the Digital India Initiative. Presently, we have over 800 public healthcare centres in Public-Private-Partnership (PPP) mode across India, spread across Andhra Pradesh, Himachal Pradesh, Uttar Pradesh, Jharkhand, etc. Like everyone else and in most spheres of life, I did face roadblocks from individuals, institutions and even circumstances. Yet, several helping hands did come along the way and enabled me to face and overcome the challenges. I would like to acknowledge the faith my leaders reposed on me.

What kind of phenomenal transformations have you witnessed in the medical space with the outbreak of pandemic Covid-19?

Since the beginning of 2020, digital strategy initiatives around telehealth, data analytics and digital engagement were well underway for many healthcare organizations. The COVID-19 pandemic accelerated the adoption of these efforts industrywide, making them essential for healthcare organizations. Also, the notion of seeing a doctor via telephone or video conferencing used to be a rarity. But healthcare systems responded by rapidly scaling up telehealth efforts. This involved infrastructure adjustments, of course, but it also required training providers and patients to successfully navigate this new virtual terrain. Apart from that, an uptick in chatbots and virtual assistants has allowed organizations to redirect staff resources to other duties while still getting patients the information they need. As healthcare institutions continue treating a new disease that evolves by the minute, strong

data analytics tools and platforms have big implications for better care. Analytics will become more critical as more remote patient monitoring programs are deployed to keep tabs on patients' recovery from home. A hybrid healthcare system with remote assessments and treatments combined with personal appointments will further create a synergistic and consistent experience for both healthcare providers and patients.

Emerging technologies like block chain, IoT, Artificial Intelligence have found many usages in different fields. What can you comment on them in health care segment?

The healthcare sector has understandably had to deal with many challenges during the coronavirus pandemic. Faced with overwhelming patient loads, a growing number of healthcare providers are turning to automated tools to help them manage the pandemic. From predictive analytics to precision medicine, several hospitals are now using AI to enhance patient care. In the process, the efficiency and precision gained from using these technologies are helping it to become the norm in healthcare, leading to a new wave of investment, research and innovation. In the fight against coronavirus, big data has been invaluable in understanding trends in the spread of the virus. It has helped with tracking the virus in populations. And it has also assisted with strategic planning and decision-making to predict and prepare for future pandemics. IoT protocols, GPS and Wi-Fi are providing solutions to the challenges that distance and accessibility would have posed.

What can you say about the utilization of Drones specifically in medical deliveries that are in the news recently?

There's a need to move pharmaceuticals, lab tests, diagnostics, blood, and small medical devices, quickly, from point A to point B. This is challenging today in rural areas with disconnected communities that cannot be served sufficiently by the current healthcare system. Drones can service those areas if they are designed to fly far, fast, and carry an adequate payload (i.e. carrying medical items). Drones can increase the accessibility to, and speed of delivery for, life-saving medications and vaccines. HealthNet Global of Apollo Hospitals Group was a part of the drone delivery programme that was held in Vikarabad district. A drone successfully delivered medicines and non-Covid vaccines during the test. In urban areas, due to the limited time window to move organs from donor to patient, often between 4-16 hours depending on the organ type, the need for ultra-fast transportation, like private jet charter or helicopter is imperative. Drones can make organ delivery faster, safer, and more cost-effective. Drones can fly fast and far and carry quite a significant payload, helping overcome the time pressure to perform a diagnostic test as well.

How would you like to utilize the Drones or facilitate their usage in the Health care or as the first responder?

Usage of Drones in healthcare has been a vision of our leadership at Apollo Hospitals. The new Drone Delivery Pilot Programme for COVID-19 Vaccines that started a few months back in India is a testament to the pioneering efforts of Apollo Hospitals in the use of drones for medical purposes. The new drone delivery pilot program which was conducted is the first in Asia to deliver COVID-19 vaccines by drones has been organised by the World Economic Forum in partnership with the state government of Telangana,

Apollo Hospital's HealthNet Global and GOI's NITI Aayog. Apollo Hospitals has been a forerunner in the use of UAV drone technology with advanced capabilities including artificial intelligence (AI) in responding to emergencies and disasters. Drones will be an important part of last-mile delivery of healthcare along with telemedicine ensuring the delivery of care when and where needed the most.

What are your development plans for 'TeleHealth' for the next 5 years and into next decade?

We have collaborated with different players for the enablement of 5G in healthcare that will help Telemedicine to build a new health ecosystem. Also, we are working on the development of connected rooms, with lots of features embedded, everything live monitored, remotely monitored. This is for hospitals and the idea is to indicate that saline is over; sensor embedded in room and bed. We also envisage a hybrid healthcare ecosystem with technologies such as AI (artificial intelligence), ML (machine learning), big data analytics, blockchain, the Internet of things (IoT), virtual care, drones delivering healthcare, remote monitoring, and smart wearables at the core. A hybrid healthcare system makes possible remote assessments and treatments combined with personal appointments. This synergistic combination of virtual and personal experiences creates a consistent experience for both healthcare providers and patients with multiple benefits. A continuum of care is ensured with enhanced health and well-being through data-based treatment decisions, personalized care, digital therapeutics, self-management of care.



Walmart and DroneUp Announce First Multi-Site Commercial Drone Delivery Operations

DroneUp, LLC, a leading global provider of drone technology and services, and Walmart announced the first multi-site commercial drone delivery operations. The three locations, which will be located at Walmart stores in Northwest Arkansas, will operate from 8:00 a.m. – 8:00 p.m., seven days per week, to deliver items to eligible Walmart customers by air in as little as 30 minutes.

“When we invested in DroneUp earlier this year, we envisioned a drone delivery operation that could be quickly executed and replicated across multiple stores,” said Tom Ward, senior vice president of last mile at Walmart U.S. “Opening our first hub within months of our initial concept showcases DroneUp’s ability to safely execute drone delivery operations with speed. We’re already hearing great

customer feedback at our first site in Farmington, Arkansas, and look forward to opening additional locations.”

DroneUp’s delivery operation provides Walmart customers a safe, convenient, fast, and sustainable delivery option on thousands of items – even the most fragile – powered by a crew of skilled operators. Enjoying the benefits of drone delivery is as easy as:

- **Verify:** Customer enters their address to verify eligibility.
- **Shop:** Customer selects from thousands of items for delivery.
- **Secure:** Operators pack the order and secure the box to the drone using a patented delivery release mechanism.
- **Deliver:** The flight engineer manages a controlled and guided delivery, placing the

order gently at the customer’s home.

Eligible customers in Farmington, AR can begin placing orders today at droneupdelivery.com.

“Teaming up with Walmart to launch three delivery Hubs marks a significant leap forward in the broader use of UAS to provide last-mile consumer delivery services and supply chain efficiency options,” said Tom Walker, CEO, DroneUp. “Walmart and DroneUp provide an unrivalled ability to pick, pack, and deliver via drones directly from the store to consumers offering efficiencies no other retailer can match. We are proud of our team’s ability to deliver the technology helping Walmart launch a new era of commercial drone operations.”



U.S. Air Force Orders 15 Silent Arrow® Precision Guided Cargo Delivery Drones

Silent Arrow announced the United States Air Force, through the Air Force Research Laboratory (AFRL), has awarded the company a contract entitled «Guided Bundle Derivative of Silent Arrow® for Side Door and Palletized Swarm Deployment at High Speeds and Altitudes» effective November 12, 2021.

Under this Small Business Innovation Research (“SBIR”) Phase II contract, the commercially successful Silent Arrow® GD-2000 (Glider, Disposable, 2000 pounds) platform will be scaled down and redesigned as a new product line called the Silent Arrow® Precision Guided Bundle (SA-PGB), which will initially be developed as an autonomous cargo delivery

glider. The SA-PGB is specifically designed for side door and multi-unit (swarm) ramp deployment, compatible with a much-expanded fleet of delivery aircraft ranging from the civilian Cessna Caravan to the military C-17.

The SA-PGB will be designed and built at Silent Arrow’s headquarters in Irvine, California and 15 aircraft will be shipped to the company’s flight test center in Pendleton, Oregon for operational evaluations at the Pendleton UAS Test Range. Initial specifications include 500-pound max weight, 350-pound cargo capacity, 39 inches long and deployable from high altitudes and airspeeds.

“We’d like to thank the U.S. Special Operations community,

the U.S. Air Force, Navy, Army and various other organizations who signed on to support this award for a new life-saving cargo delivery drone,” said Chip Yates, Silent Arrow’s founder and CEO. “We look forward to an exciting flight test program in 2022 and quickly getting this new capability into the hands of the warfighter and disaster relief organizations alike.”





Drone Delivery Canada Provides Condor Update

Drone Delivery Canada Corp is pleased to provide an update on the Condor drone development. The Company has successfully tested numerous aspects of the Condor solution at test ranges in Alma, Quebec at the Unmanned Aerial System Centre of Excellence, and in Foremost, Alberta at the UAS Test Range. On November the 4th, 2021, the Company announced its Ontario Commercialization Centre, where Condor testing will continue, in addition to customer pre-delivery inspection, maintenance, training and customer demonstrations. The Centre will also support testing and development of multiple DDC platforms, including the: FLYTE software, Detect and Avoid (DAA) systems, Canary drone, DroneSpot depots, etc.

In addition to previously announced updates on Condor development and testing, the following further progress has

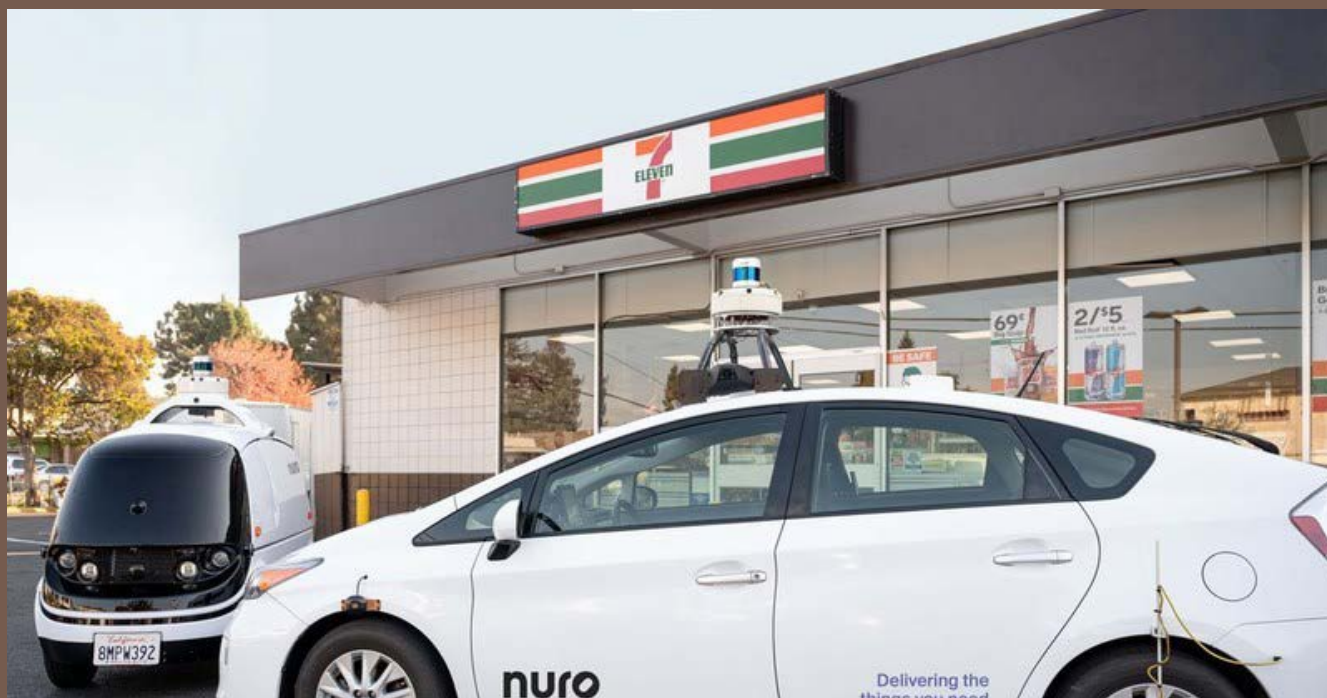
been made - engine control unit (ECU) overhaul (avionics + engine overhaul), enhanced start-up procedure process, mechanical reliability improvements, upgraded to latest components (clutch, splitter gearbox, torque valves, etc).

Additionally, some items that remain to be completed - integration of automated weight & balance system, further testing with FLYTE software system, further payload testing, environmental testing, high speed testing, etc.

“We continue the development & testing of the Condor drone, and related necessary ecosystem components, and we are pleased with the progress & success we are having thus far. This is something unique that has never been done before. In a highly regulated and safety-centric industry, it’s important to be methodical and approach this innovative

development in a disciplined way,” said Paul Di Benedetto, Company Co-Founder and Engineering Strategist.

“As a company in early-stage commercialization, and in a new and highly regulated industry, Condor progress continues at a pace commensurate with the overall complexity of the solution, global supply chain issues, and the impacts of the pandemic in Canada. The Condor will come to market when the Company feels confident that it is ready. Market response to the Condor has been favourable from prospects in Canada and internationally and we are pleased with what we think the Condor will bring to our customers and the industry in terms of potential logistical cost savings & efficiencies and incremental revenue opportunities,” said Michael Zahra, President & CEO of DDC.



7-Eleven and Nuro Team Up to Launch First Commercial Autonomous Delivery Service in California

7-Eleven, Inc. is bringing a futuristic innovation to Mountain View, CA, customers by piloting autonomous delivery with Nuro, a robotics company transforming local commerce with autonomous vehicles. In collaboration with Nuro, 7-Eleven is launching the first autonomous commercial delivery in the state of California, enabling its customers in the service area to order through the 7NOW® delivery app to have their products delivered via bot.

“7-Eleven has owned and defined convenience since 1927,” said Raghu Mahadevan, 7-Eleven Chief Digital Officer. “Our first foray into autonomous delivery was in 2016 when 7-Eleven became the first retailer in the U.S. to make a drone delivery to a customer’s house. Since then, we haven’t stopped looking for ways to redefine convenience for our customers inside and

outside the four walls of our stores. Fast forward to 2021, and we are pushing the boundaries of innovation even further to provide customers with the first commercial autonomous delivery service in California. I can’t wait to see where we go from here.”

Here’s how it works:

- **Get Started:** Download the 7NOW delivery app through Google Play, the Apple App Store or visit 7NOW.com.
- **Order:** Browse the app to purchase favorites like pizza, chips, beverages, household items and more. Add items to your shopping cart, begin the checkout process, and choose autonomous delivery. Autonomous vehicle deliveries are available daily from 8:00 a.m. – 9:00 p.m. PT at no additional charge for customers

in Mountain View, CA.

- **Enjoy:** The 7NOW delivery app will send updates as the order is processed, and orders will arrive in approximately 30 minutes. Simply meet the autonomous vehicle outside, grab your items from the back of the vehicle and enjoy.

“Residents in the state of California – a major hub of innovation – have never been able to experience the commercial delivery of goods by an autonomous vehicle. Nuro is teaming up with 7-Eleven to change that,” said Jiajun Zhu, Nuro CEO and Co-Founder. “We’ve always wanted to bring Nuro’s autonomous delivery to our local community and to our neighbors. We couldn’t be more excited to do this with an iconic neighborhood store like 7-Eleven in our hometown, Mountain View.”

Supporting Innovation Through Reformatory Frameworks - Jayesh Ranjan - P S of the Industries & Commerce (I&C) and Information Technology (IT) Departments of the Telangana government.



Hyderabad has attracted so many tech giants like Google, Apple, Amazon and others. What makes Hyderabad such a special place for such establishments?

I would say it is the pursuit that stands on top of all since these days, the incentives that states offer are pretty much on par, and there is no significant advantage of one above the other.

The state government is very proactive in industry engagement, with most of its verticals in ITE&C and Industries Department being led by professionals hired from the industry, and accommodative policies such as TSiPAAS, Open Data, etc.

The government has established a rich innovation ecosystem by setting up institutions run by industry stalwarts, such as T-Hub, T-Works, TSIC, We-Hub, RICH, TASK,

ET Wing etc. There are also many centres of excellence in multiple domains such as AI/ML, Robotics, Animation and Gaming, etc., R&D institutes, and engineering colleges in the state. This tech-focused innovation ecosystem has led to an abundance of innovators and, therefore, the state's talent pool.

In addition, Hyderabad has been rated the most liveable city as per Mercer for 6 years in a row and has pleasant weather compared

to other cities. According to the National Crime Records Bureau, Hyderabad is also the safest city, followed by Mumbai, Bengaluru, Delhi, and Chennai rank in IT Metros. The city also has excellent infrastructure such as Outer Ring Road (ORR), PVNR flyover, RRR, the SRDP projects and hence is also best placed with regards to traffic and road congestion. Further, Hyderabad's attrition rates are much lower, as low as half, than any other IT metro.

The city, its people, its organizations, and the progressive government is what has led to various MNCs such as Google, Amazon, Apple, Microsoft, Facebook, State Street, Qualcomm, Micron, Uber, etc., having their largest presence outside of the USA here in Hyderabad.

What kind of support MSMEs are getting from Government of Telangana. What could be some of the key reforms and policies that are helping in attracting the companies?

Telangana is ranked one of the best states in ease of doing business overall. This is on the back of several policies and schemes of the state such as T-IDEA (Telangana State Industrial Development and Entrepreneur Advancement) Incentive Scheme; T-PRIDE (Telangana State Programme for Rapid Incubation of Dalit Entrepreneurs) Incentive Scheme; Telangana State Industrial Project Approval and Self-Certification System (TS-iPASS).

Further, we recently issued a G.O. while working closely with NASSCOM, HYSEA, and other industry bodies to support MSMEs in the IT sector. The Government has also constituted an Advisory Committee on Telangana IT MSME Promotion that will enable experts in the industry create the required reforms and policy

outputs to promote the IT MSMEs in the state. The growth of MSMEs will be facilitated by guidelines for preference to MSMEs for government projects, relaxing procurement norms such as experience, enabling proactive solutions by SMEs on latest technologies, and more.

Additionally, the state launched the TS-Global Linker platform to promote and support local MSMEs of the state. The portal provides knowledge & efficiency tools, digitizes stores and creates free e-marketplace for SMEs to buy, sell and connect with potential partners.

T-Hub is the name that has been ringing in aspiring entrepreneurs' ears ever since it went live. Could you explain in detail how T-Hub is able to create startup friendly environment and help out these youngsters?

T-Hub along with its partners has built a strong foundation for the startup ecosystem in the state of Telangana. The spirit of entrepreneurship among youngsters drives our efforts to enable the innovation ecosystem. We focus on working with founders and entrepreneurs through their journey, converting idea to product, acquiring customers, access to funding and scaling, our focus is on providing access to 5Ms (mentors, money, manpower, market and media) and 1P (partnership) to create a flourishing environment for entrepreneurs. We have supported over 1800+ entrepreneurs in their journeys. Further, T-Hub is being further expanded into Phase 2, wherein World's Largest Innovation Space with 360,000 sft of built up area is expected to go-live in the next few months.

How are these initiatives helping in terms of generating revenue whilst creating

employment opportunities?

Telangana has recorded a double-digit growth in Revenues/IT Exports consistently for 7 years which is unprecedented in India. This is more than double the national average and any other Metro in the country. When it comes to employment, the city generated over 46K new jobs in the IT sector during 2020-21, and we expect this to cross 70k soon.

What are the measures Government of Telangana is taking to strengthen the Drone ecosystem?

Telangana as a young state has an entrepreneurial and innovation mindset, and hence is establishing itself as a leader in emerging technologies as was highlighted in ICT Policy 2016 and re-iterated in the 2nd ICT Policy 2021. It was also the first state to release a dedicated policy framework on drones, back in 2019, i.e., during the time where drone regulations were still shaping up and were more stringent.

Hence to spur the continuous innovation and growth in the drone sector, the government shall continue to act as a test bed for new and innovative use cases that leverage drones. By forging key partnerships and undertaking massive initiatives, such as Medicine from the Sky, it would continue to build momentum and generate learnings for both private and government stakeholders across the country.

Further, we are in the process of establishing Hyderabad as a Drone Hub, wherein drone startups shall be given preferential treatment in accessing state's existing state-of-the-art infrastructure as available under T-Hub and T-Works. The startups would also get preferential access to mentorship and guidance from these agencies. In addition, the state is in discussion with various industry stakeholders to



establish a drone testing range, suitable for both VLOS and BVLOS operations near Hyderabad, such that the startups can safely test their drones and make them ready for an international market.

Lastly, the state offers various incentives and land allocations in its aerospace and electronics parks based on proposals of the companies looking to set up manufacturing in the state. Such companies would also benefit from the existing Aerospace and Defence supply chain in Hyderabad.

How do you think drone technology is going to affect our society and economy?

Drones essentially extend our reach in - distance, geography and time. They have applications across various sectors with a clear tangible value addition such as in healthcare logistics, defence and law enforcement, first response and

rescue operations, urban planning, geo-surveys and mapping, precision agriculture, and accessing hard to access or hazardous areas. The technology is here to stay and become an essential part of human lives.

With the liberalisation resulting from New Drone Rules 2021, the unmanned aerial vehicles (UAV) sector shall be amongst the fastest-growing, and India is estimated to develop a **multibillion-dollar industry of drones in the next decade**. Although most drone operations are expected to be mostly autonomous, there'll be tech enabled manual overseeing of each flight to ensure safe and secure operations. This would mean various jobs shall be unlocked by the sector.

Apart from the Drones, 'EV's and 'Block chain technologies' are some of the hottest

segments right now. We would like to hear about the latest happenings in these industries concerning the Government of Telangana?

Telangana had launched its dedicated EV and ESS Policy in 2020 that was focused on making Telangana the preferred destination for component manufacturing, creation of EV charging infrastructure, promoting Recycling and Cascading of Batteries, and developing Telangana as a global centre for cutting-edge research and innovation in the sector. Further, Hyderabad has a dedicated part for EV manufacturing in Chandanvelli i.e. just 25 Km from the airport.

In Blockchain, Telangana has been one of the early and leading promoters of the technology, starting with the launch of Blockchain Framework in 2019. Under this, we had launched several

initiatives focused on skilling of young professionals, startup incubation, promoting research and innovation, and building a community. Telangana is one of the few entities globally to be recognised as the ambassadors of the Global Blockchain Business Council (GBBC). Further, the state recently launched its 2nd startup program called India Blockchain Accelerator in partnership with Lumos Labs and CoinSwitch Kuber, the registrations for which are currently open till 27th Feb 2022. (<https://www.indiablockchainaccelerator.com/>). Telangana is also leading the government adoption of blockchain, use it to enhance convenience to citizens or to solve problems. The most recent projects include AI and Blockchain based smartphone

eVoting solution that enables citizens to vote from their homes and another important one is tracking of truthfully labelled seeds in the state, to prevent spurious seeds, using blockchain.

And to conclude on high spirits, could you list out your New Year resolutions for development of eco-systems for emerging technologies?

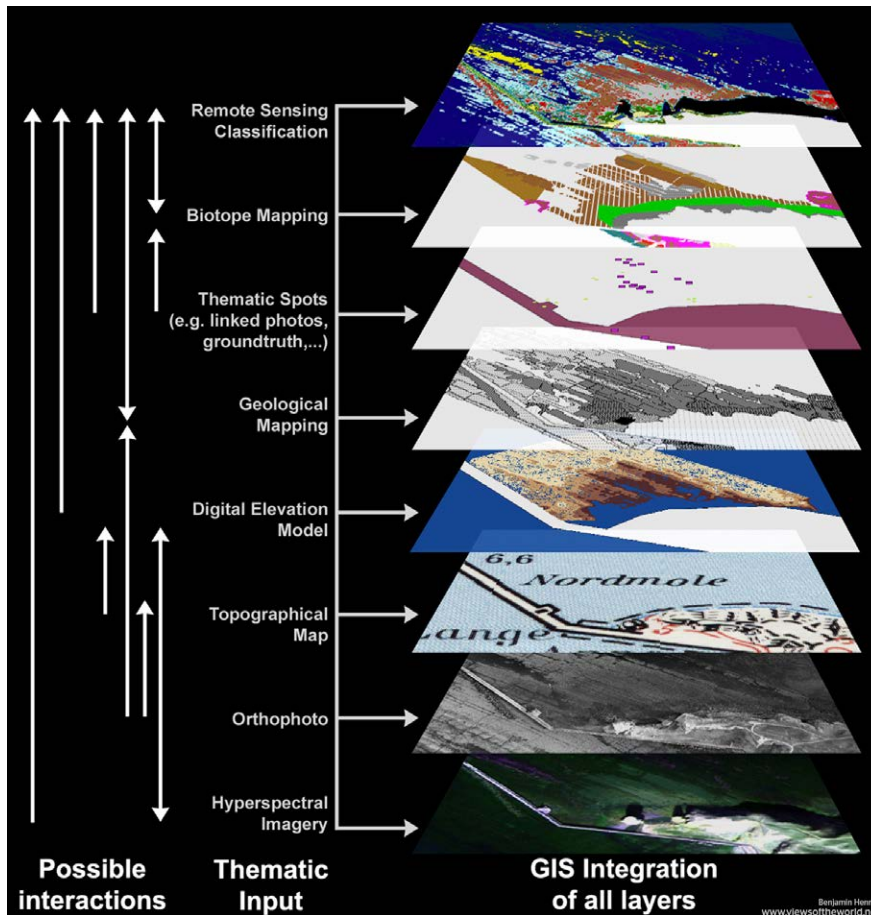
As indicated in the 2nd ICT Policy 2021-26, Telangana shall explore global developments for opportunities around transformative emerging technologies, the ones that have the potential to bring in disruptive innovations in the next three to five years. In the next few months, we'll also be inaugurating the National Centre for Additive Manufacturing

(NCAM) and launch the state's SpaceTech policy, and thereby continue to deliver upon the goals highlighted in the ICT Policy.

Further, as an enabling act, the ITE&C department is also working with Agriculture Department, under the Saagu Baagu project, to set up an Agriculture Data Exchange (ADEx) that shall unlock the potential of data and will spur AI innovations in the sector and improve the sector that is yet to see the AI revolution. The government is also in the process of establishing a Telangana Emerging Technologies (TET) Corridor to coalesce the various efforts across the state and establish a world-class ecosystem for emerging technologies in Telangana.



HYPERSPECTRAL REMOTE SENSING AND MILITARY APPLICATIONS



Remote sensing is defined as acquiring information about an object or phenomenon without making physical contact with it. The term is specially applicable to acquiring information about earth. When narrow contiguous bands are used for acquisition of digital imagery it is called Hyper spectral remote sensing. The primary difference between Multi Spectral and Hyper spectral RS is that Multispectral uses broad wavelength bands which may not be contiguous whereas Hyper spectral is contiguous bands.

Since there are no gaps in hyper spectral imagery it scores a major advantage over Multi Spectral. Hyper Spectral is able to detect Surface and Subsurface

materials and also is able to give inputs on Biological and Chemical processes. Hyper Spectral remote sensing has application in Forestry, Geology, Mineral exploration Snow, Ice and many more. The same technology can be used for military applications.

The Hyper spectral bands include Ultra violet, Visible, Near Infrared, Shortwave Infrared, Mid wave Infrared and Long wave Infrared. The wavelength Generally applied are

- a. Ultra Violet 0.28 - 0.35 μm
- b. Visible 0.35 - 0.7 μm
- c. NIR 0.7 - 1 μm
- d. SWIR 1 - 2.5 μm
- e. MWIR 3 - 5 μm
- f. LWIR 8 - 12 μm

- g. TIR 3 - 50 μm
- h. IR 1 - 1000 μm

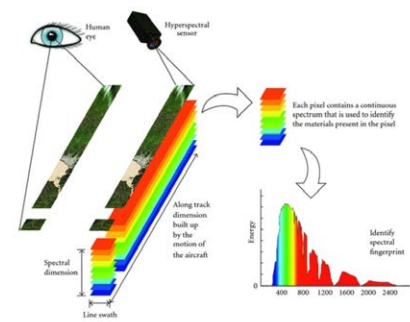
USAGE IN MILITARY

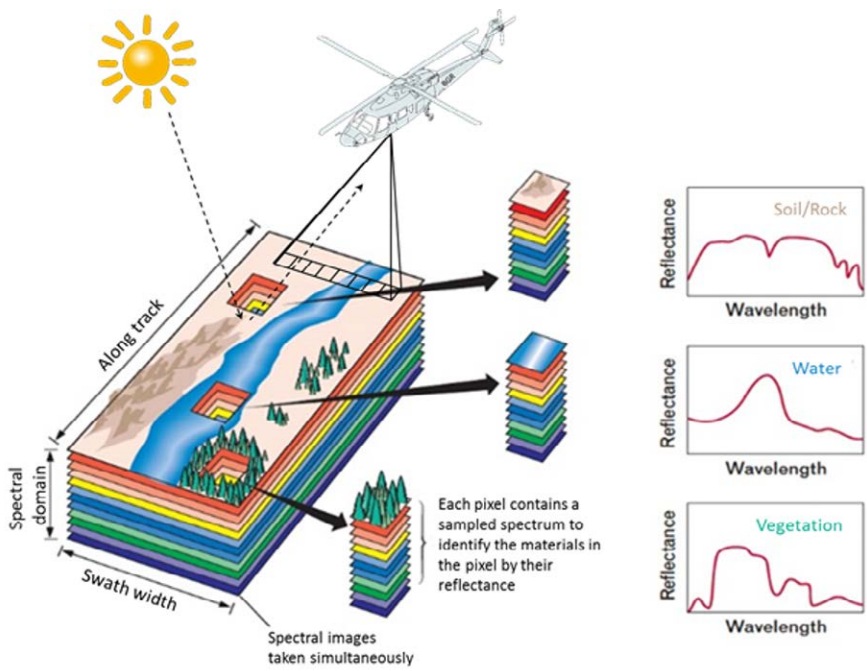
Since Hyper Spectral sensor can quantify molecular absorption and detect Surface, Subsurface material along with Biological and Chemical processes, its usage is limitless, limited only by the capabilities of the analyst.

Some important usages are

Landmines and IED detection It can discriminate in case the soil has been disturbed, the mineral content may be different from the soils around, Any chemical variation in the soil, Surface and sub surface temperatures also the depth of disturbances. Disturbed soil features increased emissivity in a specific wavelength, and analyzing images of this soil helps military commanders to identify likely locations of land mines. Detection of recently buried landmines and improvised explosive devices using Hyperspectral imaging is a growing field. This when compared with the spectral libraries and Database will give a lot of information.

Camouflage The HS sensor can detect contrast between the object and the background. It can also detect the chemical composition of the material highlighting the variation between the background,





object and the camouflage material. Moreover military objects have specific shape, size and material. It is very difficult to mimic the vegetation and terrain signature to merge the military object with the background.

Radiometric Indices The soil water and vegetation indices give a major input about terrain going , natural obstacles and load bearing of the soil for the offensive and creation of obstacles and flooding for the defensive Ops . The indices can also detect the variation and stress on the vegetation which becomes a major input for any sub surface activities.

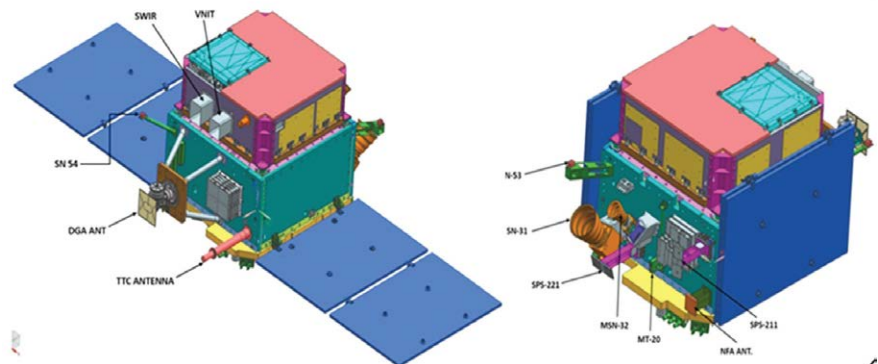
Usage of Reinforced material Any material which is reinforced or have a different composition like Reinforced glass or any such metal or plastic material which throw up a different signature which can be detected and compared with the spectral library for analysis .

Depth of water obstacles Depth of water obstacle can be measured around 2 to 2.25 mtrs using the change in reflectance and details of the reflective spectrum of the base of the obstacle. Many a time's

optical reflectance may not give the correct output.

Anti-Missile System Anti-Ballistic missile systems detect, track and intercept enemy ballistic missiles. The system consists of a ballistic-missile warning system, a target discrimination system, an anti-ballistic-missile guidance system, and a command-control communication system. Hyper spectral imaging can be used in detecting MWIR from the body and LWIR from the plume of the missile in the detection stage. This is more applicable to ICBMs.

The Way Forward



- a. Creation of Mosaics with Maps and DEMs as underlying layers
- b. Periodic imaging is another important factor for military applications, to compare and analyze the changes and highlight the differences.
- c. Association, Co location and Co occurrence rules can be applied to infer/ conclude / verify various locations and establishments.
- d. The spectral libraries need to be created and constantly updated, a database also needs to be created for comparison and accurate assessment.

Hyper spectral imagery is a very important tool for military remote sensing. It gives tremendous insights of the enemy activities or terrorist activities which can result in meaningful intelligence. It can also be used in collaboration with other forms of Tech intelligence to build an Intelligence database.

About the Author

Rahul Jain did Post Graduation in Geographic Information Systems and Remote Sensing, with an exposure to Data Science. He has extensive experience in GIS and Imagery analysis. He has keen interest in usage of Geospatial technologies for Security purposes.

UAVOS UAS Autopilot Software Upgraded

UAVOS has announced that it has launched a next-generation AUTOPILOT featuring advanced control algorithms for navigation and stabilization, powerful processing upgrades and an updated interface of Portable Ground Control Unit. Next-generation Autopilot solution gets a massive boost in speed and processing capacity, increases longevity, ease of support and integration capabilities.

The UAVOS' family of autopilot systems have operated in thousand flight hours on a variety of UAV platforms such as the Saker Medium Altitude Long Endurance (MALE) UAV, HiDRON stratospheric glider, ApusDuo high altitude stratospheric platform (HAPS), a range of piloted aircraft converted into drones, and

unmanned helicopters designed to be operated fully autonomous.

Based on distributed architecture UAVOS' flight management system consists of autopilot, a ground station, a simulation environment and operator interface software, supporting fully autonomous flight operations for complex UAVs.

Firmware updates include:

- Through upgraded control algorithms, the level of flight control precision and accuracy has been increased, f.ex. accuracy of waypoint navigation by deviation estimated not to be more than 2x2 meters (without using Real-time Kinematic Positioning mode).
- The current implementation is

capable of providing bandwidth of up to 8 KHz for primary loop controls (stabilization), and 100 Hz for outer loop controls (navigation). The update rate is adjusted automatically, based on available sensors data rate.

- Navigation accuracy within the lack of GPS signals has been increased and estimated to be around 2 -3 km per 1 flight hour.

"We are pleased to provide our reliable software solution for the unmanned platforms control," said Aliaksei Stratsilatau, CEO at UAVOS. "Next-generation Autopilot reflects UAVOS' determination to continue investing in industry-leading technology while becoming more competitive".

Inertial Labs Announces the Acquisition of MEMSENSE, a Global Supplier for MEMS-Based Inertial Measurement Units (IMU)

Inertial Labs is an industry leading developer and supplier of orientation, inertial navigation, and optically enhanced sensor modules has acquired MEMSENSE, a developer of inertial measurement units that lead the market in performance and value.

Inertial Labs & MEMSENSE have an experienced and talented workforce to address the rapidly evolving needs of customers globally. The combined company of more than 100 employees and 500 customers expects to introduce breakthrough technologies at an accelerated pace across high-value areas such as autonomous vehicles, GPS-denied navigation, industrial machines, and aerospace & defense. In addition, Inertial Labs and MEMSENSE have a strong balance sheet to support critical business initiatives, deliver with short product lead times, and the ability to invest in promising integrations.

"Our strategic acquisition of MEMSENSE brings together two high growth companies with proven performance in solving some of the

world's most difficult stabilization and navigation problems." said Jamie Marraccini, President and CEO of Inertial Labs. "Our customers will benefit from our combined capabilities and resources."

"As we move forward, Inertial Labs and MEMSENSE will define the future of MEMS IMUs," said James Brunch, CEO of MEMSENSE. "Our focus on innovation, our world-class team, and our strength in customer collaboration allow us to deliver the exact specs needed by our customers."

This strategic combination results in current and future customers receiving the following benefits:

- Increased production capabilities of up to 50,000 units annually in order to meet the needs of larger Aerospace & Defense contracts for guidance and navigation applications;
- To offer low-cost, consumer-grade IMUs; ruggedized industrial-grade models; affordable tactical-grade IMUs and finally Inertial Measurement Units with near-FOG level of performance (0.1 deg/h

bias instability);

- A larger range of devices for Unmanned Ground Vehicles (UGV); Unmanned Aerial Vehicles (UAV); Autonomous and Automated Ground Vehicles (AGV);
- Expanded R&D efforts to accelerate delivery of Inertial Measurement Units for stabilization applications like Electro-Optical Systems, Pan and Tilt platforms, and Remote Weapon Stations (RWS);
- New IMU models with improved performance will increase capabilities of the Inertial Labs - GPS-Aided Inertial Navigation Systems (INS), Wave Sensors, Motion Reference Units (MRU) and Attitude Heading Reference Systems (AHRS);
- To complete development of new high-performance systems including a MEMS-based gyro-compasses (3 MILS Azimuth and 1 MIL Elevation accuracy).

GeoCue Expands True View 3DIS® Line with True View 435



GeoCue is excited to announce that we are, once again, expanding our line of True View 3D imaging sensors (3DIS®). The True View 435 is our next-generation topography/wire grade LIDAR/Imaging sensor. Featuring a 16 beam Hesai PandarXT LIDAR unit, world-class Trimble Applanix APX-15 Position/Orientation System (POS) and dual GeoCue mapping cameras, the True View 435 is the highest performance 3D Imaging system available in its price class.

Lewis Graham, President/CTO of GeoCue, said “Our industry renowned True View 515 is the best vegetation penetration and wire detection LIDAR/Imaging system on the market today, at any price. We saw an opportunity to introduce a system with the same very high sensitivity but lower point density for situations where very dense vegetation penetration is not required. Unlike the new wave of low-end LIDAR scanners, we have seen introduced to the market over this past year, the True View

435 will not embarrass you when clients take a hard look at details such as fine ability to resolve linear features such as closely spaced wires. Additionally, it maintains the wide field of view GeoCue is known for, reducing project flight times.”

The True View 435 has a pulse repetition rate of 320,000 out-going pulses per second with an in-track field of view of +/- 15° of nadir. The sensor can detect up to two return pulses (“echoes”) per outbound pulse. This provides excellent look angles for collecting power pylons/towers as well as superb, multiangle penetrating power in vegetated areas. Like all True View 3DIS, the True View 435 features dual oblique cameras, providing a cross-track image field of view of 120°. Similar to our industry standard True View 515, the True View 435 has sufficient sensitivity to detect distribution wires at an altitude of 75 m.

The True View 435 includes complete post-processing software featuring GeoCue’s unique on-

the-fly LIDAR point colorization algorithm, producing stunning 3D colorized point clouds. Through our teaming with BayesMap Solutions LLC, StripAlign for EVO (SAFE) is available as a purchased optional module or under a pay-as-you-use (“metered”) plan. SAFE performs geometric correction for those occasional large projects that might exhibit dynamic geometric errors. Also available in the post-processing suite is Metashape for EVO (MfE), used in generating image orthomosaics based on LIDAR surfaces.

For those just entering the market or for those occasional surge projects, the True View 435 is available as part of the GeoCue Subscription (“rental”) program. This program includes the sensor, a mounting adapter for the drone of your choice and all post-processing software. With commitment periods as short as 1 month, this is a risk-free way to “test the waters” of drone-based LIDAR/Imaging.

Navitar Announces Optimized Glass Lens for BAE Systems' New HWK1411 Low-Light Imaging Module



Navitar's custom, high-performance f/1.4 Navitar glass lens, optimized for low-light imaging and superior stray light mitigation for day operations, is an integral component of BAE Systems' HWK ultra low-light imaging module.

The BAE Systems HWK1411 camera module is an integrated, ultra low-light imaging solution that features an 8.0-micron pixel sensor – providing a large pixel photon collection area, world-class quantum efficiency, and exceptional low 0.5e- read noise that provides imaging capability down to 0.0001 Lux (overcast starlight).

Navitar's proprietary lens-sensor active alignment process ensures the full capabilities of the lens and sensor are carried over to each module, and mission-critical performance is delivered for day and night operations.

The HWK1411 camera core is a compact multichip module

(MCM) designed to simplify camera integration. The MCM core integrates the HWK1411 image sensor, microprocessor, flash memory, power conditioning, and flexible interface cable for plug-and-play, optimized imaging performance. An innovative new backside illuminated process enhancement delivers world-class, broad-spectrum near-infrared quantum efficiency out to 1100nm to enhance nightglow sensitivity.

"At BAE Systems, we're allowing our customers to see what others can't," said Doug Teeter, CIS Products Program Manager at BAE Systems. "Our imaging sensors power today's most demanding cameras, enabling a broad range of applications."

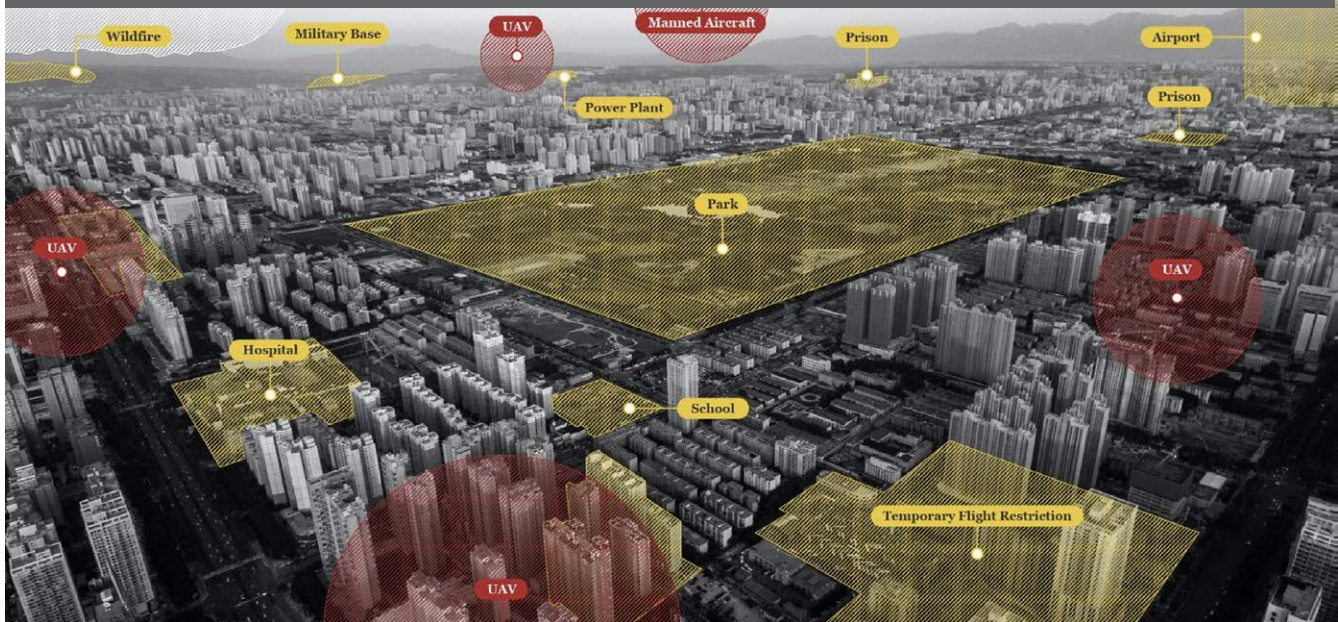
Modules are available in both monochrome and color versions and designed and built to perform under extreme environmental conditions.

The HWK1411 camera module, based on the BAE Systems Core

CMOS sensor, is suitable for a number of military, defense, and security surveillance applications that will benefit from low-light imaging, including:

- Soldier Systems - Improving Situational Awareness and Threat Detection
- Military and Commercial Night Vision
- Air Defense Systems Against Drones / Counter Unmanned Aircraft Systems (CUAS)
- Drone Air Surveillance and Reconnaissance
- Long Range Surveillance
- Missile Guidance and Missile Tracking
- Driver Vision Enhancement - Vehicle Awareness
- Homeland Security - Facial Recognition
- Gimbal Payloads
- Law Enforcement - Live Situational Awareness

DroneUp Announces Acquisition of AirMap



DroneUp, LLC, the leading drone flight services innovator and aviation technology provider, announced it has acquired AirMap, Inc., the leading digital airspace and Automation Company serving the global aerospace economy.

AirMap's Unmanned Aircraft System Traffic Management (UTM) service is the most comprehensive airspace management software solution in the world. The acquisition comes on the heels of DroneUp's recent partnership with Walmart to offer drone delivery to consumers from a growing network of drone airports, called DroneUp "Hubs."

This acquisition will aid DroneUp's robust pilot network and rapidly growing ground infrastructure with the industry's leading UTM, which provides services for as many as 100,000 global daily flights. AirMap's comprehensive flight data will help DroneUp establish market and regulatory leadership, and further advance safe last-mile drone services.

As drone flight volume

increases, safely managing flights is beyond human scale and requires an automated system to plan, request clearance, and factor in potential hazards and airspace restrictions. The AirMap platform advances safety for DroneUp's operations, while also providing advantages for other drone operators to publish their flight plans promoting uniform safety.

"We've integrated with the best aerospace teams to bring drone delivery and flight services to market faster and more economically with our patented flight management software, and now the industry's number one UTM solution," said DroneUp CEO Tom Walker. "We believe DroneUp has a moral obligation to continue investment in and expansion of the AirMap platform. We will ensure this resource remains openly available to the drone industry, municipalities, and the FAA."

"Not only is AirMap a UTM company, they are also a global leader in digital automated air traffic management (ATM) with

a best-in-class market share, geographic footprint, and seamless platform technology that supports stakeholders across several ecosystems," said John Vernon, DroneUp's CTO and representative to the FAA's Beyond Visual Line of Sight (BVLOS) Aviation Rulemaking Committee (ARC). "Transformative advances in technology are driving positive change for society, fueling decarbonization, de-congestion, and the democratization of transportation. UTM is a key enabler to high-density drone and urban air mobility (UAM) operations while unlocking autonomy and flight safety at scale. We look forward to continuing positive innovation."

"We are excited to be joining the DroneUp team," said Ben Marcus, co-founder of AirMap. "Since its inception, AirMap has worked to create a future where drones deliver value to millions of people in their everyday lives. DroneUp is also committed to this mission, and through its resilient, extensible network and partnership with Walmart, I am confident that we are going to create this reality."

CLROBUR successfully showcases drone delivery in Yeongwol with 3D UAM/UTM system



CLROBUR's DROW, an AI-integrated automatic flight ground control platform (GCP) that uses urban air traffic management (UATM) technology, has opened a new chapter in the field of logistics by delivering a product using an autonomous drone. The company, a member of Born2Global Centre, has been participating in the Born2Global-led effort to create an innovation ecosystem for free economic zones.

During a presentation on the establishment of "drone cities," which was held recently in Yeongwol, CLROBUR showcased DROW to the audience. By delivering a box of seasoned fried chicken from a drone hub in Saekyung University to a hub located in front of a drone test site in Yeongwol, the company successfully demonstrated a beyond visual line of sight (BVLOS)

flight by an autonomous drone. The company was also able to complete its urban traffic management (UTM) technology, which is necessary to enable autonomous flights with the technological convergence of drone manufacturers, 3D map providers, and telecom companies. DROW, which is equipped with diverse telecommunications protocols, is applicable to many different kinds of drones. Moreover, a commercial drone delivery service connecting a delivery drone hub with several camping sites across Yeongwol is set to be launched by Yeongwol-gun in 2022.

According to the "Korean Urban Air Mobility (K-UAM) Concept of Operations 1.0," which was unveiled in September 2021 by UAM Team Korea—a public-private consultative body sponsored by the South Korean Ministry of Land, Infrastructure and Transport

(MOLIT)—air taxis equipped with drone and telecommunications (5G/4G) technologies will become available in Seoul from 2025.

The first phase, set for the period of 2025 to 2029, will involve human pilots, while the second phase, slated for 2030 to 2034, will incorporate remote operation covering metropolitan cities with a seat in the air taxi reserved for a safety staff member. The final phase, planned for after 2035, will feature fully autonomous air taxis with nationwide coverage. Prior to K-UAM commercial operation, MOLIT designated 10 regions, including Yeongwol, Seongnam, Gyeongnam Province, Gwangju, Daegu, Daejeon, Sejong, Ulsan, Jinan, and Seosan, as drone cities and has been carrying out a wide range of drone missions.

PABLO AIR to unveil world's first ATM-UTM-integrated flight



A drone logistics company PABLO AIR, a member of Born2Global Centre, successfully demonstrated 75km maritime flight by integrating Ground Control System (GCS) as well as the unmanned traffic management (UTM) and the Air Traffic Management (ATM) at the K-UAM Confex demonstration event held at Incheon International Airport and Yeongjong Paradise City Hotel. PABLO AIR is also cooperating with Incheon International Airport Corporation through the K-drone system demonstration project of the Ministry of Land, Infrastructure, and Transport.

On this day, PABLO AIR's drone took off from Songdo, Incheon, circled Jawoldo Island, about 30km away, flying 75km round trip to return in the opening ceremony. The drone entered the sea, transmitted and received over RF modem and LTE communication. It remained stable in connection with the control system during flight using its triple communication technology, including satellite communication, even in maritime and island areas outside LTE coverage.

PABLO AIR's PAMNet also

was involved in the integration of Incheon International Airport Corporation's monitoring system ARTS and K-drone system's UTM to monitor the pilot flight of UAM aircraft (Germany) held at the same time. The single-seater drone taxi (500kg in weight), was equipped with a UTM and flew in the sky for about 10 minutes. It proved PAMNet's practical capability of monitoring UAM aircraft and drones, even compatibility with the manned aircraft ATM monitoring system.

This PABLO AIR's technology guarantees safe flight of various civilian aircrafts such as manned helicopters flying at low altitude through integration with the Aviation Information Service (AIS) and is also laying the foundation for collaboration with maritime and ground mobility through integration with Vessel Traffic Service (VTS). Furthermore, it is expected to contribute to safe military operations by sharing related data with the Central Air Defense Control Center (MCRC)

PAMNet is a real-time control system without location and time limitations in unmanned mobility operations of drones, ground

robots, and cars. It has already been recognized for its innovativeness by winning the AUVSI (The Association for Unmanned Vehicle Systems International) XCELLENCE Award 2021.

The K-UAM Confex is hosted by Incheon City and co-hosted by the Incheon Tourism Organization, Incheon International Airport Corporation, Incheon Industry-Academic Convergence Institute, and the Korea Automobile Research Association. It is scheduled for two days from the 16th to the 17th, providing venues for about 100 companies leading the UAM industry to operate booths for global and corporate cooperation's for the urban transportation revolution and urban air transportation.

Meanwhile, CEO Kim Young-Joon said, «75km flight success and integration of GCS and UTM shows that it could integrate with the UAM traffic management system (UATM), which will soon be revealed. He also said, «We have taken another step toward commercialization of delivery using unmanned mobility and innovation of integrated control systems.»



Integration of GIS with emerging technologies will result in providing complete solutions to solve complex real-world problems.

Rajesh Alla, Chairman & Managing Director, IIC Technologies

How best can you describe the journey of IIC technologies since its humble beginnings to where it is now?

IIC embarked on its journey purely as a data conversion service bureau and has transformed itself today to a complete end to end Geospatial Solutions Systems Integrator. Over the years, IIC has specialized and developed expertise in Marine GIS data & solutions, Airborne geophysical surveys for mineral exploration, cadastral surveys for land records modernization and Naval maritime GIS solutions serving clients across the world. Today, IIC is the only Indian company to own and operate survey aircraft for LiDAR and optical data acquisition. It is interesting to state that IIC has blossomed with roots sown from working with Indian national mapping agencies such as Survey of India and the National Hydrographic Office (Indian Navy). This has helped and enabled us in crossing our borders to work with over two dozen national mapping agencies of several countries to include USA, Canada, UK, France, Germany, Netherlands, Australia, New Zealand, Norway, Saudi Arabia, Oman, etc.

Apart from Geospatial activities, IIC seems to be active in other places too. Could you brief about them?

IIC has achieved a leadership role in providing data acquisition services both in the domestic market and in the international arena. It has diversified its capabilities in acquiring not merely photography & LiDAR data but also geophysical data such as gravity, magnetic, spectrometry, etc. It has gained uniqueness and recognition in offering land-based surveys, airborne surveys, and shipborne

hydrographic surveys along with airborne bathymetric LiDAR capabilities to several countries worldwide. IIC is the only company to produce Electronic Navigational Charts (ENC) for several countries including US, UK, Canada, Australia, New Zealand, etc.

GIS industry has witnessed various transformations throughout its existence by utilizing latest technological advancements. What are some of such revolutions you have witnessed since the inception of IIC Technologies?

GIS Industry has witnessed several transformations in India over the years but more specifically in last 10-15 years with its usage in major national programs and initiatives that is aligned with the new developments in state-of-the-art geospatial technologies. The integration of GIS with IT and ICT in these national programs witnessed the growth of GIS technology from just being digital 2D map products and services to evolve into integrated solutions that models the real world and provide real time analytics. Providing substantial budget in 11th FYP and thereafter for geospatial technology in various government programs of national importance such as R-APDRP, NLRMP, IWMP, Smart Cities, AMRUT, Digital India had resulted in mainstreaming of GIS technology. Further the innovations that have occurred both at the technology level as well as platform level in geospatial with advent of LiDAR, 3D Laser Scanning, Hyperspectral, Unmanned Aerial Vehicles (UAVs) has changed the GIS industry at its core. The other paradigm change has been brought out with evolution of 3D modelling with advancement in photogrammetry and LiDAR technology. The ability to capture ground reality “AS IS’

and building 3D model of real world, resulted in applications and solutions to model, manage and virtualize the world in three-dimensional information spaces. The last few years especially has witnessed major transformations in both hardware and software in managing geospatial information. From advancements in embedded technologies to AI/ML in digesting data to IOT for many an application; has changed the dimension of GIS industry in providing predictive modelling and simulations. The rapid emergence of UAVs and Drones have resulted in being a game changer by serving several niche areas; and there’s more to paint this landscape of geospatial technological advancements in the near future through convergence with Augmented and Virtual Reality. Another very interesting development of Digital Twin is bound to bring phenomenal changes in how we use geospatial technology and solutions in real world scenarios.

What is your say on the integration or utilization of emerging technologies in GIS sector?

Emerging technologies will have a significant impact in this sunrise sector. From cameras to immersive technologies, Cloud computing, AI/ML, IOT measurements, drones & UAV’s will be consumed contributing to bringing this sector into mainstream horizon. In the digital system, geospatial will be the master integrator with location as a common denominator providing answers to all the questions of what, why, when, and how. While all the other technologies provide knowledge through contextual and synthesized learning, geospatial provides the essential wisdom in decision making through understanding

of the real world resulting in integrated and actionable solutions. The integration of GIS with emerging technologies will result in providing complete solutions to solve complex real-world problems.

How are the unmanned Aerial and marine systems transforming the scape of survey and mapping industries?

These systems with the advent of latest in technology are contributing in a big way in the manner at which we can think out of the box in deploying them to several applications that influence our daily lives. Further these systems can provide details of the real world to finest granularity resulting in seamless connect between micro to macro level. This will result in connecting the local and regional issues with the global issues and challenges and provide tangible solutions across different levels of decision making. With these systems still in the emerging phase, both ends of demand and supply needs to be actively engaged from conceiving the requirements to implementation strategies to maximize the use of these

platforms in the years to come. IIC has been using unmanned systems for both terrestrial surveys and bathymetric surveys. IIC recently used unmanned systems to survey the Arctic region.

Can you talk about the employment opportunities GIS industry is capable of creating in the next 2-5 years period?

With the policy liberalization, technology infusion and most importantly government impetus, the GIS industry is sure to become one of the largest employment generation sectors in the country. The opportunities of employment will be available not just in geospatial but also in various other sectors, as GIS is becoming more and more mainstream technology. Every sector, be it urban development, utilities, infrastructure, natural resources, agriculture, banking and finance, retail, real estate, are using GIS in their planning, development, operations, management, and overall decision making. Expectantly, in the next 2 - 5 years this sector will generate over a few lakh jobs even estimated in a

conservative mode.

What are your wishes for the Geospatial industry entering the New Year 2022?

An increase in government spending to usher in a major revolution triggering this industry as never before. This coupled with advanced data analytics solutions together with AI/ML, image processing, and advanced sensors will result in digital transformation & automation. UAV data and services with manifold applications, demand for LIDAR-based technology services to get precise 3D imaging and 3D mapping data are part of our wish list that will encourage even start ups to invest in these arenas of growth. We wish that geospatial industry comes to the forefront as we are struggling with challenges of uncertain situations such as pandemic, climate change, unprecedented weather events and provide actionable solutions in navigating through the current times and contribute towards a sustainable, safe and healthy future.





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