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Near-infrared light kills cancer, builds immune response

This NIR photo immune therapy is to be licensed to Rakuten Aspyrian Therapeutics, in San Mateo, California.

By Ford Burkhart in San Francisco

Researchers are using near-infrared light to kill off cancer cells while also creating immunotherapy to guard against any future cancer relapse and distant metastasis.

That message was the core of a keynote speech at Photonics West in San Francisco, for an imaging and therapy session by Hisataka Kobayashi, chief scientist and senior investigator at the Molecular Imaging Program in the U.S. National Cancer Institute's Center for Cancer Research in Bethesda, Maryland.

Kobayashi presented a method called NIR-PIT, for near infrared photo immune therapy. It will be licensed by NIH to a company called Rakuten Aspyrian Therapeutics, in San Mateo, California.

Generous backing

The research has support from Hiroshi Mikitani, an entrepreneur in Japan, who has made a \$284 million contribution to the multinational project, underway in Japan, the U.S. and Europe, Kobayashi said.

"We are doing precision medicine," said Kobayashi. "We are treating a patient with a single drug and crushing cancer cells while also creating an immune response." Healthy cells will grow into the area where the cancer cells were killed off.

"The technique can very quickly break down the tumor and allow healthy cells to grow in their place," said Samuel Achilefu, professor of radiology at Washington University in St. Louis and chair of the conference.



Rakuten Founder and CEO Hiroshi "Mickey" Mikitani and Dr. Hisataka Kobayashi, senior investigator at the National Institutes of Health.

"They have developed an elegant way to stimulate immune cells to eradicate the cancer by injecting a light-activable molecule, that generates toxic products, which disrupts cancer survival."

In his research, Kobayashi observed fast

destruction of the tumors, starting within 24 hours, and continuing until after three months the tumors were mostly gone in both human patients and mouse models.

<http://optics.org/news/10/2/9>

Image courtesy of the Rakuten Foundation.

Sofradir and ULIS to invest €150M in French Nano 2022 program

Five-year investment to develop next-generation infrared detectors; part of EU initiative to strengthen microelectronics.

Sofradir and its subsidiary ULIS have recently announced their participation in the Nano 2022 initiative, which will see the Group invest €150 million (\$171 million) over the period 2018-2022.

Sofradir and its subsidiaries ULIS and Sofradir-EC design and manufacture imaging technologies for aerospace, defense and commercial markets; ULIS develops IR components that thermal camera manufacturers can integrate into diverse products.

The announcement follows the European Commission's December 2018 approval of the Important Project of Common European Interest (IPCEI), a joint project by France, Germany, Italy and the UK to invest

€1.75 billion in public support for research and innovation in microelectronics.

Nano 2022 is France's initiative within the cross-border program that will support developments in nanotechnology, including applications such as smart sensors. The Auvergne-Rhone-Alpes region, where Sofradir and ULIS have operations, announced it will contribute €35M (\$40M) to support Nano 2022.

'Next gen' IR detectors

Sofradir and ULIS, the infrared technologies of which are used in a range of applications from space observation and environmental monitoring to security surveillance and predictive maintenance, will invest €150 million in the Nano

2022 initiative in order to develop next-generation infrared detectors.

Jean-François Delepau, chairman and CEO of Sofradir and ULIS, commented, "Infrared technologies can offer the necessary solutions for improving assisted living, mobility, energy efficiency, security and environmental monitoring. As a result of our investment, equipment manufacturers will benefit from the ease-of-use and performance these new products will offer."

ULIS believes that the Nano 2022 initiative will enable it to develop the next generations of infrared detectors to address trends in autonomous systems for smart buildings (workspace management, energy savings), road safety and in-cabin comfort of vehicles.

It also enables Sofradir to develop the very large dimension infrared detectors needed for space and astronomy observations as well as compact and light sensors that can be used in portable devices and on drones. The company stated, "Nano 2022 contributes to the funding of the pilot lines required for developing these technologies and products."

Sofradir and ULIS are participating in Nano 2022 alongside other companies based in the Auvergne-Rhone-Alpes region, including ST Microelectronics (Geneva, Switzerland) and Soitec, (Chemin des Franques, France).

The European IPCEI framework is developing key cross-border R&D and infrastructure projects aimed at encouraging member states to channel their public spending into large projects. These are intended to make a clear contribution to economic growth, job creation and the competitiveness of Europe.

<http://optics.org/news/10/1/25>



Courtesy Sofradir.

Product research and development at Sofradir's plant in Palaiseau, France.



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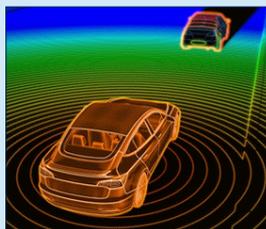
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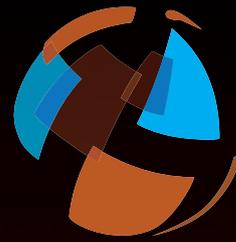
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Rockley Photonics completes silicon photonics platform for sensing

Having overcome significant technological challenges, chipsets have started shipping. Products implementing them will “ramp up the production curve.”

Rockley Photonics, a developer of integrated optics for high-density digital systems, has announced the completion of its fully integrated silicon photonics platform running in a large-scale foundry environment.

The company says it has overcome significant technological challenges that have, until now, “held back the broad adoption and implementation of integrated photonics in high-volume applications.” Chipset shipments to Rockley customers have started and products implementing them will “ramp up the production curve,” the company stated.

Its integrated photonic platform, which delivers wafer scale processing to photonics, is key to many product opportunities in applications where Rockley has established go-to-market partnerships including: optical sensing;

3D laser imaging and AI computing connectivity.

The new silicon photonics platform is said to “solve the key issues experienced by wafer scale silicon photonics to date, including elimination of active precision fiber alignment, full functionality in a single chip and optimized integration with microelectronics and systems.”

Chinese partnership

Andrew Rickman, Chairman and CEO commented, “In one partnership example, Active Optical Cables and transceivers will be manufactured by our joint venture with Hengtong Optic-Electric Suzhou, an optical fiber and cable provider, based in Suzhou, Jiangsu, China.

“The platform-derived photonics and electronics chipset we are providing are key to facilitating the massive scaling required in datacenter expansion, AI



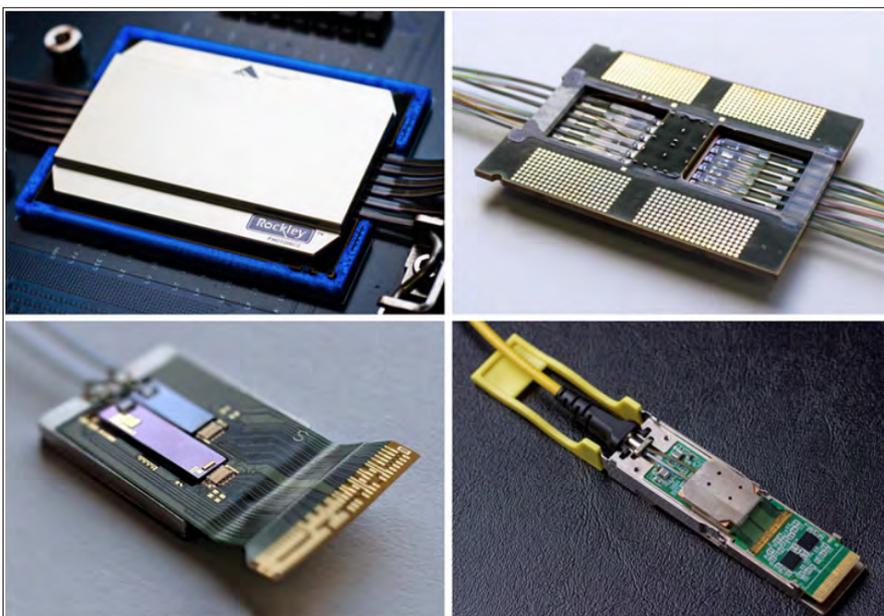
Andrew Rickman, CEO and Chairman, Rockley Photonics.

computing connectivity and 5G backhaul, where high bandwidth and dense optical input/output are paramount and also where cost and power utilization are critical.”

High-density in-package optical connectivity for powerful ASICs, known as optoASICs, is one of the applications Rockley’s technology platform has been developed for. In 2018, Rockley demonstrated this technology in the world’s first single ASIC Level 3 datacenter routing switch with integrated 100G network ports using single-mode optical fiber.

Rickman continued, “The platform’s ability to fully integrate transceiver functionality sets it apart from other transceiver solutions that use older chip-on-board, labor-intensive assembly practices. Its versatility provides the pathway for the vertical integration of a low-cost, differentiated product set that will help drive new competitiveness in large established markets like the AOC/transceiver market as data links reach 400G and beyond.”

<http://optics.org/news/10/1/30>



Products galore: Rockley Photonics’ optoASIC platform demonstrator (top left); underside depicting multiple 100G link optical fiber connectivity within package of silicon CMOS chip package (top right); Transmit-Receive Optical Sub-Assembly (TROSA) for data communication AOCs and transceivers depicting simplicity (bottom left); TROSA mounted in AOC, reference design, no package cover (bottom right).

SiOnyx lands \$20M US Army deal to advance night-vision cameras

Low-light cameras set to be provide US soldiers with technological advantage.

Massachusetts-based SiOnyx, the developer of high-performance CMOS image sensors, has won a \$19.9 million deal with the US Army to deliver digital night-vision cameras.

The contract forms part of the Integrated Visual Augmentation System (IVAS) program – the same project under which Microsoft recently won a near half-billion-dollar order for up to 100,000 augmented reality (AR) headsets.

IVAS is designed to incorporate head, body, and weapon technologies on individual soldiers, giving them an advantage over adversaries increasingly able to use technologies that were previously only available to the US and its allies.

According to prior reports, the US Army wants to improve low-light detection of people at a distance of 150 meters, and thermal recognition of people at 300 meters, as well as reduce the weight of the headsets providing the technology.

The current version of the Hololens headset is approximately 0.6 kg. Bernard Kress, Microsoft's optical architect for AR technologies, discussed Hololens at SPIE's Photonics West, in the opening presentation of a special conference dedicated to AR and related technologies.

Black silicon

The SiOnyx agreement for IVAC was issued via SOSSEC, Inc., a consortium formed specifically to address technology needs for the US Department of Defense (DoD).

SOSSEC has set up the Sensors, Communications and Electronics Consortium (SCEC) to conduct research and development activity with the DoD, and to establish technology demonstrations and prototyping projects.

The US Army awarded the contract via



Image: SiOnyx.

The 'Aurora' night-vision HD camera from SiOnyx is aimed at consumer applications, but the company has just agreed a \$20M deal with the US Army to deliver a compact, high-performance version that will give soldiers an advantage over adversaries.

its specialist Night Vision and Electronic Sensor Directorate (NVESD), with SiOnyx required to deliver low-light camera modules within two years, for prototyping of low-light and night vision capabilities to the IVAS system.

Around a decade ago, SiOnyx licensed so-called "black silicon" technology from Harvard University, where the mysterious material was reputedly invented by accident. Created by transforming the silicon surface from a shiny material to one covered in nanostructured "spikes", black silicon is sensitive to wavelengths between 400 nm and 2.5 μm – far beyond the infrared response of regular silicon.

Back in 2012, SiOnyx attracted venture

funding from laser company Coherent and In-Q-Tel - the venture wing of the US Central Intelligence Agency (CIA).

A year later, SiOnyx said that its night-vision camera had passed a key military performance test when operated by the US Army in a scene to replicate the conditions found on a moonless night in a desert.

The company has also ventured into much more commercial applications of the technology, last year smashing a goal on the Indiegogo fundraising site with the launch of its "Aurora" camera for capturing high-definition video at night.

<http://optics.org/news/10/1/27>

L3 division wins \$26M contract to deliver weapon sights

US Special Operations Command to receive updated version of holographic sights.

EOTech, a division of the US defense contractor L3, has won a \$26.3 million contract to provide the US military with its latest holographic weapon sights.

The five-year deal with US Special Operations Command (USSOCOM), which coordinates and carries out elite-level anti-terrorism missions, will see EOTech provide its holographic weapon sight



Image: EOTech.

EOTech says that it will ship an updated version of its holographic weapon sight to US Special Operations Command, over the course of a five-year deal worth \$26.3 million.

and G33 clip-on magnifier optics. The contract will be fulfilled at the company's headquarters in Ann Arbor, Michigan.

Jeff Miller, who heads up L3's ISR (intelligence, surveillance, and reconnaissance) systems business unit, said in a company release: "We are extremely proud to continue to provide America's tip-of-the-spear warriors with the most advanced holographic sights in the world.

"It's a testament to L3's commitment to quality that USSOCOM has once again competitively selected EOTech as their choice for battle optics."

Razor-sharp views

According to EOTech, it has been providing various elements of the US military's special forces operations with holographic sights for nearly two decades, although this latest contract will see it deliver an updated model of the technology.

It says that the devices give an instantaneous, razor-sharp view of both reticle and target – claiming an advantage over tubular red-dot scopes that are said to amplify "tunnel vision" under the kind of duress encountered in combat.

"With [our holographic weapon sights], the holographic reticle is perceived by the shooter to be as far away as the target, allowing focus on both the target and the reticle," it adds. "The focus is on the target, versus shifting back-and-forth from near to far, reticle to target."

Another advantage over so-called red-dot sights is that the EOTech holographic alternatives use a non-reflective window, without any mirrored or metal-coated surfaces that might give away a position.

The devices can also be equipped with a night-vision capability that is said to be undetectable by enemy surveillance systems.

<http://optics.org/news/10/1/23>

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Hera spacecraft takes Asteroid Framing Cameras to Didymos asteroids

Imaging technology previously used on the Dawn mission remains the instrument of choice.

In 2023, if all goes according to schedule, the ESA will launch a spacecraft to the Didymos asteroid pair.

Design work on the Hera vehicle is currently underway, but it has already been decided that the camera system used to navigate through space and survey the twin Didymos bodies will be the same Asteroid Framing Camera (AFC) previously employed by the Dawn mission to examine the protoplanets Ceres and Vesta.

Having proved its worth on Dawn, which mapped the designated asteroid targets without problem from distances as low as 30 kilometers in 2011 and 2012, and with two completed spare AFC assemblies ready and waiting at the Max Planck Institute for Solar System Research as part of the original AFC development program, the ESA has concluded there is no reason to make changes to that aspect of the mission.

On Dawn the AFC instrument had a dual function, to both map Vesta and Ceres so that the exact topography and reflective characteristics of the surface could be assessed, and provide the critical orbit navigation to the craft on its journey to the asteroids. There was no other camera aboard the spacecraft.

"The AFC worked like clockwork throughout Dawn's eleven-year lifetime," said Max Planck Institute's Holger Sierks. "The camera, equipped with seven spectral filters from the visible to the near-infrared, was able to gather spectral information on Ceres' striking bright spots as well as the rest of the asteroid. An eighth clear filter was used when the AFC was employed for navigation purposes and for broadband surface science."

The complete AFC platform consists of two identical but physically separate assemblies, a necessary redundancy in case of failure. According to specifications



Credit: ESA.

The Asteroid Framing Camera provided to the Dawn mission. Hera is planned to use a flight-spare of the same system.

published by Max Planck Institute it uses a 20 millimeter aperture, f/7.9 refractive optical system with a focal length of 150 millimeters. A CCD sensor originally supplied by Thomson-CSF, now Thales, has a resolution of 1024 x 1024 pixels and yields a 5.5 x 5.5-degree field of view.

A key component is the eight-position filter wheel that allows the camera to carry out both spectrally selective imaging through any of seven narrow band filters, and panchromatic imaging through a clear filter at wavelengths ranging from 400 to 1050 nanometers. In use during the Dawn mission, the AFC offered resolutions of 17 meters per pixel for Vesta and 66 meters per pixel for Ceres.

In sharp focus

Two AFC flight units were supplied to NASA for Dawn by the Max Planck Institute, in cooperation with the DLR German Aerospace Center and the Technical University of Braunschweig's Institute of Computer and Network Engineering. A spare camera was built and kept at the Institute to replace a flight unit if needed.

"We still had spare flight-quality subsystems, including the optics, that we could integrate into a full camera, so we ended up with two flight-ready spares on the shelf," said Sierks. "We wanted to find a flight use for them, and decided we should contribute these fully mission-proven cameras to Europe's next asteroid mission free of charge."

That mission was conceived as the Asteroid Impact and Deflection Assessment (AIDA) project, specifically investigating aspects of safety and security related to potential asteroid deflection in the face of future impact from space.

The intention was for the ESA's Hera to orbit the Didymos asteroid pair, and a separate NASA probe christened DART to deliberately impact the surface. Changes in funding priorities have meant that the two probes are currently due to launch separately, with Hera now arriving some two years after DART's impact, although the schedule is being reviewed.

While the AFC was designed specifically for Vesta and Ceres, Sierks commented that the AFC camera is also a very good fit for Hera, thanks to its dual science and navigation functionality.

"When we designed it, those two asteroids were only known to us as little dots in the sky, just a few pixels across at best using the Hubble Space Telescope, like the Didymos system today," he said. "The camera's optics, the work of the Kayser-Threde company in Munich now owned by OHB, are distortion free with a sharp focus, right down to 150 meters from the target surface."

<http://optics.org/news/10/3/31>



Photo: Courtesy Brittany Hosea-Small/Silicon Valley Business Journal / Twitter.

Louay Eldada, CEO of Quanergy, poses with a Mercedes Benz AMG GLE 450 Turbo equipped with an S3-8 solid state lidar sensor at Quanergy's headquarters in Sunnyvale, Ca.

Quanergy and Athena offer LiDAR tech to the Indian market

LiDAR manufacturer expands availability to cater for innovative smart sensing solutions.

Quanergy, a developer of LiDAR sensors and smart sensing solutions, has announced a partnership with Athena Security Solutions, a Hyderabad, India-based developer of cameras, thermal devices, and security systems, among other things.

Athena will now be offering the full range of Quanergy's solutions, including the Solid State S3-X series sensors and Qortex

for Security to its range of corporate and government clients across India.

Dr Louay Eldada, CEO of Quanergy, commented, "Partnering with Athena gives us the ability to expand our global footprint to offer our technology to Indian companies and organizations in need of smarter, more secure systems." Dr Eldada wrote his doctoral thesis on lidar 30 years ago.

Security and surveillance

Qortex for Security is Quanergy's LiDAR-based 3D perimeter fencing and intrusion detection system. The platform integrates hardware and software with the combination of the M8 LiDAR sensor and its Qortex perception software. The platform is integrated into an existing video management system and physical security information management infrastructure and offers surveillance automation with real-time detection, tracking and classification.

"Athena aims to provide our clients with the highest performing solutions available," commented Vishnu Choudhary, CEO of Athena Security Solutions. "Partnering with Quanergy will enable us to provide the Indian market with increased access to LiDAR technology, offering customized solutions for Indian conditions and industry-specific applications."

Athena has secured several projects working with partners, including the Comprehensive Integrated Border Management System for India's Border Security Force and the protection of key defense facilities. It has also completed projects for refineries, ports, pipelines, police, educational institutions, factories and power plants.

<http://optics.org/news/10/3/16>

CEA LETI announces next-gen photo-acoustic sensors for gas detection

REDFINCH team achieves capabilities in MIR region, where many chemical, biological species have strong absorption.

Leti, an institute of CEA-Tech, based in Grenoble, France, has announced the prototype development of highly miniaturized, portable optical sensors for chemical detection and analysis of gases.

The “next-generation”, centimeter-sized photo-acoustic sensors are based on mid-infrared photonic integrated circuits (MIR PICs). These silicon PICs, created by integrating optical circuits onto millimeter-sized silicon chips, make for extremely robust miniature systems, in which discrete components are replaced by on-chip equivalents. This makes them easier to use and reduces their cost dramatically, expected at least by a factor of 10.

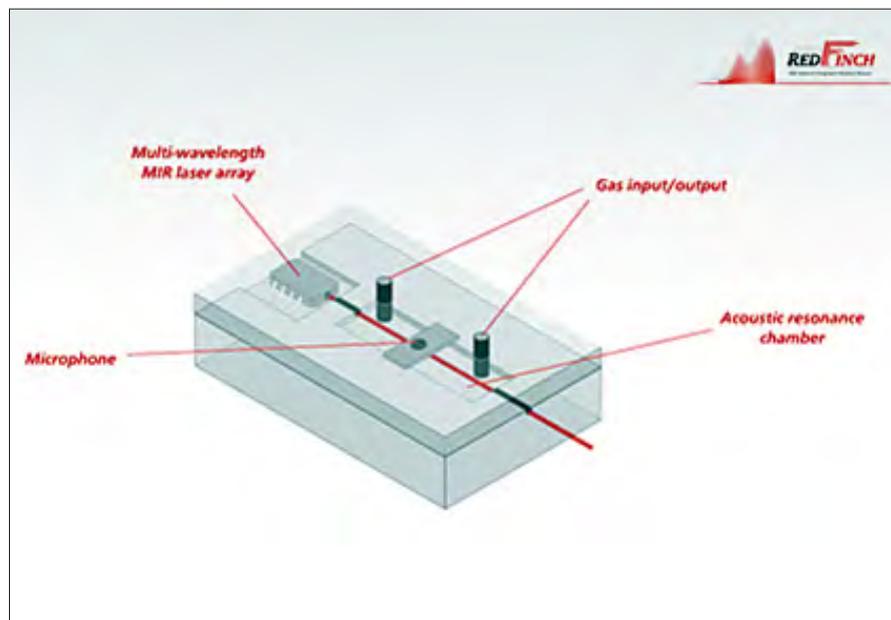
Developed by the European Commission’s REDFINCH Project headed by CEA-Leti, the prototype photo acoustic sensors were fabricated on a CMOS line in a miniaturized silicon photo-acoustic cell, which allows extreme integration.

In demonstrations, the sensors match the performance of bulky commercial gas-sensing systems commonly available today. They are targeted at applications such as process gas analysis in refineries, gas leak detection in petrochemical plants and pipelines, and protein analysis in liquids for the dairy industry.

Best Paper Award at PW2019

An invited paper on the breakthrough, “Photo-acoustic cell on silicon for mid-infrared QCL-based spectroscopic analysis”, won a Best Paper Award at Photonics West 2019.

The sensors aim to consume less than 10W in continuous operation. They can be operated in a slow pulse-burst mode for infrastructure monitoring and when leaks are detected, the pulse frequency of the sensor automatically increases. This keeps average power consumption very low so the sensors can be battery-operated for more than a



Next-gen photo-acoustic sensors for gas detection.

year or powered by an ambient energy harvester, such as a solar cell.

“The big picture is that the miniaturization of photo-acoustic spectroscopy based on quantum cascade lasers (QCLs) is entering the stage of mass production,” said Jean-Guillaume Coutard, an instrumentation engineer at Leti, who coordinates the project.

To develop these chemical sensors, the REDFINCH consortium overcame the challenge of implementing their capabilities in the important mid-infrared region, where many important chemical and biological species have strong absorption fingerprints.

“This allows both the detection and concentration measurement of a wide range of gases, liquids and biomolecules,” Coutard said. “This is crucial for applications such as health monitoring and diagnosis, detection of biological compounds and monitoring of toxic gases.”

“This project is a perfect fit for mirSense’s development roadmap. Our mission is to democratize QCL usage,” said Mathieu Carras, CEO of mirSense, which

participated in the project. “mirSense is ready to produce these state-of-the-art integrated QCL-based components and do a similar job on electronics and software to bring the value of this technology to the market.”

Consortium members, contributions

- **Cork Institute of Technology (Ireland)** – PIC design & fabrication, hybrid integration
- **Université de Montpellier (France)** – Laser growth on Si, photodetector growth
- **Technische Universität Wien (Vienna, Austria)** – Liquid spectroscopy, assembly/test of sensors
- **mirSense (France)** – MIR sensor products, laser module integration
- **Argotech a.s. (Czech Republic)** – Assembly/packaging of PICs
- **Fraunhofer IPM (Germany)** – Gas spectroscopy, instrument design/assembly
- **Endress+Hauser (Germany)** – Process gas analysis and expertise, testing validation

<http://optics.org/news/10/3/30>

Lockheed Martin-led group offers IR-enabled Falcon to counter missiles

Falcon is driven by Diehl's 40-km range Infra-Red Imaging System Tail/Thrust Vector-Controlled (IRIS-T) SLM interceptor.

Security and aerospace company Lockheed Martin, along with Diehl Defence and Saab have together launched the Falcon air defense weapon system, a short- and medium-range air defense solution.

The Falcon integrates Diehl's 40-km range Infra-Red Imaging System Tail/Thrust Vector-Controlled (IRIS-T) SLM interceptor and vertical launcher, Saab's 360-degree AESA Giraffe 4A radar through Lockheed Martin's flexible SkyKeeper command and control battle manager. Falcon's open architecture allows the system to be integrated into any air operations center.

Threats such as unmanned aerial systems carrying lethal payloads, cruise missiles that can attack from any direction, and fixed and rotary winged aircraft capable of

delivering ordnance at extended ranges, demand a technologically advanced counter measure, which the developers say that Falcon delivers.

'Next-generation air defense'

Scott Arnold, Lockheed Martin VP and deputy for Integrated Air & Missile Defense, commented "Our customers are looking for the next-generation short and medium range air defense solution. Falcon is a great example of our working with customers to identify potential gaps and find rapid-response solutions to take on today's evolving threats."

The Diehl IRIS-T SLM is a highly maneuverable interceptor fired from a 360-degree vertical launcher with the ability to engage multiple targets simultaneously in all weather conditions.

The Saab Giraffe 4A AESA radar offers high discrimination capabilities and leverages gallium nitrate technology to detect and track both fixed and rotary-wing aircraft and drones, while simultaneously featuring an Automatic Sense & Warn functionality.

Lockheed Martin's SkyKeeper command and control battle manager gives commanders unparalleled situational awareness with real-time early warning of incoming threats and optimized engagement solutions for critical decision making. Together, say the partners, "these elements make the Falcon weapon system the only integrated short and medium-range missile defense system available in the world with the capabilities required to defeat current and emerging air threats."

<http://optics.org/news/10/2/20>



Infra-ready: the new Falcon air defense weapon system.