Directory

Urban Air Mobility

Daedalean AG

The future of air transport is almost here. Situational Intelligence™ will soon herald its arrival.

Beyond just situational awareness, Situational Intelligence is the ability of a machine to understand and make sense of the current flight environment and then to anticipate and react to threats to flight safety. Put another way, it's a computer able to sense, analyse and respond to environmental situations – just like a human pilot does. But better.

In the near term, Situational Intelligence will provide indispensable pilot assistance in the fundamentals of flying, conveying to the pilot answers to three essential questions:

Where am I?
Where can I fly?
Where can I land?

One day soon, Situational Intelligence will act upon the answers to these questions enabling aircraft to fly autonomously, always with a human in control, but, quite possibly, without the need for human intervention.

Situational Intelligence will usher in a new era enabling all air transport to reach safety levels now possible only for the heavy infrastructure-burdened airlines and airports. The dream of air taxis and flying cars is now emerging from imagination as the new reality where distance and division are easily overcome. At scale, movement about the planet will be more accessible, providing more opportunity and equity to all.

The Technology for Autonomy

Coined by Daedalean, the leading software and hardware developer of pilotless flight, the term Situational Intelligence is made possible by a new level of flight control algorithms resulting from recent developments in artificial intelligence, or, more accurately, machine learning.

"Machine learning is central to our work in providing intelligent cockpit systems," says Luuk van Dijk, who founded Daedalean in 2016 along with Anna Chernova. *"It's a more specific term than the much bandied about 'AI'. Machine learning is, basically, training systems to learn to do a task without being explicitly programmed to do that task. We train a machine in the lab, for example, to recognise a runway so that it can recognise runways out in the world in real life."*

Out in the world, a live stream of video footage from cameras mounted on the exterior of an aircraft is fed to an onboard computer, which interprets and categorises in real time the various objects it detects: mountains, clouds, lakes, rivers, aircraft (and even specific aircraft types), masts, cranes, wires hanging between utility poles and, of course, runways, and for a rotorcraft – flat, clear areas that could serve as emergency landing options.

At the moment, video footage from the cameras is the only information the onboard computer processes.

"We based the initial version of our system solely on computer vision," says van Dijk. *"We chose to start with visual information because compared to other sensors like radar and lidar, training a machine to identify specific objects is the hardest function to design in the whole system. And visual information is the most useful – there is nothing more fundamental to flight than looking out the cockpit window to figure out where you are, where you can fly, and where you can land. With onboard computer and cameras, our system can do just that."*

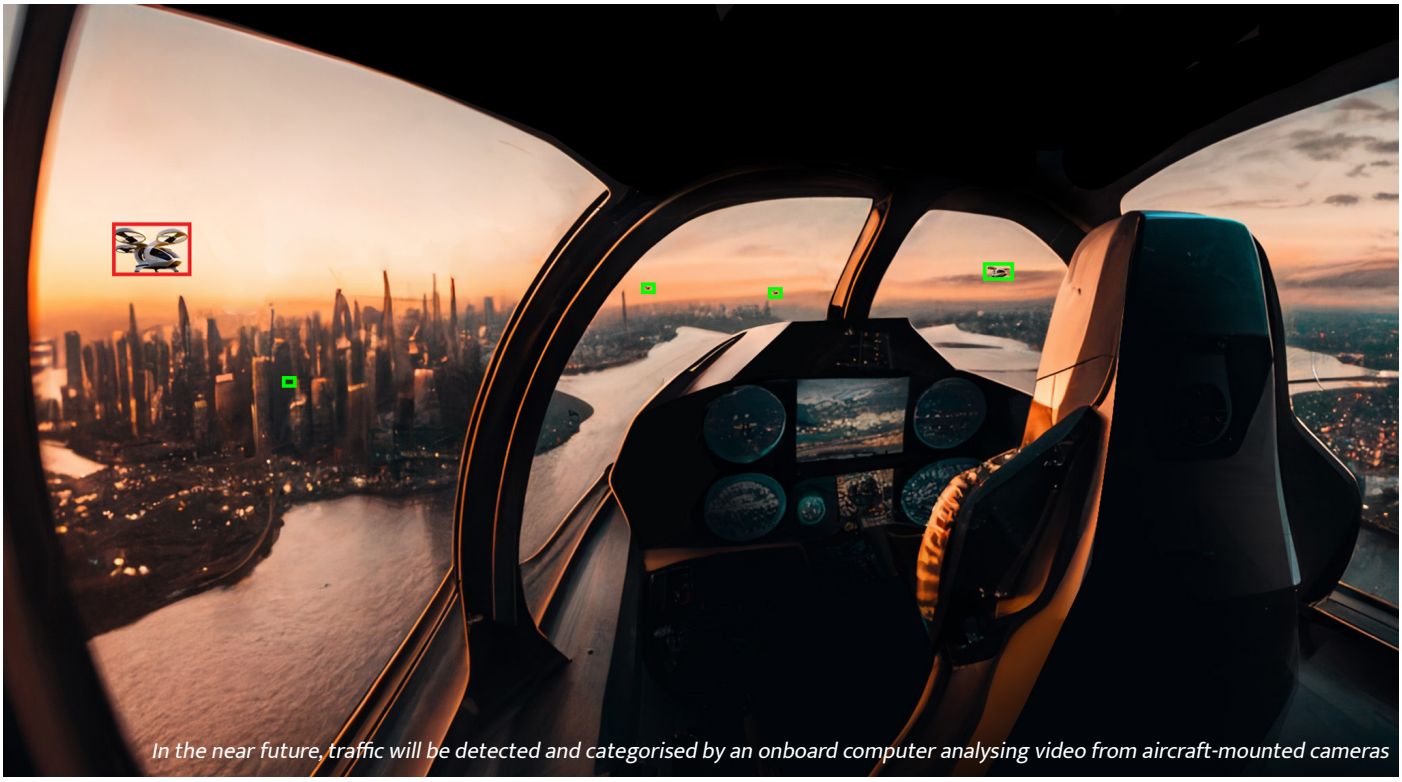
The first product to implement Daedalean's technology is about to hit the market. In a joint partnership, Daedalean and Avidyne Corporation, a well-established US-based provider of integrated avionics systems, flight displays and safety systems for general aviation and business aircraft, are developing, manufacturing and certifying the Avidyne PilotEye™ Visual System.

It is poised to become later this year the world's first certified machine learning application for a safety-critical case for civil aviation.

While the current version of PilotEye is capable of providing traffic detection, future versions will extend to the full suite of situational awareness functions, acquiring positioning and landing guidance as well – all based solely on visual data from the onboard cameras. And on Daedalean's roadmap, the next generation of the system will incorporate additional sensors to create a complete picture of situational awareness.

The next step forward expands the potential of AI to react to environmental conditions and anticipate problems. That is how Situational Intelligence is going to change the role of a human pilot – from managing all risk to overseeing a system that automates risk management. Aircraft will share data to create a web of information aloft. When aircraft inform each other about real-time conditions in the sky, co-ordinate their movements and intentions and report to each other on

Background Image: Visitors and local inhabitants could navigate untouched and fragile ecosystems with light environmental impact



In the near future, traffic will be detected and categorised by an onboard computer analysing video from aircraft-mounted cameras

observed threats to safety, the flight will be safer and a massive scale-up will be possible. At scale, the benefits to humankind are limitless.

Autonomy for the People

Transportation has a long history of improving human civilisation by expanding opportunity, quality of life and cross-cultural understanding. And while much recent attention has been focused on air taxis that promise to whisk passengers across town from gleaming vertiports capping downtown skyscrapers, the promise of Situational Intelligence goes well beyond the urban core and ultra-frenzied professionals fighting for time savings at any cost. Here are just some of the use cases to benefit:

Low-cost, life-saving autonomous aircraft could be quickly deployed to meet humanitarian crises

- One of the most important missions in all of aviation is emergency response, yet helicopter emergency medical service, or HEMS, continues to suffer among the most serious accident and fatality rates resulting from, for example, controlled flight into terrain, collisions with drones and birds and dangers at uncontrolled landing sites. Having a digital co-pilot in the cockpit would help the mostly single-pilot HEMS operations avoid these outcomes and allow the pilot's attention to focus on the rescue mission at hand.
- When humanitarian crises break out, time and cost are the two key factors in alleviating wide-scale human suffering. Fleets of low-cost, life-saving autonomous aircraft could be quickly deployed, preventing the increase of devastation that can compound if aid is not delivered immediately.
- In our rapidly globalising world, ever-decreasing areas of untouched and fragile ecosystems continue to be threatened by traditional modes of access – whether road, rail or airport-dependent

aircraft. But small, personal, electric rotorcraft would deliver visitors and ferry local inhabitants alike without needing to default to traditional development's destructive footprint.

- A less obvious but still significant consequence of the widespread adoption of low-cost, accessible air transportation may be its impact on freedom itself. Many rural, isolated, off-grid communities as well as under-resourced urban neighbourhoods suffer from a lack of access to healthcare options, educational possibilities and professional opportunities precisely because of their geographical segregation. If transportation were no longer an impediment, services could be rendered to (not to mention contributions to society made by) people who just happen to live in a certain community.
- Although we currently enjoy overnight-everything-delivery, we still can't ship time-sensitive cargo directly point-to-point at a price affordable to a broad segment of consumers. What might a world of low-cost, direct delivery look like? What would you want to send to, or receive from, far-off lands? Something from your favourite market back home? A chilled bottle from that rural microbrewery? Fresh farm-to-your-kitchen table fare? Or maybe your homesick soul has a hankering for grandma's apple pie. What if it could be delivered straight to you, almost piping hot?

The future of air transport is almost here. Situational Intelligence will help make the skies safer and the cost of traversing them lower. Machines are now learning how to fly better so that pilots can better accomplish their missions, cargo can quickly and cost-effectively reach its destination, and all people can more easily connect with resources and one another.

"We chose to start with visual information because compared to other sensors like radar and lidar, training a machine to identify specific objects is the hardest function to design in the whole system."

Luuk van Dijk, CEO and Founder, Daedalean AG

Get ready for take-off.

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APPLIED INTELLIGENCE

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