Singapore

Cutting-edge drones and unmanned vehicles to boost Singapore's surveillance capabilities

The V15 can take off and land vertically. (Photo: Howard Law)

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02 Nov 2017 06:46AM
(Updated: 02 Nov 2017 02:51PM)

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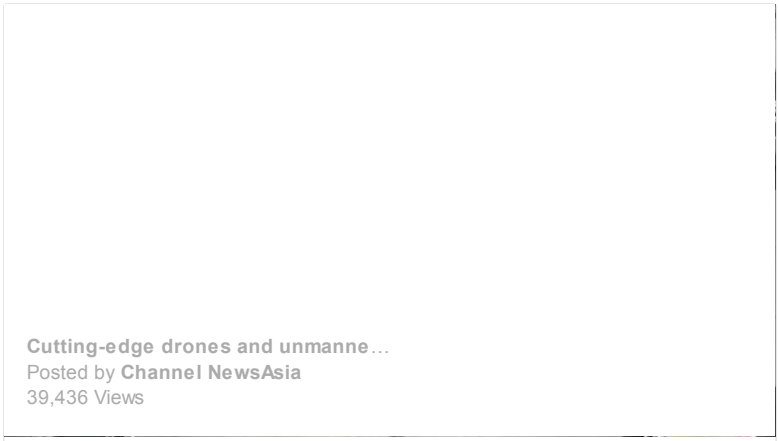
SINGAPORE: As wars are increasingly won and lost on urban battlefields, defence research and development organisation DSO has produced a game-changer in the region in terms of how surveillance is done.

The V15 is Singapore's first locally developed unmanned aerial vehicle (UAV) that can take off or land vertically.

A major breakthrough is its ability to team up with an unmanned ground vehicle (UGV), which can act as the drone's landing platform, to explore unfamiliar terrain.

Equipped with one day and one night camera, the V15 is used for surveillance in built-up areas where there is no space for conventional launch and recovery systems.



VIDEO: The V15 can take off from a space the size of a small table and can be assembled in just 2 minutes.

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"We can take off from very confined spaces, like from a small urban canyon or from the rooftop of a building," said Mr Jonathan Yong, a senior research engineer in DSO's guided systems division.

While the V15 can take off from a space the size of a small table, conventional UAVs require an area 10 times larger, Mr Yong said.

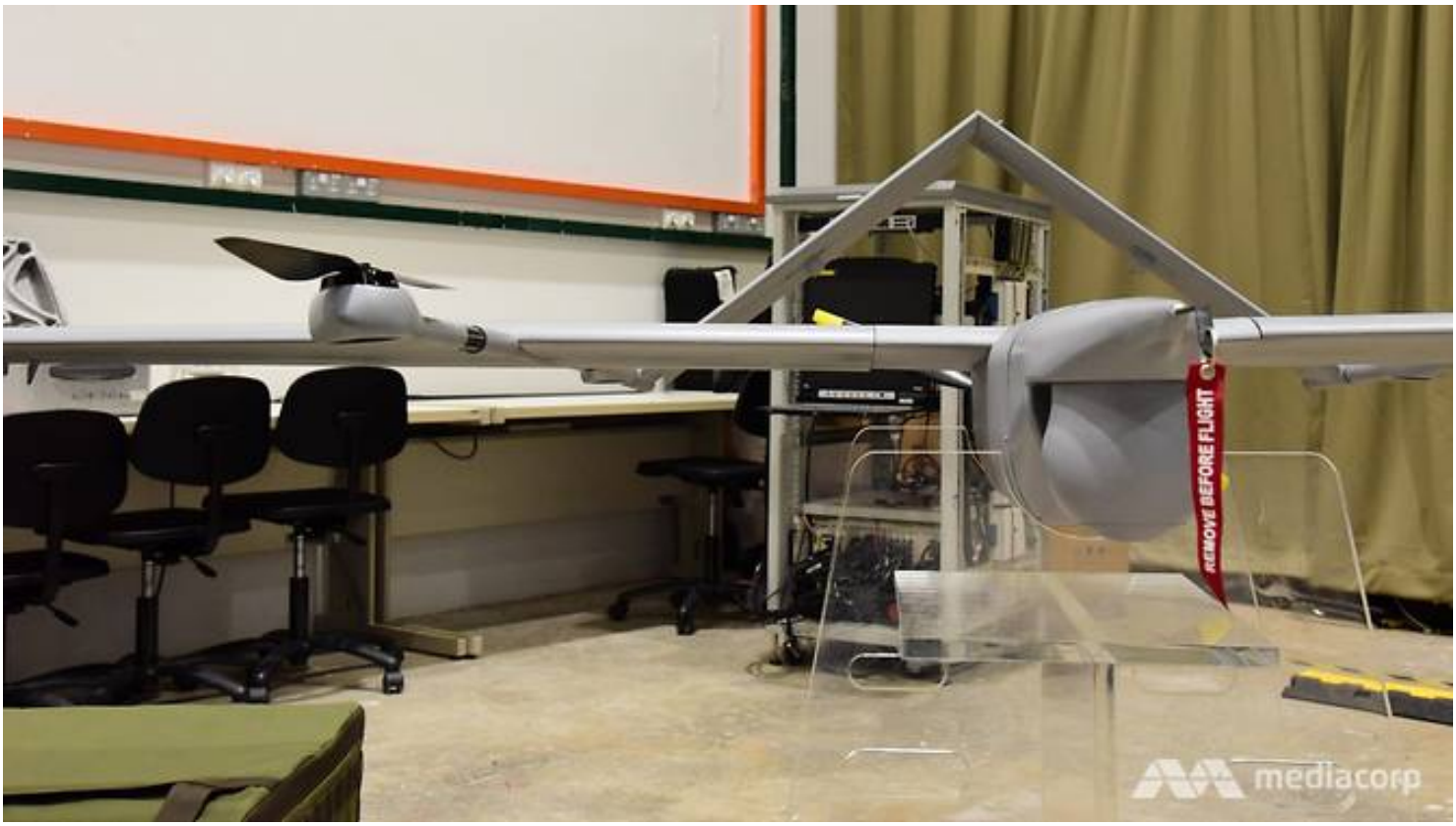
This is because they use a bungee launcher, which Mr Yong described as a "giant rubber band shooting a paper plane". In contrast, the V15 has four electric rotors that allow it to take off vertically.

Landing is a breeze too. While other UAVs land using a parachute or airbag, Mr Yong said, the V15's vertical landing capability is more accurate and "removes landing shock to the aircraft".

Improvements are also seen in set-up time.

Because the V15 can be assembled without tools, a two-man team can snap it together in two minutes. Combined with improved autonomous pre-flight checks, the drone is ready to go in less than 15 minutes.

This is two times faster than conventional UAVs, which require the set up of a bungee launcher, Mr Yong said. "When it comes to military operations, time is always of the essence."



The V15 can be assembled in less than two minutes without tools. (Photo: Howard Law)

During operations, the V15 uses onboard sensors to fly through waypoints. It also takes off and lands with the flick of a switch, Mr Yong said.

“So, you don’t have to have a trained pilot to operate the UAV,” he added. “All you have to do is plant waypoints on your tablet, tell it where to go and where to look.”

UNMANNED AIR-TO-GROUND TEAMING

The V15, which took two years to develop, is so smart that it can even take off and land on a moving unmanned ground vehicle or driverless vehicle.

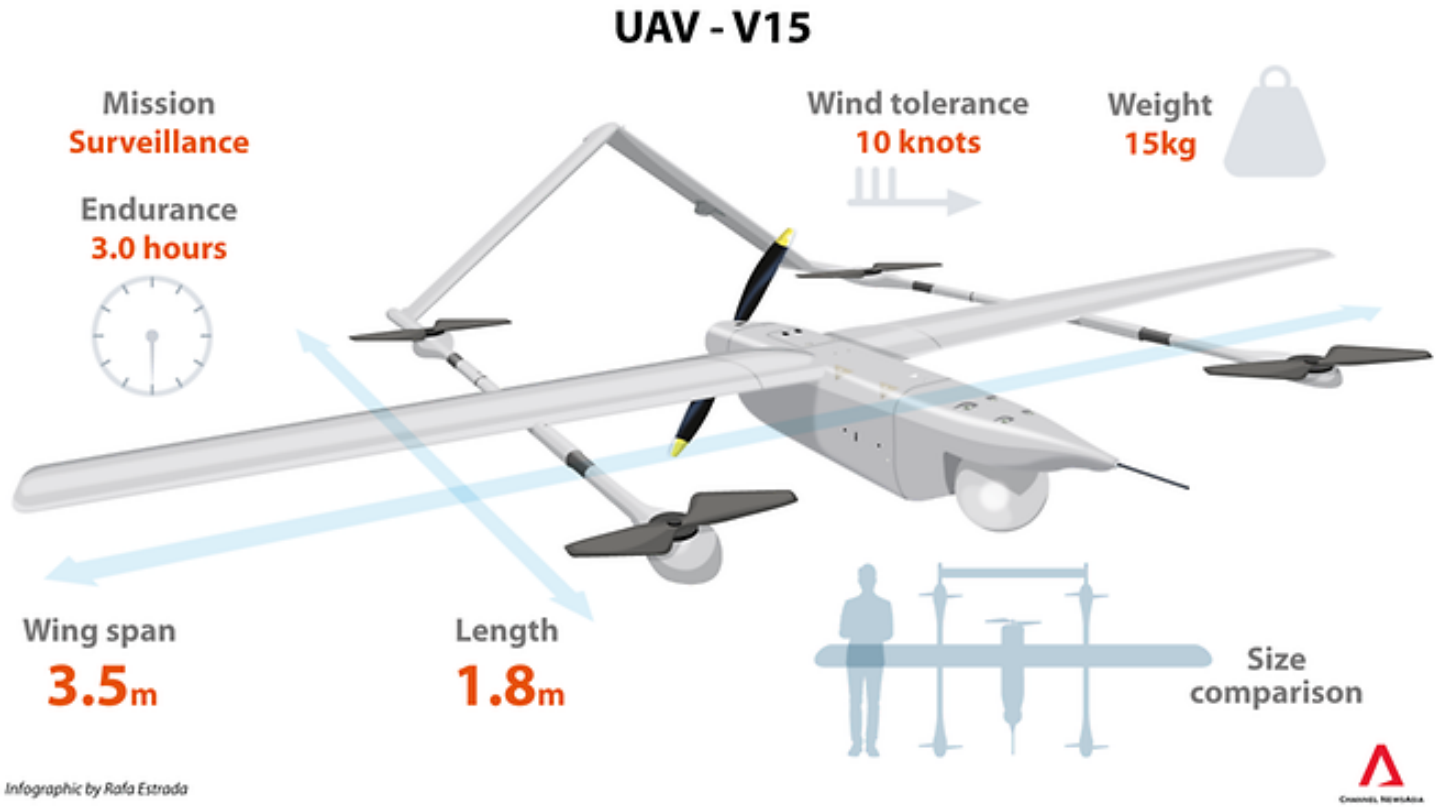
“It’s able to use vision sensors to home in on a tracker board on top of the vehicle and come in for landing after a mission,” Mr Yong said.

The V15 can take off and land on a moving unmanned ground vehicle. (Photo: DSO)

This is useful, for example, when a driverless truck is being used to deliver supplies in unfamiliar territory. “What you will do is send the drone to pave the way and make sure that it is safe for the unmanned ground vehicle,” he added.

Weapons and Equipments Editor at Jane's by IHS Markit Kelvin Wong said the technology on the V15 is "nothing groundbreaking", but noted that DSO is highlighting a "high level of control and integration, especially with another unmanned vehicle".

"Vertical take-off and landing type UAV designs are already mature at this stage, with numerous products already available to civilian and military users alike," he said, adding that American and Israeli companies have developed similar designs.



The V15 specifications. (Source: DSO)

According to an Aerospace and Defence News report, citing a 2016 MarketForecast study, the market for military vertical take off and landing UAVs will grow from S$110.4 million in 2016 to S$535.7 million in 2022.

Countries that have "bought or intend to buy" such UAVs include the United Arab Emirates, South Korea and the Philippines, the report added.

"As far as I am aware, regional forces still use conventional designs and launch and recovery methods," Mr Wong said.

NO GPS REQUIRED

Meanwhile, the unmanned vehicle is designed to operate in areas where Global Positioning System (GPS) does not really work, like in thick forests or dense urban areas with tall buildings.

This capability is the first of its kind worldwide, said Mr Stephen Chai, a system engineer who works on the driverless vehicles.

In the absence of GPS, it navigates using lasers or cameras. The lasers map precise distances, while the cameras provide a visual and textural representation of the terrain. The team is working on integrating the two.

“With all these capabilities, what you can do is just give a waypoint and it will drive there by itself, day and night, while avoiding static and dynamic obstacles,” Mr Chai said. “All these without much intervention from the operator.”

In addition, Mr Chai stressed that the unmanned ground vehicle technology is platform-independent.

For example, it has been tested on vehicles as small as a robot vacuum cleaner and as big as an armoured troop carrier. Right now, it is being trialed on a commercial pick-up truck.

The unmanned ground vehicle can navigate without GPS by using lasers or cameras. (Photo: DSO)

“We can adapt these sensors to different platforms in accordance to the needs of the SAF (Singapore Armed Forces),” he said. “They have a whole fleet of vehicles, so whatever they need that for, we will adapt it.”

This opens up the possibility of having an unmanned tank paired with a V15 charge into battle, but Mr Chai was quick to point out that the team is focused on developing the technology and reducing manpower for surveillance.

The team is also scaling up the project so multiple V15s and unmanned vehicles can work together simultaneously, Mr Yong said. “Anything in our arsenal, we’re linking them all together. We’re teaming whatever is available to us to form a bigger picture of things.”

Besides wartime missions, these unmanned teams can be used for homeland security. For instance, Mr Yong said, unmanned vehicles can supplement police cars in providing regular patrols.

“So, we relieve manpower requirements from local law enforcement to further improve our round-the-clock surveillance of the country," he added.

Source: CNA/hz