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# **CARGO DRONES MAY BE THE FUTURE OF DELIVERY SERVICE**

**DESIGNS FOR MILITARY AND CIVILIAN  
APPLICATION**



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## WHAT ARE THEY?

Cargo Drones, Cargo Air Vehicles, or Heavy Lift Drones are the latest in unmanned aerial vehicle (UAV), or drone, technology. These pieces of equipment are being developed to transport cargo manually, remotely, and autonomously and may be used in civilian and military applications (Using cargo drones in last-mile delivery | Deloitte, 2018). Boasting impressive carrying power, cargo drones can lift anywhere from 2.26 to 2449.39 kilograms (Team, 2021). This carrying power establishes new possibilities for the delivery of packages without direct human involvement and may therefore be used to deliver lifesaving supplies to dangerous locations. The technology is also more environmentally friendly than traditional delivery services. Cargo drones are most commonly “electric or hybrid-electric vehicles with four or more rotors” (Using cargo drones in last-mile delivery | Deloitte, 2018). Some cargo drones can take off and land from a standing position, known as either an eVTOL (electric vertical take-off and landing) vehicle or VTOL (vertical take-off and landing) vehicle. VTOL makes cargo drones more versatile than cargo planes as they do not require a runway for operation. Many companies are in the process of developing proprietary cargo drone technology to improve upon traditional forms of delivery services.

## CIVILIAN APPLICATIONS

Apple, Google, Amazon and other delivery service enterprises have seen the possibilities of this technology and invested in cargo drone research and development to speed their delivery services and create a fleet of heavy lift drones which operate as autonomous airfreight (Using cargo drones in last-mile delivery | Deloitte, 2018). This technology is also being developed by Boeing, Sabrewing, and drone specialists. These companies have invested in research and development to create faster end to end delivery systems and improve customer satisfaction. By investing in cargo drone technology, companies are working to solve problems created by the standard postal delivery system, such as clogged roadways, delayed deliveries, and pollution.

Today, cargo drones have a limited civilian application but a wealth of possibilities. Canada and African countries are using cargo drones to reach remote destinations and deliver medicine, while the Netherlands are investigating whether they can do the same to reach the remote island of Schiermonnikoog (Using cargo drones in last-mile delivery | Deloitte, 2018).

## WHAT HAS BEEN DEVELOPED FOR CIVILIAN APPLICATION?

Boeing, Sabrewing, and Elroy air are just some of the companies developing this technology. Naturally, each company is developing a different form of cargo drone to meet various market demands.

Boeing, the largest aerospace company in the world and manufacturer of commercial jetliners, defence, and security equipment, first unveiled their Cargo Air Vehicle (CAV) in 2018. The CAV is an eVTOL which has been produced for the transport of payloads and goods. With twelve rotors, the CAV is six metres wide weighing more than 450 kilograms and designed to carry a payload of 227 kilograms (Cargo Air Vehicle, n.d.). The UAV is tested several times a day – weather dependent – and “typically flies no farther than a mile, no higher than 400 feet (120 metres) and no longer than three minutes during testing” (Boeing: Cargo Air Vehicle: Boeing Tests the Advanced Technology behind Its Cargo Air Vehicle., n.d.). These short flight tests are priming the vehicle for short distance transport of large hauls.

Name	Rotors	Payload carry	Flight Distance	Flying Height	Width	Weight
Cargo Air Vehicle	12	227kg	1 mile	120m	6m	450kg

**Sabrewing Aircraft Company (SACO)** is focused on the development and manufacturing of unmanned heavy-lift commercial cargo air vehicles. Their current project, the Rhaegal RG-1, is a 4.6-metre-high VTOL, with a wingspan of 17 metres that is capable of carrying a payload of up to 2,455 kilograms (“Cargo UAV,” n.d.). The Rhaegal RG-1 flies in all weather conditions and can travel 1850 kilometres with a cruise speed of 370 kilometres per hour (“Cargo UAV,” n.d.). Unlike Boeing’s CAV, the Rhaegal carries cargo inside a cargo bay boasting a roller floor and space for three cargo containers (“Cargo UAV,” n.d.).

Name	Height	Wingspan	Payload Carry	Flight Distance	Cruise Speed
Rhaegal RG-1	4.6m	17	2,455kg	1,850km	370km/h

**Elroy Air’s** mission is the same-day delivery of goods for people all over the world. The company is concentrated on advancing the technology of cargo drones and fabricating autonomous cargo aircraft systems for express shipping purposes. Elroy Air believes that their technology will, “expand the reach of express shipping, provide humanitarian aid in regions with challenging infrastructure, immediate relief in disaster situations, and enable rapid autonomous aerial resupply to troops in the field” (Elroy Air, n.d.). Elroy Air’s current project, titled the Chaparral, is a VTOL aerial cargo platform equipped to carry up to 226 kilograms over a 482-kilometre range (Elroy Air, n.d.). The company has improved upon the original version of the Chaparral by adding a cargo pod however, unlike the Rhaegal, the Chaparral is designed for lightweight cargo with the intention of quickly delivering several small payloads each day (Elroy Air, n.d.)

Name	Payload Carry	Flight Distance
Chaparral	226kg	482km

**Dronamics** has developed 'The Black Swan', which aims at improving upon the standard cargo aircraft via UAV technology. Dronamics sees a wide range of application for this technology including delivery of e-commerce goods, medical supplies, perishable foods, automotive parts, valuables, and mining sites supplies (Home | Dronamics Delivering Today, n.d.). The Black Swan has a wingspan of 16 metres and stands at a height of 4 metres (Home | Dronamics Delivering Today, n.d.). It can transport a 350-kilogram payload over 2,500 kilometres at a maximum speed of 200 kilometres per hour (Home | Dronamics Delivering Today, n.d.). The Black Swan flies autonomously and is monitored and managed via satellite (Home | Dronamics Delivering Today, n.d.). This is not VTOL technology and therefore requires at least a short unpaved runway for take-off and landing to ensure same day delivery. The Dronamics air network reaches Europe and beyond.

Name	Wingspan	Height	Payload Carry	Distance	Max Speed
The Black Swan	16m	4m	350kg	2,500km	200km/h

## DESIGNS FOR MILITARY APPLICATION

Based on the civilian applications, it would seem that cargo drones could be an asset in the military setting for deliveries to high-risk areas. This technology has the possibility to prevent potentially fatal military resupply trips made by land; they would also accelerate the delivery process. To meet this need, Silent Arrow has developed four platforms for military application: the GD-2000 Glider, GD-2000 WB Glider, SA-PGB, and ER-2500 (Arrow, n.d.).

Silent Arrow's device, "is a tandem-wing, precision delivery vehicle developed for the U.S. Department of Defense to conduct resupply missions when overland delivery is infeasible or undesirable" ("Silent Arrow® for resupply and relief", n.d.). Their GD-2000 Glider can carry 680 kilograms of cargo through battlegrounds using GPS to reach the correct destination. The GD-2000 WB Glider has a wider body and is 60% larger than the GD-2000 Glider and carries 635 kilograms. The SA-PGB can fly at a height of 13 metres carrying 158.7 kilograms. The ER-2500 has VTOL technology, and the capability to make airdrops ("Silent Arrow® for resupply and relief", n.d.). The company has also developed the Mercy-2000, a cargo UAV for civilian use specially for humanitarian relief after natural disasters and during global pandemics or famine.

Name	Payload Carry
GD-2000 Glider	680kg
GD-2000 WB Glider	635kg
SA-PGB	158.7kg
ER-2500	Unknown

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**KAMAN Air Vehicles** are an engineering company developing innovative solutions to challenges in the aerospace and defence markets. KAMAN has created the KARGO UAV for military application, a 2.2-metre-high cargo drone which can fold from 7.4 metres wide to 2.2 metres to fit inside a standard shipping container (“Kargo,” n.d.). The KARGO UAV can self-deploy beyond 926 kilometres, carries a payload of up to 362 kilograms, and travels at 224 kilometres per hour (“Kargo,” n.d.). The technology has been designed for true autonomy, and “will sense and avoid obstacles en route, and deliver payloads with pinpoint accuracy” (“Kargo,” n.d.).

Name	Height	Width	Folded Width	Self-Deploy Distance	Payload Carry	Speed
KARGO UAV	2.2m	7.4m	2.2m	926km	362kg	224km/h

## THE FUTURE OF TECHNOLOGY

Cargo drones offer a copious array of benefits to militaries and civilians around the world. Their use improves delivery times and brings immediate relief to victims of natural disasters and they prevent personnel on the ground from embarking on dangerous resupply missions. These pieces of equipment are faster than traditional delivery services in both military and civilian applications, and in military use some are designed to allow for airdrops. Cargo drones release fewer carbon emissions than traditional delivery services, improve operational efficiency, and require less human interaction therefore making them a better option for transport to dangerous – or potentially dangerous – locations.

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