



# Aviation Investigation Final Report

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<b>Location:</b>	Beeville, Texas	<b>Accident Number:</b>	DCA19CA170
<b>Date &amp; Time:</b>	June 21, 2019, 08:42 Local	<b>Registration:</b>	N243XT
<b>Aircraft:</b>	Boeing CV2	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Nav system malfunction/failure	<b>Injuries:</b>	N/A
<b>Flight Conducted Under:</b>	Part 91: General aviation - Flight test		

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## Analysis

On June 21, 2019, at 0842 central daylight time (CDT), N243XT a Boeing CV2-Cargo Air Vehicle (CAV), unmanned aircraft system (UAS), sustained substantial damage during a contingency landing during a test flight at Chase Industrial airport (TX2), Beeville, TX.

This aircraft is a large UAS with 12 electric motors and 12 propellers mounted in the horizontal or near-horizontal plane. It is a developmental platform for unmanned cargo operations. The pilot does not control the flight path, speed or attitude of the aircraft in flight, all flights are preprogrammed. The only ability the pilot or ground control station operator has to affect the flight is through contingency management via the "abort to planned zone" (APZ), "land now" or "cut power" (terminate the flight) commands.

Flight testing of the aircraft had been going on for several weeks, with approximately 45 flights completed. Test flights were very short in duration, no longer than 4 minutes. According to the manufacturer/operator, the accident flight was a planned 30 knot flight over the grass area between the runway and the taxiway. All preparations for the flight were normal. After takeoff and turning on course to parallel the runway/taxiway, the aircraft started to deviate from the programmed flight profile. The flight test area included a two-level geo-fence boundary to keep the aircraft contained within a safe area. The aircraft identified the deviation and autonomously triggered an "abort to planned zone" (APZ). The APZ is a contingency plan where the aircraft stops the current flight and immediately turns towards the closest planned landing zone (in this case, the taxiway) and begins the approach. However, the aircraft continued the lateral deviation. The aircraft reached the first geo-fence boundary and then autonomously executed a "land now" command where the aircraft immediately begins a landing regardless of its position. The aircraft appeared to adjust pitch attitude for the abort to planned zone landing and drifted towards the second geo-fence boundary. Upon reaching the outer geo-fence, the aircraft autonomously cut power to all motors and dropped to the ground, as designed. The aircraft was substantially damaged, there were no injuries. The aircraft remained within the test area.

A review of the flight data by the manufacturer/operator revealed that the lateral deviation initiated due to higher than expected and accounted for wind, which resulted in high vibration within the aircraft navigation system. The contingency logic was unable to return the aircraft to the planned abort zone prior to reaching the outer geo-fence. The manufacturer/operator determined that there had been insufficient tests related to high crosswinds, and insufficient ability to determine winds during test flights. Additionally, the manufacturer/operator determined that the physical separation between the abort to planned zone (APZ) and geo-fence locations was inadequate for the aircraft to maneuver considering the wind and other environmental factors.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A higher than expected and accounted for crosswind which initiated a lateral deviation, and resulted in the aircraft reaching the limits of the geo-fence area triggering a contingency forced landing.

### Findings

<b>Aircraft</b>	Maximum crosswind component - Capability exceeded
<b>Aircraft</b>	Global positioning sys (GPS) - Capability exceeded

## Factual Information

### History of Flight

<b>Enroute</b>	Nav system malfunction/failure (Defining event)
<b>Emergency descent</b>	Off-field or emergency landing

### Pilot Information

<b>Certificate:</b>	Commercial; Flight instructor	<b>Age:</b>	51
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	None
<b>Other Aircraft Rating(s):</b>	Gyroplane; Helicopter	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane; Helicopter	<b>Second Pilot Present:</b>	
<b>Instructor Rating(s):</b>	Gyroplane; Helicopter; Instrument helicopter	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	December 6, 2018
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	March 28, 2019
<b>Flight Time:</b>	5662 hours (Total, all aircraft), 1 hours (Total, this make and model), 5326 hours (Pilot In Command, all aircraft), 14 hours (Last 90 days, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Boeing	<b>Registration:</b>	N243XT
<b>Model/Series:</b>	CV2	<b>Aircraft Category:</b>	Helicopter
<b>Year of Manufacture:</b>	2018	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Certificate of authorization or waiver (COA)	<b>Serial Number:</b>	004
<b>Landing Gear Type:</b>	Ski	<b>Seats:</b>	0
<b>Date/Type of Last Inspection:</b>	March 20, 2019	<b>Certified Max Gross Wt.:</b>	1200 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	
<b>Airframe Total Time:</b>	4.5 Hrs at time of accident	<b>Engine Manufacturer:</b>	
<b>ELT:</b>	Not installed	<b>Engine Model/Series:</b>	
<b>Registered Owner:</b>	Boeing	<b>Rated Power:</b>	
<b>Operator:</b>	Boeing	<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>		<b>Distance from Accident Site:</b>	
<b>Observation Time:</b>		<b>Direction from Accident Site:</b>	
<b>Lowest Cloud Condition:</b>	Scattered / 2000 ft AGL	<b>Visibility</b>	
<b>Lowest Ceiling:</b>		<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	10 knots / 6 knots	<b>Turbulence Type Forecast/Actual:</b>	/
<b>Wind Direction:</b>		<b>Turbulence Severity Forecast/Actual:</b>	/
<b>Altimeter Setting:</b>		<b>Temperature/Dew Point:</b>	
<b>Precipitation and Obscuration:</b>			
<b>Departure Point:</b>	Beeville, TX (TX2)	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Beeville, TX (TX2)	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>		<b>Type of Airspace:</b>	Class G

## Airport Information

<b>Airport:</b>	Beeville TX2	<b>Runway Surface Type:</b>	
<b>Airport Elevation:</b>	184 ft msl	<b>Runway Surface Condition:</b>	
<b>Runway Used:</b>	13	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	8000 ft / 200 ft	<b>VFR Approach/Landing:</b>	None

## Wreckage and Impact Information

<b>Crew Injuries:</b>	N/A	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	N/A	<b>Latitude, Longitude:</b>	28.363611,-97.664169

## Administrative Information

**Investigator In Charge (IIC):** English, William

**Additional Participating Persons:**

**Original Publish Date:** March 27, 2020

**Last Revision Date:**

**Investigation Class:** [Class](#)

**Note:** This accident report documents the factual circumstances of this accident as described to the NTSB.

**Investigation Docket:** <https://data.nts.gov/Docket?ProjectID=99683>

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