



**Australian Government**

**Australian Transport Safety Bureau**

# In-flight break-up involving a DJI S900 remotely piloted aircraft

Toowoomba, Queensland, on 19 September 2015

**ATSB Transport Safety Report**  
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#### **Addendum**

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# In-flight break-up involving a DJI S900 remotely piloted aircraft

## What happened

On 19 September 2015, the flight controller of a DJI 'Spreading Wings' S900 remotely piloted aircraft (RPA), prepared to conduct aerial photography in Toowoomba, Queensland.

As part of the preparations, the flight controller identified potential hazards associated with the planned operation. The flight was to be conducted over a populated area, and within 3 NM of the Toowoomba aerodrome. The risk assessment included the identification of suitable emergency landing sites for the RPA. The RPA was designed to be capable of flight in the event of one rotor failure, and was also fitted with a parachute. The parachute deploys automatically in certain conditions, and deployment can also be commanded by the flight controller.

The flight controller conducted a daily inspection of the RPA, and found it to be serviceable, including no evidence of damage or cracking to the arms.

Prior to the flight, the flight controller conducted the pre-flight checks and made the appropriate broadcasts on the Toowoomba common traffic advisory frequency (CTAF). The flight controller performed control checks and verified that the controls were working correctly on the ground.

At about 1415 Eastern Standard Time (EST), the flight controller launched the RPA from the rooftop of a nine-storey building. The flight controller again performed control checks, and then commanded the RPA to climb out to the north-northeast. About 30 seconds after becoming airborne, the flight controller heard a loud crack and observed the RPA roll rapidly onto its back. The flight controller commanded the parachute to deploy, but the RPA descended rapidly and collided with the roof of a parked car in the street below.

The RPA was destroyed, the car roof was dented, and no one was injured.

## ***RPA serviceability***

The RPA had a total time in service of 10.1 hours prior to the incident flight. Six arm tubes connect the motors to the main frame. The No. 5 arm, constructed of carbon fibre, was fractured, but remained attached to the main frame by the motor cable running through it.

The parachute had deployed and the gas canister used to deploy it was empty, but the parachute did not effectively decelerate the RPA. This was probably due to the RPA being on its back and preventing the parachute from opening properly.

## ***Arm inspection***

The ATSB conducted a visual inspection of the fractured arm. The arm was primarily comprised of plies of unidirectional carbon fibre tape. The ply orientation alternated between running parallel to the tube length and 90° to the tube length. The outer layer of the tube was woven carbon fabric with a clear gel coat.

Within the unidirectional plies around the fracture site, there were regions where the carbon fibres were not well consolidated or bonded with the resin matrix. Figure 1 shows some of the loose filaments observed on the innermost layer of the tube.

DJI Spreading Wings S900



Source: dji.com

**Figure 1: Innermost layer showing loose filaments**



Source: ATSB

***Distributor comments***

The Australian distributor of the DJI S900 advised that their pre-sales testing included the following.

- During the process of assembly and configuration of the UAV system, all arms were raised and lowered numerous times.
- Upon installation of each arm, each arm was tested individually to ensure correct tension on the arm screws, light horizontal pressure was applied to ensure there is no lateral movement in the arm when it is locked, and to listen for any stress sounds that may emanate from the carbon fibre and/or connecting joints.
- The UAV system was tested to ensure proper and consistent functionality of the system. This included flying ‘full stick’ in all directions, and sudden stops.

***Australian Certified UAV Operators Incorporated (ACUO) comments***

The ACUO advised that they had no known issues regarding motor arm failures of DJI products.

**ATSB comment**

The ATSB was unable to determine whether or not pre-existing damage was present from prior operation or transit. However, the ATSB identified regions close to the fracture surface where fibres were not well consolidated within the resin. This may have affected the strength of this arm, possibly resulting in the in-flight failure.

The observed lack of bonding between fibre and resin is a result of manufacturing processes and would not have been caused by damage during transport or operation.

Even under maximum loads, the flight tests performed by the distributor may not necessarily identify defects (such as poor bonding between fibre and resin) within the manufactured carbon fibre tube, regardless of whether or not these defects ultimately result in failure. This is because subsurface cracks can propagate unpredictably in fibre composites. Failure can occur at a later time and even when the arm is experiencing loads below its designed maximum.

Despite this, the ATSB is unaware of any other arm failures on this model RPA, indicating that the design and properties of the arms are probably appropriate for the intended application.

## Safety message

This incident highlights the importance of appropriate RPA operational controls and procedures. These are particularly important where operations are intended in the vicinity of populous areas or other traffic. The careful application of operational controls and procedures, underpinned by robust risk assessment, is essential as RPA use increases.

Information about remotely piloted aircraft systems (RPAS) is available from the [CASA website](#).

## General details

### Occurrence details

Date and time:	19 September 2015 – 1415 EST	
Occurrence category:	Accident	
Primary occurrence type:	In-flight break-up	
Location:	Toowoomba, Queensland	
	Latitude: 27° 32.48' S	Longitude: 151° 54.75' E

### Aircraft details

Manufacturer and model:	DJI Spreading Wings S900
Type of operation:	Aerial work – Survey/Photography
Damage:	Destroyed

## About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

## About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an

investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.