

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Parrot Anafi	
<b>No &amp; Type of Engines:</b>	4 electric motors	
<b>Year of Manufacture:</b>	2020 (Serial no: P1040505AA0K000249)	
<b>Date &amp; Time (UTC):</b>	19 February 2021 at 1400 hrs	
<b>Location:</b>	Highlands Road, Fareham, Hampshire	
<b>Type of Flight:</b>	Commercial Operations (UAS)	
<b>Persons on Board:</b>	Crew - None	Passengers - None
<b>Injuries:</b>	Crew - N/A	Passengers - N/A
<b>Nature of Damage:</b>	Battery and front left propeller arm detached, both front propellers damaged.	
<b>Commander's Licence:</b>	Other	
<b>Commander's Age:</b>	34 years	
<b>Commander's Flying Experience:</b>	11 hours (of which 11 were on type) Last 90 days - 5 hours Last 28 days - 4 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

**Synopsis**

A failure of the bonding between two halves of the front left propeller arm may have caused the unmanned aircraft to repeatedly lose control in flight until it collided with trees. The aircraft was substantially damaged.

The manufacturer has notified the five other UK owners of the Parrot Anafi USA aircraft to inspect the propeller arms and return the aircraft to their supplier for replacement propeller arms if the bonding problem is identified.

**History of the flight**

The unmanned aircraft (UA) was operating at 58 m agl to maintain a minimum distance of 50 m from nearby buildings. The UA was stable and hovering without difficulty, the weather was overcast but with good visibility and low wind. After the UA was repositioned, the operator looked down at his electronic tablet to check the remaining battery life and the camera image. When he looked back at the UA, it was spinning and descending towards the nearby buildings. By applying full thrust, the pilot was able to stabilise the aircraft and regain height. There was a minor gust of wind a few seconds later but the UA remained stable and in the same position. During the spinning event, there had been no vibration feedback through the controller to indicate a problem with the aircraft or the controller.

The pilot kept his eyes on the aircraft to maintain visual line of sight so he could react quickly if the loss of control reoccurred. He had decided to return the UA to the launch site but a few seconds after turning the aircraft around, it spun violently and started to descend. Once again, the pilot regained control by applying full thrust and he activated the return to home function. The pilot was unsure if this was effective because he was also using the hand controller to manually control the UA's return flight. The aircraft was returning to the launch area when it suddenly spun violently again before flying over the heads of the pilot and observer and colliding with trees in nearby woodland.

### Accident site

Most of the UA was found at the base of the trees, however, the main body upper casing, the upper half of the front left propeller arm and the battery pack were discovered in a nearby clearing next to a car park. The lower half of the propeller arm and one blade from each of the front propellers could not be located.

### Aircraft information

The Parrot Anafi USA is a small Class C1 drone<sup>1</sup> with a maximum takeoff weight of 501 grammes. The body of the UA contains the battery, flight and camera control circuitry, communications link to the ground controller and flight sensors. Gimbal stabilised optical and thermal imaging cameras are mounted on the front of the body. Lift and flight capability is provided by four 60 watt electric motors each mounted on an arm attached to the aircraft body (Figure 1). Each motor powers two propeller blades.



**Figure 1**  
Parrot Anafi USA

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### Footnote

<sup>1</sup> A Class 1 drone weighs less than 900 grammes with a maximum speed of 15 m/s and includes certain safety features. CAP722 Chapter 3, *Unmanned Aircraft System Operations in UK Airspace – Guidance*, 5 November 2020. Available at [https://publicapps.caa.co.uk/docs/33/CAP722%20Edition8\(p\).pdf](https://publicapps.caa.co.uk/docs/33/CAP722%20Edition8(p).pdf) [accessed April 2021].

## Aircraft examination

Examination of the remains of the front left propeller arm revealed the bonding between the upper and lower halves of the arm had failed allowing the two halves to separate (Figure 2).



**Figure 2**

Recovered aircraft, battery, and motor arm plus an example of bonding failure

Three other UAs had also been discovered with similar bonding faults, two before the incident flight during the operator's pre-use checks and one after the incident by the manufacturer.

## Analysis

If separation of the two halves of the front left propeller arm had occurred in flight, it is likely the upper arm containing the motor and propeller would have lost rigidity allowing the arm to bend and twist unpredictably due to a combination of lift and gyroscopic forces from the propeller and vibration from the motors. The increased bending and twisting would have resulted in variations in the direction of thrust produced by the front left propeller. The UA's flight control system may have been unable to compensate for this resulting in the repeated loss of control. It is also possible that these forces caused the lower half of the arm to fail and break away from the UA during its return to the launch point.

## Other information

During consultation between the operator of the UAS and the manufacturer it was determined that six of the operator's 10 Anafi USAs were included in a batch of 269 which the manufacturer had identified as potentially suffering from propeller arm bonding problems. Inspection confirmed that four of the six UAs showed bonding failures, including the accident aircraft. All four were sent to the manufacturer for repair. The manufacturer recommended that a strong adhesive tape should be used to secure the upper and lower halves of the propeller arms of the two remaining UAs from the same batch. The manufacturer has since stated that they could not reproduce the symptoms experienced by the customer and similar failures had been cosmetic rather than causing control problems.

The manufacturer identified a further five UAs from the affected batch that were sold in the UK and have contacted the operators to request they return the aircraft to their supplier to have the propeller arms replaced if the bonding problem is present.

### **Conclusion**

Failure of the bonding between the upper and lower halves of the front left propeller arm may have caused loss of control of the aircraft and resulted in a collision with nearby trees. The UA has been repaired by the manufacturer together with a further three of the operator's aircraft that were discovered with similar bonding problems.

The manufacturer has notified the UK operators of a further five Anafi USAs that may have similar propeller arm bonding problems, to inspect the bonding and return the aircraft to their supplier for replacement propeller arms if the bonding problem is present.