Safety recommendation no. 588

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Safety deficit	About one minute after take-off at the University of Zurich (UZH) Irchel, the M2 V9 drone automatically triggered the flight termination system (FTS) and initiated an emergency descent with a parachute. After ejecting the parachute, the connecting rope broke and the drone hit the forest floor without deceleration and was destroyed. As the investigation showed, the applied firmware of the flight controller based on the software version ArduCopter 3.5.0-rc5 was only capable of using two of the three available inertial measurement units (IMU) for the flight control of the drone. As a result, the flight controller's software lacked the ability, known as resilience, not to fail completely in the event of malfunctions or the failure of individual components, but to maintain control of the drone. Only from software version 3.6.12 onwards was it possible to achieve this resilience with the corresponding configuration of the safety-critical parameter ("EK2_IMU_MASK = 7"), as published in a discussion forum of the flight controller manufacturer as Service Bulletin SB 0000002. In the case of the accident involving the largely identical drone SUI-9909 on 25 January 2019 (cf. summary report), the FTS was also immediately triggered due to a loss of the GPS signal. As the investigation showed, the drone's flight attitude was still stable at this time and thus a landing under engine power, either manually controlled on sight or autonomously, would not have been fundamentally impossible. When operating under extreme climatic conditions, corresponding flight-critical parameters such as ambient temperature and humidity are not included in practice. This would allow a flight mission to be aborted early or not carried out at all under certain conditions.
Safety recommendation	The Federal Office of Civil Aviation (FOCA) should ensure that operators of drones that are used in scenarios with higher risk – in particular for flights beyond the visual line of sight (BVLOS) over populated areas – comply with Service Bulletins on flight-critical components or their software.
Addressees	BAZL Bundesamt für Zivilluftfahrt
Stage of the implementation	Implemented – In a letter dated 29 September 2023, the Federal Office of Civil Aviation (FOCA) commented as follows: "The Federal Office of Civil Aviation (FOCA) is in partial agreement with Safety Recommendation (SE) No. 588. The FOCA is not the competent authority for monitoring the conformity of the design and continuous airworthiness of an unmanned aircraft. The roles and responsibilities of the competent authorities are defined in the Implementing Regulation (EU) 2019/947, or the Applicable Means of Compliance (AMC) 1, Art. 11, para. 1.5 (f):

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	‘According to Regulation (EU) 2018/1139 (the EASA ‘Basic Regulation’), EASA is the authority competent in the European Union to verify compliance of the UAS design and its components with the applicable rules, while the authority that is designated by the Member State is competent to verify compliance with the operational requirements and compliance of the personnel’s competency with those rules.’ Accordingly, the FOCA considers EASA to be responsible for implementing the safety recommendation. In addition, when operating SAIL II licences, the responsibility for maintaining airworthiness is transferred to the operator of the unmanned aircraft by means of Operational Safety Objectives (OSO). With this safety recommendation, the FOCA recognises that more is being done than before to ensure that operators of unmanned aircraft comply with the service bulletins for flight-critical components or their software. This is ensured during the review of operating manuals or through audits. The FOCA hereby considers Safety Recommendation No. 588 to be fully implemented and finalised."
Investigation report concerning the safety recommendation	Zwischenbericht Schlussbericht Final report Vorbericht

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