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The Current State of Safety Reporting in Unmanned Aircraft Maintenance and Manufacturing: An Opportunity for Improvement

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Currently, unmanned aircraft system (UAS) safety reporting processes regarding maintenance and manufacturing-related hazards are nearly non-existent or immature. A review of recent UAS safety reporting data suggests the overall reporting of UAS incident and accident data needs to improve. In addition, the accelerating growth of UAS innovation requires more robust processes that proactively identify product-related defects or failures and support the FAA's performance-based certification of UAS. This review explores current programs used in traditional aviation and other industries to identify best practices that may provide a path forward for developing similar programs for the UAS industry. First, this review compares existing manned aviation safety reporting and risk management procedures with the current state of safety reporting in the UAS industry. Second, this review explores the safety reporting processes of different industries such as automotive, consumer electronics, and the food and drug industry. Third, researchers reviewed safety risk data from the UAS insurance industry, including a cost comparison of insurance premiums and coverages. Ultimately, this review suggests practices and strategies that may improve safety reporting in the UAS industry.

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Safety reporting is an integral part of high consequence industries such as healthcare, nuclear, and aviation (Lercel, 2013). NASA and the FAA first established the foundation of aviation safety reporting in 1976 with the inception of the Aviation Safety Reporting System (ASRS) (FAA, 2021b). Fast forward to today when UAS operations are increasing exponentially and close to 863,000 UAS are registered in the United States (FAA, 2021d). With the influx of UAS operations, there is a need for a more robust safety reporting process for UAS manufacturers and maintenance providers (GAO, 2019; Greenwood, 2021; Speijker, 2018; Weldon et al., 2021).

To gain perspective of the current state of reporting in the UAS industry in comparison with related industry segments, researchers reviewed literature associated with safety management and reporting. Specifically, this effort explored safety management systems (SMS) for non-part 121 operators (FAA, 2015), safety reporting in manned aviation and other high consequence industries, and the current state of safety reporting for commercial UAS. This research draws comparisons of these processes and highlights some potential best practices that may serve as a starting point for the UAS industry.

Literature Review

A review of the literature initially considered SMS for non-part 121 operators and FAA's manufacturer failure, malfunctions, and defect reporting. To better identify and rectify such safety issues, the FAA may issue airworthiness directives (ADs) as corrective actions, which are legally enforceable regulations.

SMS for Non-Part 121 Operators (FAA)

An SMS program for non-Part 121 operators was created by the FAA in 2015 "to voluntarily develop and implement an SMS" (pp. 1, FAA, 2015). The SMS is comprised of four components and 12 elements (FAA, 2015), mainly safety policy, safety risk management, safety assurance, and safety promotion. These components provide an adequate basis to manage hazards, comply with the high safety standards of the aviation industry, and maintain safety throughout the organization. In addition, an SMS goes beyond preventive measures and instills a predictive approach to managing safety. However, of the approximately 5,012 FAA certificated aviation service providers (FAA, 2021c), less than 5% are currently enrolled in the FAA's Voluntary SMS Program, and no UAS service providers are enrolled (Roberts, 2021).

FAA Manufacturer Failure, Malfunctions, and Defect Reporting

The FAA first established a manufacturer failure, malfunction, and defect reporting process in 1970 through Advisory Circular (AC) 21-9. In 1982 the FAA issued a revision (21-9A) to the AC, which included a requirement that any holder of a type certificate, parts manufacturer approval (PMA), or a technical standard order (TSO) authorization, and licensee of a type certificate to notify the FAA of any failure (FAA, 1982, pp.1). Subsequently, a second revision to this AC (21-9B) broadened this requirement to include manufacturers of aeronautical products (FAA, 2010). Below is an outline of this FAA reporting process (FAA, 2010, p. 2).

a) "Ensure an understanding of the rules,"
b) "Establish the most expeditious means of conveying the required information in a manner and form acceptable to the FAA,"
c) "Determine the person(s) to be contacted,"
d) "Establish a means of keeping the appropriate FAA office informed of progress and providing additional information on those cases where only preliminary information has been reported."

Leveraging the aspects of manned aviation and applying them to unmanned may be an effective strategy in developing a similar UAS reporting structure. UAS registration data under Part 107 may be considered a starting point for a reporting failure database and help in establishing a UAS reporting program for manufacturers and maintenance providers – assisting both the manufacturers and the FAA in managing product-related safety issues.

Airworthiness Directives (ADs)

The FAA states, "Airworthiness Directives (ADs) are legally enforceable regulations issued by the FAA in accordance with 14 CFR part 39 to correct an unsafe condition in a product. 14 CFR part 39 defines a product as an aircraft, engine, propeller, or appliance" (FAA, 2021). Manned aviation has enhanced the process of carrying out corrective actions based on failure reports. The FAA scrutinizes these reports, which may result in a corrective action of an unsafe condition through the issuance of an AD (FAA, 2002). This reporting process and the resulting corrective action plan contribute to an ongoing assurance that a product is safe.

Currently, the UAS segment of aviation lacks many of the safety reporting processes found in traditional aviation, such as product failures and defects. This is not unexpected given the technological advances and rapid adoption of UAS. However, as the proliferation of UAS increases, so too does the need for strategies that address unsafe conditions associated with UAS products, such as the Unmanned Aerial Vehicle (UAV), the ground control station (GCS), or software. By better identifying unsafe conditions related to UAS products, these processes may contribute to an acceptable level of safety in the National Airspace System (NAS).

Developing processes that support the reporting of product failures and defects improves safety practitioners' ability to proactively identify and address these hazards and risks. Building upon this process, practitioners may capture reports from consumers, maintenance providers, and insurance companies more broadly. Assessment of manufacturer-provided information, coupled with failure, malfunction, and defect reports, may help the FAA formulate a data-driven approach for managing risks associated with UAS products, such as the newly developed regulatory policies regarding UAS flight over people and anticipated beyond visual line of sight operations. These policies are heavily dependent on product reliability data to support future approvals (FAA, 2019).

UAS Safety Reporting

The Center for Unmanned Aircraft Systems for Public Safety stated in 2018 that “the issues of UAS legality, safety, and technology are just now beginning to be explored, largely because of the scarcity of data available. Key to the evaluation process is the process of reporting and data collection” (GAO, 2019; Greenwood, 2021; Speijker, 2018; sUAS in Public Safety, 2018; Weldon et al., 2022). The FAA established a Part 107 accident reporting system through its UAS-specific website, FAA DroneZone (14 CFR Part 107, 2021). Recently, FAA and NASA established a reporting system for UAS through NASA’s ASRS system. The following section reviews the FAA DroneZone and the newly integrated ASRS UAS safety reporting process, followed by a discussion on safety reporting in other industries.

The FAA DroneZone enables Part 107 operators to report accident reporting, whereby law the UAS operator must submit a report under the following circumstances (14 CFR Part 107, 2021),

1. If serious injury to any person or any loss of consciousness occurs,
2. The incident results in damage to any property, other than the sUAS unless one of the following conditions is satisfied,
   a. The cost of repair (including materials and labor) does not exceed $500,
   b. The fair market value of the property does not exceed $500 in the event of total loss.

Even though the DroneZone provides a platform to report UAS accidents, it is only for incidents that occur during operations that meet a minimum reporting threshold. This reporting structure likely does not capture less severe incidents, which are often precursors to more severe events (Reason, 2016). Furthermore, the DroneZone is not explicitly intended for manufacturers and maintenance providers to report product defects or failures.

A more formal UAS safety reporting process was introduced into NASA’s ASRS reporting program in April 2021 through advisory circular AD-00-46F (FAA, 2021a). The advisory was to encourage the users of the NAS and other people to report UAS-related safety incidents. This reporting system is open for all types of UAS operators, such as recreational flyers, Part 107 crews, public operators, and Part 135 operators (ASRS, 2021). Users can report incidents such as “Collision or Near Mid Air Collision with another UAS, Aircraft, or Object, Equipment Issues (hardware/software/automation), Lost Link, Fly Away, Uncontrolled Descent, Airspace Incursions (e.g., Flying too close to an airport), Environmental Hazards, Miscommunication, Procedural Issues, Human Error / Mistakes, and Injuries” (ASRS, 2021). Although this new ASRS reporting process is a positive step towards improving UAS related safety reporting, like the DroneZone, it lacks the focus and specialization of the current FAA product defect reporting process used in manned aviation.

A review of the recent ASRS reports suggests an in-flight component failure caused only two UAS incidents. These events included a loss of link and structural fatigue cracks on the UAS (2021). Even though the ASRS safety reporting system enables reporting of UAS operations, there is no means to track data by UAS manufacturers. The ASRS reporting system also provides UAS operators similar protections as manned operators, which states “protection against civil penalty and certificate suspension in exchange for filing an ASRS report as this is indicative of a constructive attitude which will tend to prevent future violations" (ASRS, 2021). These reporting protections are a positive development and may help encourage more UAS reporting in the future.

One potential issue is that the FAA DroneZone and the ASRS systems may be perceived as duplicative by UAS stakeholders and may lead to confusion regarding the reporting requirements and where to report. For example, it is unclear if the ASRS reporting system fulfills the FAA regulatory reporting requirements or if this information must be reported via the DroneZone. In addition, it is unclear if these two databases are inter-connected – meaning does a report submitted to DroneZone also populate in the ASRS database. A review of these reporting formats found significant differences in the reporting forms, which suggests they likely do not cross populate. A review of reports across these databases also found no cross population of reports. The overall UAS reporting structure may be improved by ideally developing a single point of reporting or at least connecting the DroneZone and ASRS reporting systems to allow for a cross population of data. This combined reporting structure may then have a common reporting platform, which streamlines the process and allows for a single information source that supports a more robust safety library. In addition, developing a single system of reporting may reduce the administrative costs of supporting multiple systems (Lercel, 2013).

UAS defect, malfunction, and failure data will increasingly become a vital source of information for safety practitioners to manage safety risks, mainly as operational complexity further develops (i.e., drone delivery, air taxi, etc.). In addition, this type of data is essential in supporting the FAA's move towards performance-based decision-making with regards to UAS product and operational certifications (14 CFR Part 21, 2018). However, hazardous UAS situations arising from component issues are not widely documented nor communicated. Due to the absence of a historical database, UAS regulators and consumers are often left to rely solely on the manufacturers' after-sale customer service for product defects and associated corrective actions. Currently, safety-related decisions related to regulatory waivers or advanced UAS operations are often based primarily on the applicant's operational safety risk management plan and their experience or qualifications (14 CFR Part 107, 2021; FAA, 2022b) – often the actual manufacturer's product reliability and testing data, performance record, or technical specifications are not considered in the decision to approve or deny the application.

Safety reporting processes of Other Industries

This research reviewed the safety reporting process of the automotive, food and drug, and consumer electronic industries. This review may further assist in developing a similar safety reporting process for UAS.

National Highway Traffic Safety Administration (NHTSA)

The National Highway Traffic Safety Administration (NHTSA, 2021c) is tasked with the primary regulatory oversight of the automobile industry in the United States (Rupp & Taylor, 2002). Therefore, researchers reviewed these applicable policies to gain perspective of the automotive industry's safety reporting process.

The NHTSA defines a safety defect as "a problem that poses a risk to motor vehicle safety and may exist in a group of vehicles or equipment of the same design and/or manufacturer" (NHTSA, 2021a). Manufacturers and customers may report safety issues to the NHTSA regarding automotive parts or components such as seats (child and adult), tires, vehicles, and after-market equipment. The safety report is then stored in a dedicated database by the NHTSA. The vehicle safety reporting process is as follows,

1. <u>Complaints:</u> The first step of the reporting process is to file a complaint. Vehicle users can report an issue by submitting a voluntary form through the NHTSA website (NHTSA, 2021b).
2. <u>Investigation:</u> The NHTSA then reviews the complaints to determine the course of the investigation. They analyze the respective complaints and decide whether to accept or deny the petition. An accepted petition is then investigated and has two significant outcomes: a recall recommendation or a finding of no safety-related defects (NHTSA, 2021b). The investigation stage is divided into preliminary evaluation (PE) and engineering analysis (EA). The PE process takes up to 4 months with three possible outcomes: recall, close, or upgrade (NHTSA, 2021b). The EA process includes a detailed technical analysis, which may result in the issuance of a product upgrade. During the EA process, the NHTSA physically inspects the vehicle and conducts safety testing, which may take up to 12 months (Rupp, 2004).
3. <u>Recall Management:</u> The NHTSA supervises the recall process in this final step. It ensures that the vehicle owner is notified of the recall recommendation and tracks the completion of each recall (NHTSA, 2021b).

The manufacturer must notify the NHTSA in writing when initiating a voluntary recall (Rupp, 2004). When the NHTSA is notified, they post these notifications to a publicly available database (Rupp, 2004). The NHTSA also requires the manufacturer to notify the vehicle owner via mail within 60 days of the report. The NHTSA then monitors each recall and oversees its completion.

Consumer Product Safety Commission

The Consumer Product Safety Act established the Consumer Product Safety Commission (CPSC) to protect the public against unreasonable risks of injury associated with consumer products; assisting consumers in evaluating the comparative safety of consumer products, developing uniform safety standards for consumer products; and promoting research and investigation into the causes and prevention of product-related deaths, illnesses, and injuries. (Reczek & Benson, 2021, pp. 2). The CPSC's handbook defines the following safety reporting process (CPSC, 2012),

1. <u>Reporting:</u> The manufacturer, importer, distributor, or retailer is responsible for reporting safety issues to the Office of Compliance and Field Operations (CPSC, 2012). The concerned entity can submit reports on the CPSC website. This reporting form is distinct for consumers and manufacturers.

2. Identification: The defect identification process primarily relies on the reporting entity to provide information on the issue. Such information assists the CPSC in the evaluation process and is used to identify the hazard to consumers (CPSC, 2012).
3. Evaluation: The defect evaluation process involves determining risks associated with the hazard. The CPSC (2012) categorizes hazards into,
   a. Class A: "Exists when a risk of death or grievous injury or illness is likely or very likely, or serious injury or illness is very likely" (CPSC, 2012, pp. 14).
   b. Class B: "Exists when a risk of death or grievous injury or illness is not likely to occur but is possible, or when serious injury or illness is likely, or moderate injury or illness is very likely" (CPSC, 2012, pp. 15).
   c. Class C: "Exists when a risk of serious injury or illness is not likely but is possible, or when moderate injury or illness is not necessarily likely, but is possible" (CPSC, 2012, pp. 15).
4. Correction: Concerned companies are responsible for developing a corrective action plan.
5. Communication: Companies are then advised to use multiple modes of communications to inform customers about product defects and recalls, such as email, ground mail, phone, etc.
6. Monitoring: Once the customers are informed of the recall, companies must maintain a record of each recall in accordance with the CPSC.
7. Policy Development: Companies must develop an organizational policy and action plan to manage product recalls.
8. Records Maintenance: The company must maintain a record of the corrective actions and the product.

Researchers reviewed the CPSC database for any reports related to UAS or drones. This review found only three related incident reports (CPSC, 2022).

TÜV SÜD

TÜV SÜD is an international organization that develops safety standards that may apply to various products. According to a report by TÜV SÜD (2019), consumers are becoming increasingly aware of such safety standards and ratings. As it applies to this research, TÜV SÜD also conducts "drone testing and certifications," wherein they evaluate various aspects of the UAS. These aspects of testing include electrical, batteries, functionality, environmental, mechanical, chemical, and radio frequency/wireless testing (TÜV SÜD, 2021). This testing is intended "to minimize the risk of non-compliance and product liability" (TÜV SÜD, 2021).

Underwriters Laboratories (UL)

Similar to TÜV SÜD, UL is an organization that helps companies "demonstrate safety, enhance sustainability, strengthen security, deliver quality, manage risk and achieve regulatory compliance" (UL, 2021). With regards to UAS, UL recognized the increase in commercial applications and developed UAS safety standards. For example, in 2018, the UL developed the UL 3030 safety standard, which focuses on UAS electrical systems and batteries.

Consumer Electronics Industry

The consumer electronic industry has a broader safety reporting scope and includes private entities. In addition to CPSC oversight, Underwriters Laboratories (UL) and TÜV SÜD also conduct safety tests, create standards, and provide product certifications for consumer electronics.

Food and Drug Administration (FDA)

Another industry this research explored is the Food and Drug Industry. The US Food and Drug Administration (FDA) is the authority responsible for "protecting the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, and medical devices" (FDA, 2018). Accordingly, the FDA established a reporting process for adverse hazards or issues associated with medicine and food in the United States. Apart from reporting problems, the FDA also enables people to report emergencies, non-emergencies, and unlawful sales of medical products.

FDA Mandatory Medical Devices Reporting

Manufacturers, importers, and users (such as hospitals, clinics, etc.) of medical devices are required to file a report regarding issues and adverse events related to these devices (FDA, 2020). Reports are filed on the MedWatch portal by submitting Form 3500 A. Manufacturers and importers have 30 days to report serious injuries and malfunctions and five days to report hazardous conditions and risks that may be eliminated or reduced by some preventive action (FDA, 2020). The regulatory requirement for this reporting is outlined in 21 CFR Part 803 (2021). The FDA reviews these reports, and information regarding product withdrawals, recalls, and safety alerts are issued in the form of press releases and public notices (FDA, 2021).

Risk Management in the Insurance Industry

Next, this research explores risk management in the insurance industry. Increasingly, customers require commercial UAS operators to have proper liability insurance. Generally, insurance companies provide coverage for damages or losses caused by the UAS (liability), while some provide additional coverage for damage or loss of the UAS itself (hull). The need for insurance companies to have a formal and robust risk management process became prominent after the 2008 global financial crisis (NAIC, 2021) when companies incurred significant financial losses.

Researchers reviewed a sample of risk management processes UAS insurance providers may prefer or require as part of their process of assessing risk in organizations. Some of these processes are listed below as defined by Global Aerospace (2021), which is a major UAS insurance provider in the United States.:

1. <u>Training:</u> UAS-related operations and safety training.
2. <u>Safety Management:</u> Documented safety management system along with various checklists and pilot flight logbooks.

3. Maintenance: Scheduled maintenance programs are conducted as per the manufacturer's instructions. Maintenance is to be done regularly to ensure the UAS is in a condition for safe operation.
4. Environmental Hazards: UAS operators shall have situational awareness of the operating environment before, during, and after the flight. Factors like wind, clouds, manned aircraft, and even people shall be considered.
5. Privacy Issues: Ethical use of UAS and safeguarding public privacy.

Furthermore, the literature found that insurance providers give historical data the most significant weight when analyzing risks. Therefore, researchers contacted three UAS insurance providers to gain perspective on the cost to insure a popular model of UAS. Researchers used the following basic criteria when requesting this insurance coverage and premium pricing:

1. Hull coverage for a DJI Mavic 2 Enterprise valued at $2,000.
2. $1M liability coverage (bodily injury and property damage).
3. Commercial operations in accordance with FAA CFR Part 107.

A summary of the received cost quotations is provided below in Table 1.

Table 1
Hull Insurance Premium of DJI Mavic 2 Enterprise

Entity	Insured Value of UAS	Deductible	Premium
Insurer 1	$2,000	$280	$160
Insurer 2	$2,000	$200	$192
Insurer 3	$2,000	$250	$180

Researchers referenced the DJI Mavic 2 Enterprise in their insurance application. In addition, researchers reviewed industry resources to identify any risk assessment of UAS products by the insurance industry but were unable to find a publicly available database. These providers likely maintain such data but consider it proprietary as it may provide them a competitive advantage. However, a system that encourages data sharing across organizations may provide safety practitioners a powerful source of information that supports more robust safety risk management across the UAS community (FAA, 2019).

Discussion

This research reviewed various safety reporting processes used in the automobile, consumer electronics, manned aviation, and food and drug industries. Reviewing the safety reporting processes of other industries, UAS safety practitioners may identify best practices that help create similar safety reporting processes for UAS. As discussed earlier, further maturation is required for UAS safety reporting to approach the performance level of manned aviation. Reviewing the literature and current data regarding UAS-related failures, researchers found a deficient number of reports; therefore, one may conclude that the UAS safety reporting processes, for various reasons, are underutilized or ineffective (GAO, 2019; Greenwood, 2021; Speijker, 2018; Weldon et al., 2021). For example, the ASRS (2021) database search resulted in only 13 reports over an eight-month period, which is significantly lower than manned aviation over this same period and likely does not serve as a representative sample of the UAS population operating in the NAS. Further data queries of the FAA's Aviation Safety Information Analysis and Sharing (ASIAS) database resulted in 104 UAS reports, with the latest report from August 2014 (FAA, 2022a). Requests for FAA DroneZone incident reports resulted in less than 30 reports. The literature discusses the importance of effective safety reporting as a critical component of a robust SMS; however, since no small UAS operators or manufacturers are enrolled in the FAA's voluntary SMS program (Roberts, 2011), this further suggests a lack of effective safety reporting across the industry.

With the ever-increasing number of commercial UAS applications, the FAA issuance of special airworthiness certifications for UAS has also increased, mainly in the experimental category (14 CFR Part 21, 2021). As part of this process, the FAA may review and assess any available UAS product reliability performance data before issuing an airworthiness certificate. Similar to other consumer products, UAS manufacturers are likely to perform some level of testing of their product prior to customer delivery, or what many may consider as self-certification (Perritt, & Plawinski, 2016). Additionally, the FCC requires some UAS to be tested with regards to transmitter power and frequency (Wiley Rein, 2021), such as the ground control station. These system tests and subsequent tests results may be reviewed by the FAA when considering the issuance of an airworthiness certificate. At their discretion, the FAA may request to witness the actual system testing (14 CFR Part 21, 2021). These performance-based test results may provide evidentiary data of an acceptable level of reliability and, by extension, an acceptable level of risk.

As the advantages of UAS are being recognized, companies are increasingly opting for special airworthiness certificates to conduct advanced operations or utilize larger and more complex UAS. However, to a large extent, this data, and any corrective action, is proprietary or simply not available to consumers or regulators. As more UAS-platforms are certified, consumers may have the ability to purchase these UAS based on their performance capabilities. With the increase in a performance-based model of certification, the need for a documented form of UAS defects, failures, and malfunctions data may prove beneficial. Data obtained from UAS defects, failures, and malfunctions may be utilized by UAS regulatory bodies to determine the reliability of a particular UAS system and proactively address any problems. Likewise, this data may help establish future airmen certification standards for those operating high-performance UAS, conducting complex operations, or maintenance technicians.

The ASRS UAS reporting process does provide the FAA a system by which they can capture a breadth of safety-critical information regarding UAS operation (ASRS, 2021), but these reports currently lack the attributes found in other industry reporting systems. For example, a review of the ASRS (2021) UAS reporting found no attributes regarding UAS related defects at the maintenance and manufacturing levels. However, other industries, including manned aviation, provide separate processes that support manufacturer defect reporting. Attributes such as risk evaluation have proven beneficial in a safety reporting process where safety practitioners may analyze these failures to proactively avoid similar issues in the future. Likewise, a system that supports UAS manufacturers' and maintenance providers' reporting of product defects and warranty information would enable a more informed safety risk assessment. Such data is an integral part of an SMS and may support a UAS airworthiness directive process – similar to what is currently used in manned aviation.

At present, UAS consumers have little information regarding product safety because there is a lack of transparency regarding UAS manufacturers' safety performance, such as product recalls, defects, warranty, and repair data - information that is often considered critical to commercial UAS operators and regulators. Most consumers are left to do their own product research, primarily through publicly available sources, such as any manufacturer websites, consumer magazines, or social media (Fisher, 2019; Krishnamurthy & Kumar, 2018; Mechanics, 2022; Park et al., 2007). From a safety management perspective, these types of data are unreliable, inefficient, and not conducive to supporting robust safety decisions. Making product safety data available to consumers and regulators through a more systematic process will likely help them in making more informed purchase and policy decisions, and spur UAS manufacturers to have a greater focus on the quality and safety of their products (Cicchino, 2014; Consumer Reports, n.d.; J.D. Power, n.d.; NHTSA, 2021c).

Limitations

This research comprehensively looked at different industry safety reporting processes and attempted to form a basis for UAS safety reporting, especially for manufacturers and maintenance providers. However, while the researchers carried out a comprehensive literature review and database search, they did not perform any actual UAS product evaluation or testing, which may be a limiting factor for this research. In addition, researchers were unable to obtain UAS manufacturer and maintenance warranty or repair data.

Future Research

As the number of commercial UAS operations increases, the need for a safety reporting process to report component defects, malfunctions, and failures may increase. Safety certification of all aspects of the UAS (electrical, mechanical, airworthiness, chemical, functional, and wireless) may reduce the risk of UAS malfunctions and defects. In the future, researchers anticipate a system where consumers and manufacturers may report issues regarding UAS components to the aviation regulatory body – encouraging the sharing of safety-related data. Such a database may assist federal regulatory agencies to better manage UAS-related risks. This system will support a proactive approach to safety through improved incident investigation and evaluation. The regulatory body may then publish corrective actions, like an AD, to reduce risks associated with a UAS and improve safe commercial operations. Further research is required to explore best practices in establishing a more effective UAS safety reporting process, subsequent corrective measures, and policies that encourage UAS stakeholders to report safety issues.

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