

THE CHALLENGES IN THE PREVENTION AND INVESTIGATION OF SMALL DRONE SAFETY EVENTS

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ACCIDENT PREVENTION: RISK ASSESSMENT OF SMALL DRONE FLIGHTS

- Published hazard analysis and risk assessment of drones are based on probabilistic and deterministic approaches.
- However:
 - We do not have data and consistent reports for failures
 - Such data is impossible to collect consistently
 - Common risk management framework at an international level does not exist
- We lack a data-driven justification to:
 - Establish small-drone “airworthiness” standards
 - Require from manufacturers to increase drone reliability



ACCIDENT PREVENTION: DRONE USERS POPULATION

- A heterogeneous and uncontrolled population with the role of both maintaining and flying a drone.
- The main scope of small-drone flight is entertainment; no direct connection of the end-user with social responsibility, job security etc.
- Most of the drones users lack:
 - knowledge, experience and training in human performance limitations.
 - detailed technical knowledge of how drones function.

ACCIDENT PREVENTION: DIVERSITY OF DRONE CHARACTERISTICS

- During a study¹, System Theoretic Process Analysis (STPA) was applied to derive safety requirements (SR) for the “ideal” small drone.
- Specifications documented in manuals of 19 drones were analysed.

Safety requirements level	Minimum % SR met	Maximum % SR met	Similarity amongst drones
Manufacturer	30%	77%	0.440
End-user	20%	66%	0.433
Automation support	13%	68%	0.433

¹Plioutsias, A., Karanikas, N. & Chatzimichailidou M. M. Hazard Analysis & Safety Requirements for Small Drone Operations: To What Extent Most Marketed Drones “Embed” Safety?, Risk Analysis (under review)

SAFETY INVESTIGATION: RESOURCES

- We do not have the resources and we cannot afford investigating all drone related safety events.
- If we want to investigate some events, we need to set prioritization criteria.
 - what the perception of public about those criteria will be
 - we must decide between actual severity or potential outcomes
- Drones might be highly automated and they embed diverse technology:
 - investigators might need new technical skills



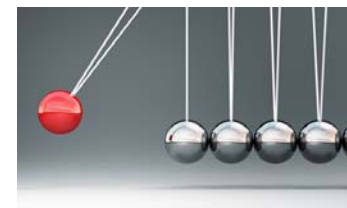
ACCIDENT INVESTIGATION: FACTUAL DATA COLLECTION AND ANALYSIS

- Preservation of evidence:
 - who will guard the evidence
 - what records to be maintained before the event
- Material and system analysis
 - where and what to analyze and test: recall the little similarity across drones
- Interview of witnesses:
 - not sure who was really flying the drone
 - problems with retention and language of communication in cases of foreign end-users



ACCIDENT INVESTIGATION: FACTUAL DATA COLLECTION AND ANALYSIS

- Past performance and medical records of end-user
 - not predefined periodicity and type of exams / evaluations
 - no baseline for assessment of records
- Analysis of data:
 - no common standards across regions as a reference point
- Rules do not appoint responsible “supervisor” and “management” levels



ACCIDENT INVESTIGATION: IMPACT OF RESULTS

- Type of investigation
 - legal or safety investigation
 - how the choice will be justified
- Recommendations and remedies
 - Not clear where to be addressed since responsibilities, apart from the user, are not defined.
- Cultural and market issues:
 - no common policy and perception of just culture, even across companies
 - confidential or public investigation reports
 - impact of findings on users' behavior and growth of international market



CONCLUSIONS

- We do not obtain adequate and reliable data to perform probabilistic analyses of drone accidents.
- Small drones are highly diverse in the safety characteristics they embed.
- Drone users are not a homogeneous, controlled population.
- Complete and effective investigation of all small drone accidents is unachievable.
- We need to move towards a more proactive approach
- Negative impacts of investigations on drone market are expected to be higher than the effects of small-drones standardization over time.



RECOMMENDATIONS

- It's time to apply new hazard analysis methods based on systemic approaches.
- Manufacturers and authorities must agree on a minimum list of safety requirements for small drones at international level.
- Human factors must be considered in the design of small drones.
- Fundamentals of human factors and a systems approach must be included early in education.
- Responsibilities amongst stakeholders of small-drones flights must be fairly distributed and adequately monitored.
- Clear policies, goals and procedures for investigations of small-drones events must be established.



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Questions?

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CREATING TOMORROW

