

HOW COMPLETELY AND SIMILARLY DO SAFETY AUTHORITIES ADDRESS HAZARDS POSED BY DRONE OPERATIONS?

Anastasios Plioutsias (Technical University of Athens, GR)

Dr. Nektarios Karanikas (Amsterdam University of Applied Sciences, NL)

Dr. Maria Mikela Chatzimichailidou (University of Cambridge, UK)

FSF-MED 7th International Conference,
21 October, Larnaca, Cyprus.



SOME FIGURES (PROXIMALLY)

- Commercial Aviation
 - 21.000 aircraft
 - 34 million departures annually
 - 3.5 billion miles flown annually
 - 92 accidents / 474 fatalities (2015)
- General Aviation (2014)
 - About 365.000 aircraft
 - ? departures
 - 42 million flight hours annually
 - x 50 more accidents than commercial aviation (EASA, FAA)
- Drone market
 - 700.000 - 1.200.000 drones sold worldwide only in 2015
 - ? departures, miles, hours
 - 37 accidents, 584 occurrences only in EU in 2015.

HOW MUCH IS AVIATION REGULATED

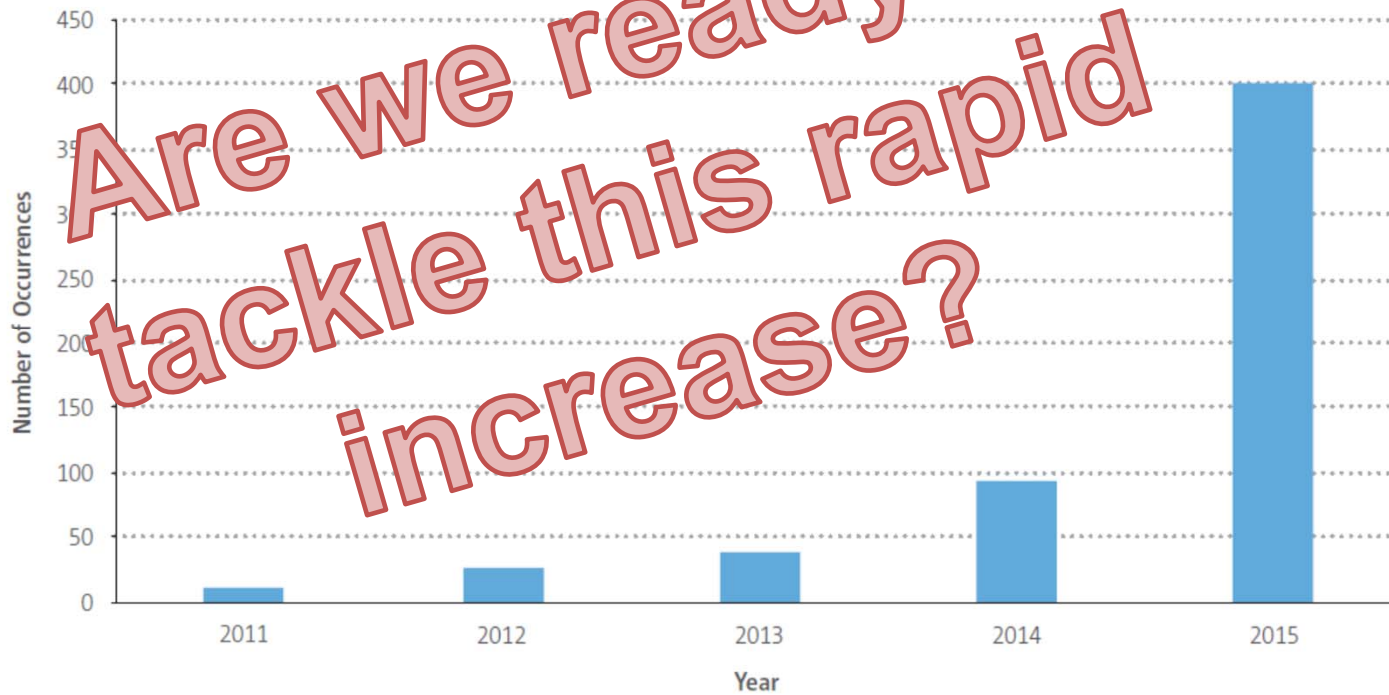
- Commercial aviation:
 - Fully standardized for airworthiness, air operations, staff qualifications, air navigation, aerodromes, airspace control & management across all levels (e.g., from pilots to authorities) etc.
- General aviation:
 - Mostly standardized for airworthiness and aircrew qualifications
 - Less strictly regulated for air navigation, aerodromes, control & management
- Drone flights regulations:
 - Focus mainly on the end-user, who is frequently the only responsible for a safe flight.
 - Lack of reference to the role and responsibilities of the manufacturers and authorities.
 - No universally accepted risk assessment framework.

2.8 / million dep

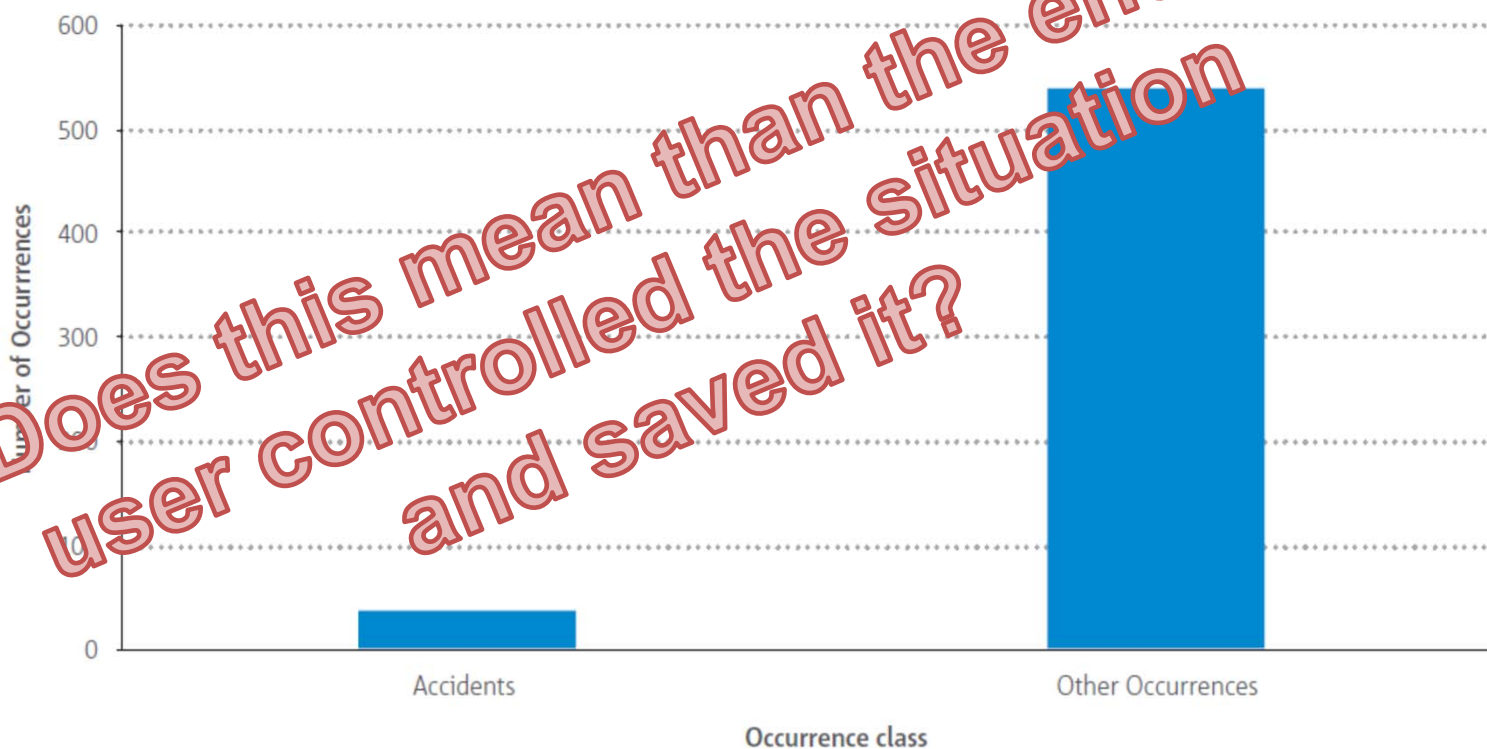
140 / million dep

???

DRONE EU OCCURRENCES 2011-2015

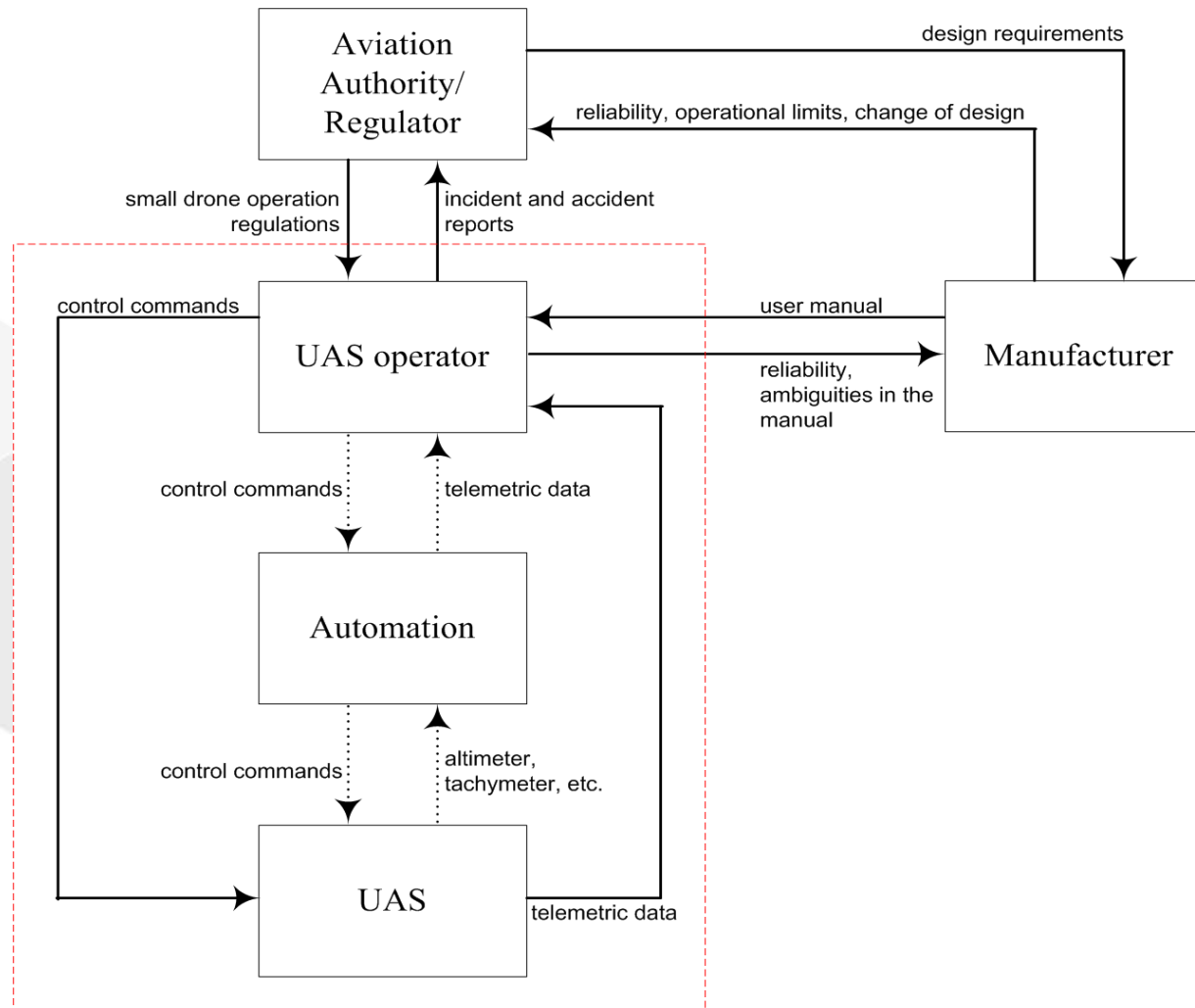


DRONES EU OCCURRENCE CLASSES 2011-2015



Does this mean that the end-user controlled the situation and saved it?

A SYSTEMIC VIEW

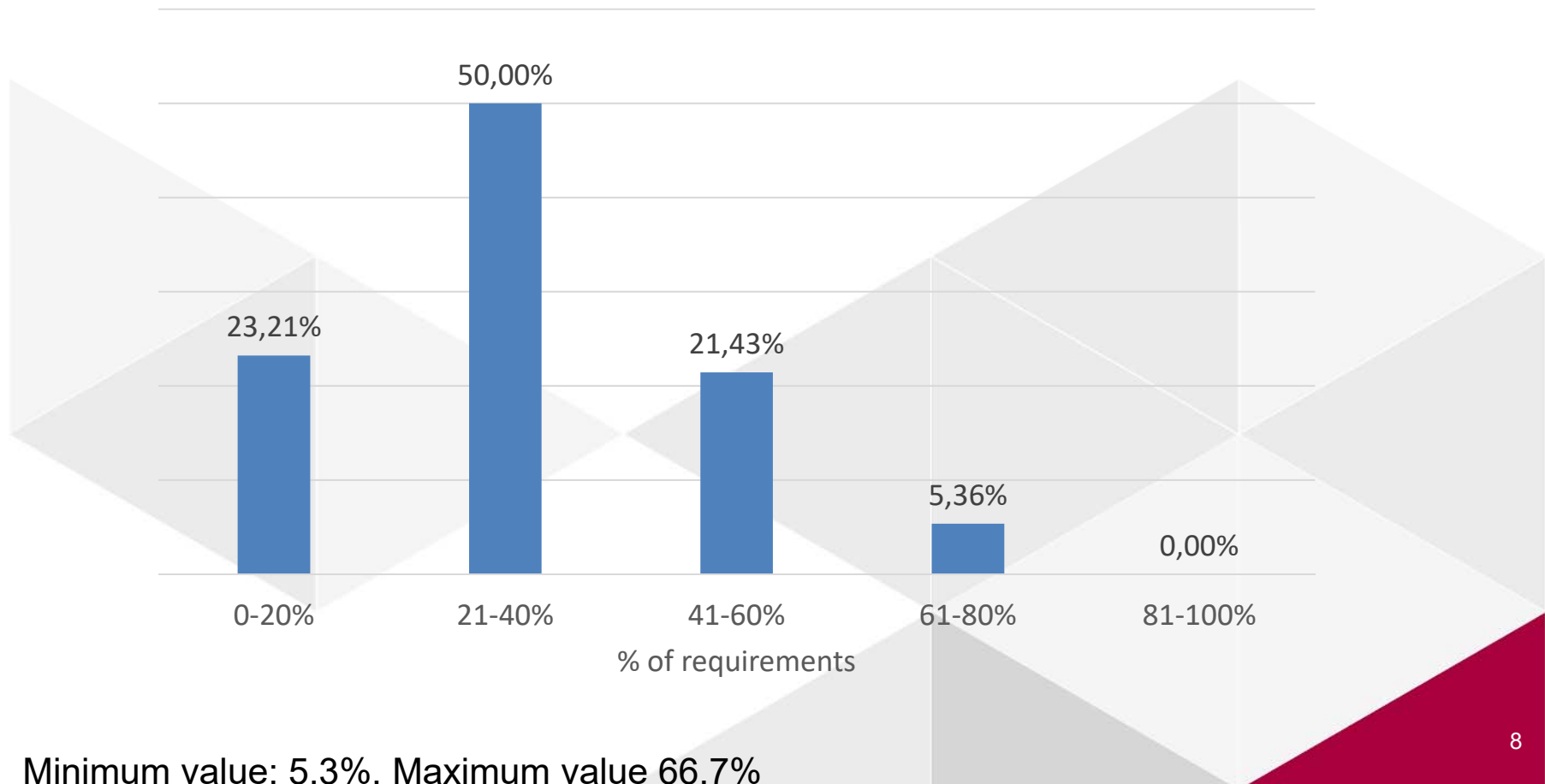


RESEARCH METHOD

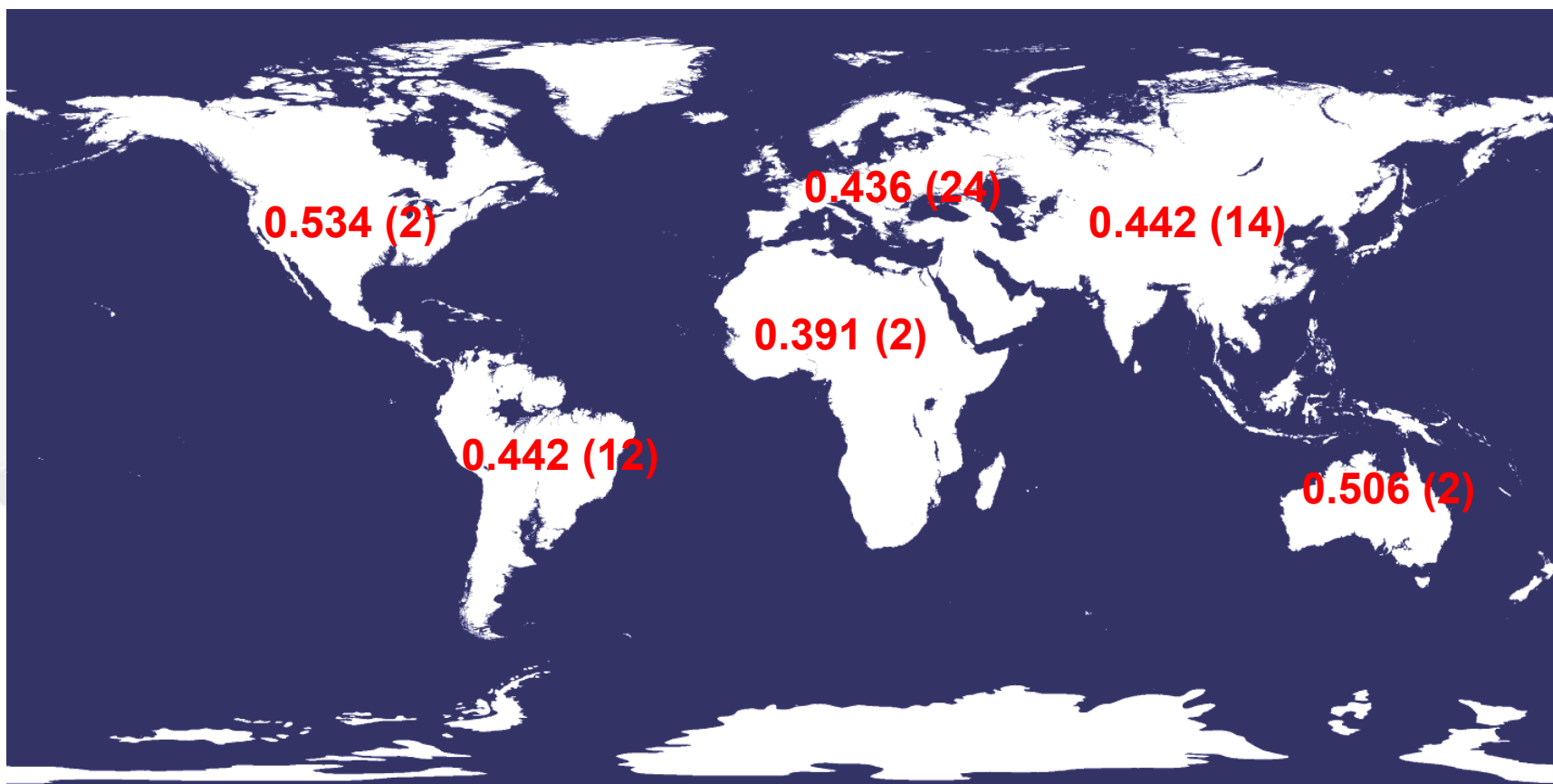
- Application of the System Theoretic Process Analysis (STPA) method (Leveson, 2011) on a small drone system.
- Generation of:
 - 28 hazardous states
 - 24 causal factors
 - 67 safety requirements across: authority, manufacturer, end-user and automation.
 - Assignment of type of responsibility for each requirement/actor: Regulate, Document, Define, Act, Informed, Support
- Gap analysis and statistical comparison amongst regulatory frameworks from 56 countries.

RESULTS: REGULATIONS' ANALYSIS

Regulations meeting % of requirements



RESULTS: REGULATIONS' COMPARISON



OVERALL AGREEMENT: 0.432

RESULTS: REGULATIONS' COMPARISON

- Things are even “worse” in terms of diversity and complexity:
 - Req: Operator shall maintain continuous visual contact with drone during flight.
 - All 56 authorities dictate so.
 - 33 States have no value for the distance between end-user and drone. Some require extra attention to weather conditions, obstacles, drone capabilities etc.
 - 11 States allow a maximum distance between 100m to 5.5Km. One of those States express the distance in Ft and another in Miles.
 - Highly different requirements about:
 - Skills and competencies of the operator
 - Flight area boundaries
 - Separation from other flying objects

CONCLUSIONS

- A common regulatory framework based on a systemic and systematic risk analysis is missing.
- Current regulations assign the end-user almost as the only responsible for observing rules and limits.
- Existing regulations meet the requirements of the authority level at extremely low to moderate levels.
- Regulations across States are highly different amongst them, even when they address the same requirement.
- The high differentiation of rules across countries might confuse users and affect the market.

RECOMMENDATIONS

- A common regulatory framework based on systemic and systematic risk analysis is needed to avoid impeding drone market growth.
- Such a framework must clearly state the roles, responsibilities and interdependencies of the main system controllers, namely authorities, manufacturers and end-users.
- States might adopt a customizable and flexible regulatory framework which will:
 - Classify drones depending on how risk control is distributed between the operator and the automated functions of drones.
 - Based on the classification above, define the set and boundary values of certification, training, maintenance etc. requirements

HOW COMPLETELY AND SIMILARLY DO SAFETY AUTHORITIES ADDRESS HAZARDS POSED BY DRONE OPERATIONS?

Anastasios Plioutsias (Technical University of Athens, GR)

Dr. Nektarios Karanikas (Amsterdam University of Applied Sciences, NL)

Dr. Maria Mikela Chatzimichailidou (University of Cambridge, UK)

Questions?

FSF-MED 7th International Conference,
21 October, Larnaca, Cyprus.

