

# Autonomous Service Drones for Safety-Compliant European Operations

Popular scientific abstract

Kristian Husum Laursen

The drone legislation was unified across the European Union (EU) on the 31st of December 2020. This new legislation divides drone flight into three categories: Open, Specific, and Certified. Operations utilizing drones' potential in society, such as overflight of populated environments and automatic pilot-less flights, are placed in the Specific category due to their inherent risk. The Specific category requires the drone operator to perform a risk assessment of the operation based on a framework called Specific Operations Risk Assessment (SORA). This risk assessment must then be approved by the national civil aviation authority before flights can take place. However, acquiring such operation permission is a complex process. This is proven by the lack of abundant Specific category operations taking place in the EU. This research explores how to create a systematic mapping between drone technology and methods and the technical SORA requirements, thereby systematizing the process of achieving operational approval for Specific category drone operations in the EU.

This work has produced methods and technological solutions by performing action research on real-life challenges in research projects and industry. The developed solutions solve risk-handling challenges within the areas of ground risk, drone containment, and safety assurance provision. A generic drone test platform has been created and used for testing a fail-safe system capable of stopping the drone and deploying a parachute, a module for allowing multiple pilots to control a single drone at strategic parts of a flight, a technical drone description structure for version control, and a framework for indoor, drone durability and fault testing. Additionally, a tether concept to safely operate heavy-lift drones has been produced. A suggested way of performing drone system analysis, required by EU regulations for operations of a certain risk, has been proposed. Finally, a code generator for simplifying the drone system analysis has been developed.

The contributions have been compiled into an Optimized SOra Process (OSOP), leading the user to the appropriate solutions given a drone and a desired operation. Elements from the OSOP have helped researchers and industry partners to achieve operational permission in a range of scenarios under the SORA framework. The OSOP covers some of the technical challenges faced when performing a drone risk assessment. It has been tested on small multirotor drones, vertical take-off and landing logistics drones, and heavy-lift multirotor drones. Further research should strengthen the optimized process by applying it to a wider range of drone platforms and operation scenarios while also proposing methods and technology for the risk mitigation challenges not treated in this work, such as detect and avoid and deconfliction with other airspace users.