

Thales Avionics contribution to ICAO Drone Enable: Geofencing systems

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Purpose and Context

Focus on geofencing function design within an UAV

Hypotheses:

Services are provided by UTM

- **The UTM provides the definition of height limits and no fly zones**
- **The Flight Authorization or Clearance relates to a given zone of operation or a given flight corridor**

The UAV is equipped with a geofencing function

Geofencing : A key contributor to both safety and security

Basically designed for

- Privacy : private properties
- Security : critical infrastructures, military sites, sensitive sites,
- Safety : manned air traffic ; population, infrastructures,...

But also

- Safety : could prevent Pilot errors and also UAS control system defaults
- Security : could make much more difficult malicious or even terrorist use

Geofencing : Shall be designed for security and safety

- Shall be specified in terms of performance ,reliability and safety ,
 - in relation with expected effect of malfunction
 - In relation with possible unintentional or intentional misuse
- Take into account the need to lock/unlock the limitations for authorized users
- A range of some standardized classes should be proposed
 - to fit the different needs, from the less critical to the most critical
- A device independent of the flight controller could be a solution
 - To reduce common failures effect and simplify legal obligation fulfillment

Example of classes of geofencing function and performances

Function role	Example of use	Function details	Reliability objectives
Advisory warning (basic minimum)	Very light drone , intrinsically limited range, relatively acceptable infringements	Information of the remote pilot versus limits Aural and visual alerts	Low
Distance and height limiter (to stay within a cylinder)	Drones authorized only at a limited distance and height from the operator, and not over people	+ independent distance / height sensing and monitoring. When limit exceeded, crash triggering (switch-off power)	High (commensurate with impact of no effective limitation)
Flight Zone limiter	Drones authorized in a zone of complex definition , and not over people	+ independent position/ height sensing and monitoring When limit exceeded, crash triggering (switch- off power)	High (commensurate with impact of no effective limitation)
Highly reliable system with intrinsic zone conformance	Drones authorized over people	+ fault-tolerant control system including zone conformance monitoring. When degraded, safe land asap	High

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Geofencing has to be standardized to be efficient and affordable

- **Definition of geographical restrictions, distribution of these data to the airspace users # UTM « information service**

- **Standardization and if possible simplification of the no flyzone format**

- **Definition of authorized users and way to get authorization to fly in a no fly zone**

- **Agreement on function classes / levels**

- **Functional behavior, effect of limitation,**
- **Reliability : availability, integrity, missed and false activation rate :**
- **Resolution , accuracy, border margins , time to activate, source of position reference**

- **Definition of security levels of the function**

- **To protect against the unlocking**
- **To secure the authorization to fly in a restricted area**

- **With standardization at both levels , the function and the UAV**