

Solutions to Regulate & Manage Drone Flying Before the Advent of a Standardized UTM

Luc Haeberlé

Colibrex GmbH, Germany

The number of UAS flying for both recreational & professional usage is inexorably increasing worldwide. For most of the applications, the UASs fly into uncontrolled airspace. Another big step is the foreseen introduction of sophisticated operation modes like BVLOS and autonomous flights.

In parallel, concerns are raising regarding risks of incidents not only for aviation safety but also for public and homeland security. The industry is however working on technological progress like Detect & Avoid systems, tracking, visualization and automation.

All in all there is no doubt that UAS Traffic Management Systems (UTM) will be necessary and ultimately implemented. At this stage it is unclear to which extent these UTM systems shall be integrated into the existing ATM solutions, but we can at least expect some kind of interface between the two environments.

The concept of UTM has been initially defined by the NASA as “UAS Traffic Management (UTM) for UAS operations in uncontrolled airspace, where Air Navigation Service Provider (ANSPs) don’t offer services, and is similar to Air Traffic Management (ATM) in controlled airspace”.

There are however no standardized specifications and definitions of operational conditions yet for UTM. Looking at various conceptual approaches already presented by various UAS or aviation stakeholders, a UTM could ultimately include functionalities such as online flight authorization, geo-fencing or geo-caging, automated airspace notification and authorization tools, Sense & Avoid, low altitude automation and scheduling. The operational risks and types of operation authorized will influence the level of complexity but also the costs of the system. One thing is sure at the moment: there is considerable uncertainty on how a fully integrated UTM system will exactly look like.

Above all, various issues have to be clarified before the implementation of a full-scheme UTM. We can distinguish between legal, technical and operational issues.

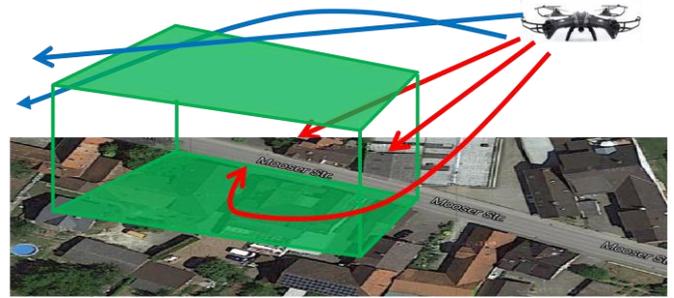
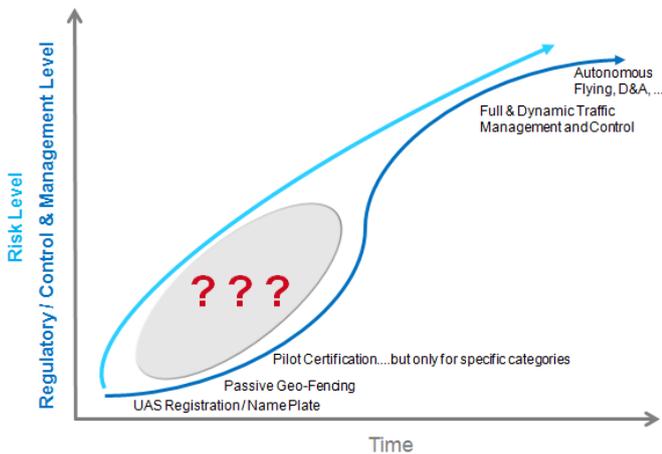
The first legal issue arises from the fact that in most of countries the existing regulations and laws have still to be adapted to enable UTM basic functionality like registration and flight authorization. Regulators are working on it and international organizations are proposing new frameworks, but the speed of the legislation process is not to underestimate. Another “legal” issue concerns the selection of the responsible authority which should be in charge of managing a UTM. Or can we even expect various (if not competing) organizations in the future? And what about the financing and accounting models? Should there be centralized state financing or something more commercially oriented with user fees? Last but not least the question of liability will for sure be crucial. It is nice to see that some apps are already available on the market indicating the no-drone-zones. But do they guarantee that an area presented as free zone does really not contain any restriction? Are the data legally binding? In case of an accident you can be sure that insurance companies will look very carefully into that.

Regarding technical issues let’s cite some of the key topics only. The connectivity and communication between all elements (UAS, UTM, ATM, non aviation data, weather data, etc...) represent a major challenge, but also offer interesting opportunities for players such as mobile network operators who are pushing for such kinds of applications with their upcoming 5G networks. Some questions on how to achieve a stable coverage “in the air” need however to be answered.

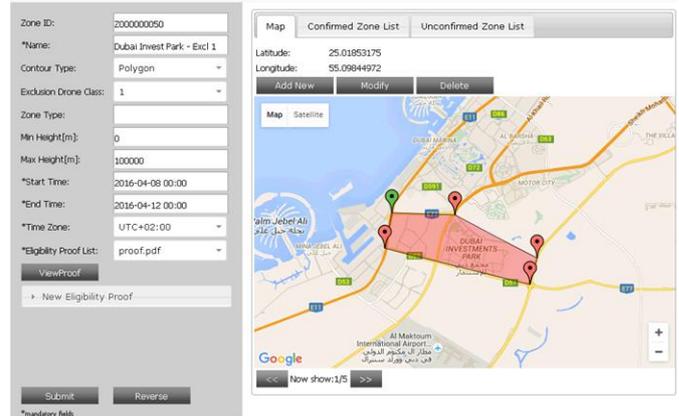
Attention should also be drawn to securing the identification and localization of the UAS, in parallel to the subject of Detect & Avoid. Last but not least, cybersecurity shall surely be considered with the highest priority in the whole communication approach of UTM.

On the operational level, various questions need to be answered beside the issue of BVLOS and autonomous flights already mentioned in the introduction. The UTM should include specific rules for ex. for urban operation and consider weather related limitations and maybe even spectrum allocation.

All these issues will be solved, sooner or later, but a minimum level of standardization and time for further R&D and operational validation are necessary. But shall or can we wait, considering that in the meantime the number of operating UAS will continue to increase ?



3D No-Drone-Zone (NDZ)



Registration of a "No-Drone-Zone" via the Drone-Flight-Check System

For sure not. A few key decisions from a regulator at national level combined with the implementation of a system like "Drone-Flight-Check" from Colibrex that can dynamically manage and link registration and no-fly-zones represent a significant progress. And it is a first step in the preparation of UTM.

The proposed concept is based on following scheme

- Define the limits (Authorities): "where, when, who"
- Register Pilots and Owners
- Drone License Plate (possibly with electronic-ID) for all UAS
- Facilitate Flight Planning for the Users and Authorize Flight Operations by the Authorities
- Enforce the rules

We insist on the fact that the "limits" should be defined by the authorities, and not be restricted to aviation related data like the airport data for example imported from the European AIS Database (EAD). The idea of the proposed system is to allow other entities to easily establish their no-drone-zones (NDZ), but via a centralized database and a legal approval or confirmation of the data. Another necessary function is the creation of temporary no-drone-zones (e.g. by importing relevant NOTAM information) or the definition of limited-drone-zones (LDZ), i.e. areas where only certain categories of UAS will be allowed to fly. Last but not least the areas have to be defined in the database as 3D layer taking into account the limitation of the altitude for the given category.

The other part of the database shall contain the user data. The idea is to request the users to register themselves and their drones via a simple app. As mentioned above, different categories with appropriate flight rights can be defined. A commercial user (company) can register several pilots.

Having the two main data components registered (no-fly-zones and users), the proposed concept is to have the system validating appropriate "flight requests" (also called "flight leases"). This part is the most demanding in terms of data and logical processing and in terms of dynamic. It represents the key of "Drone-Flight-Check".



At first the user can check with the system app if he can fly or not in a given area and a defined timeframe. In the future, when appropriate standards and interfaces will be defined, the limitation data will be directly communicated, saved and processed by the on-board controller units of the UAS for an automatic "geo-fencing" or "geo-caging".

But we have seen in the introduction the limit of the “passive” approach of self-verification of the intended flying plans. An official validation would still be missing.

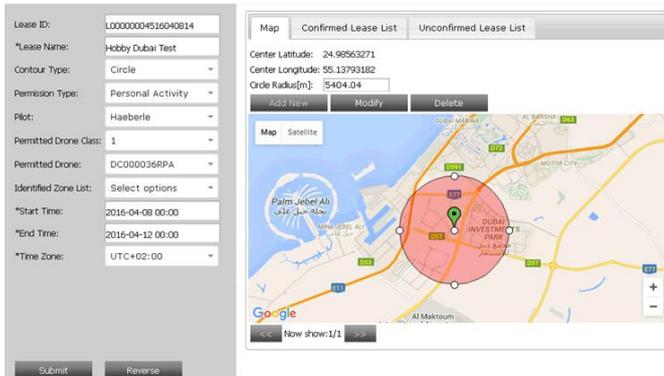
Drone-Flight-Check integrates a validation process and differentiates itself in this approach from other tools available on the market: Before flying (or organizing a batch of flights for a defined period of time), the user sends via the app his flight lease request. A flight lease area can be requested with only a few clicks on the app only. The user can also select the flight lease from a predefined list of flight requests or from former flight requests. In the future we can even imagine, for specific applications, flight leases requested in an automated scenario by the drone itself.

The process described above can be easily implemented as a first step to regulate the drone traffic and especially to insure that drones are flying in authorized areas. For the regulators already requesting more control and “enforcement” possibilities and in preparation of future UTM, the system offers additional functionalities.

One of these functionalities would be a mandatory geo-fencing and geo-caging, as seen earlier. But instead of a passive geo-fencing as offered by some UAS manufacturers, the advantage here is that the UAS autopilot downloads the dynamic geo-fencing data and approved flight area as generated “online” by the Drone-Flight-Check system.

The other important step is to make use of the flight lease ID data for tracking in combination with an onboard unit (Drone-ID) that should be mounted on the registered UAS. The onboard unit permanently transmits a status info, including the digital number plate of the UAS, the actual flight lease ID and the flight status. This allows enforcement entities like police or other services to easily identify UAS and verify if a flying UAS is authorized or not!

LS telcom and Colibrex propose a small onboard-unit working on a proprietary RF interface and ensuring a permanent traceability.



Flight Lease Request via the Drone-Flight-Check System

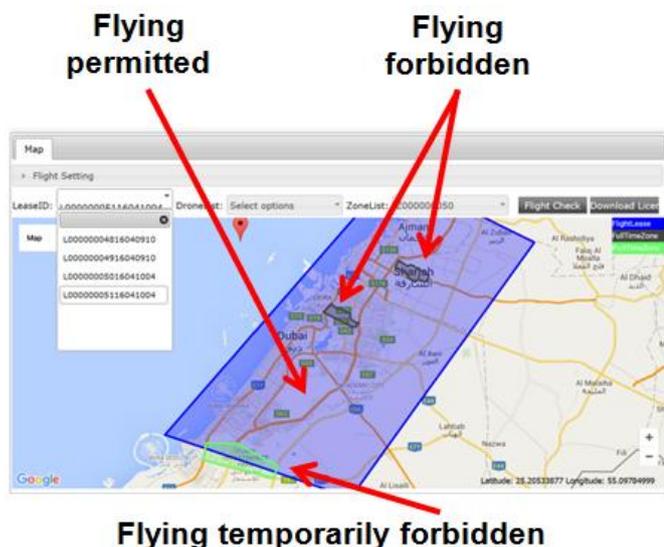
When all parameters are fulfilled (considering the allocated operation rights), Drone-Flight-Check will automatically generate a flight lease approval. Each approval becomes a flight lease ID. The system shall also allow manual processing for specific approvals in case of special requests.

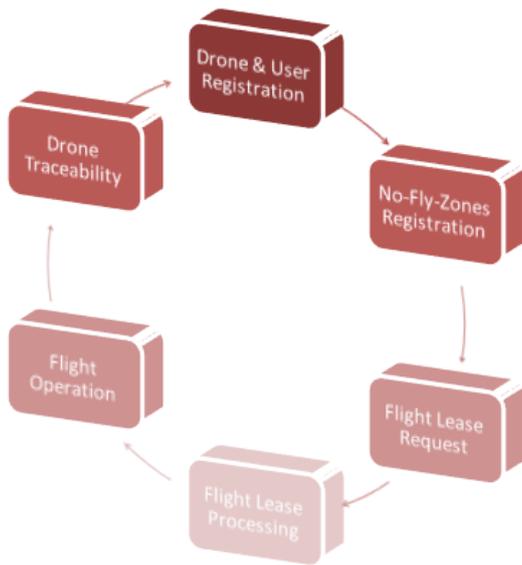


Drone Number: DC000038RPA
 Flight Lease: L00000004416040814
 153946.20: E_DroneCheck_OK

Other solutions under investigation rely for example on 4G and in near future 5G networks to provide coverage and localization. All in all, the drone-ID will be part of any future UTM system. In the concept of Drone-Flight-Check, it can be already part of the integrated process of registration, authorization and tracking.

The complete integrated process is summarized below:





As a conclusion, we would like to emphasize the following key points of our proposal of solutions to regulate & manage drone flying before the advent of a standardized UTM:

- Authorities (directly or via a mandated organization) should be responsible for the management of no-fly-zones and more generally for authorizing UAS operation: “where, when, who”.
- Solutions exist to combine registration and up-to-date (even temporary) no-fly-zone data and to enable authorities to easily (and mostly automatically) authorize UAS flight operations, based on “flight lease requests” issued by the users via a simple App.
- With a Drone-ID / number plate, this kind of system even allows enforcement entities to verify if a UAS in operation is authorized to fly.
- Drone-Flight-Check is an expandable solution, adaptable to the requirements of dedicated authorities and to recommendations of international organizations. It forms the prerequisites and basis of future UTM systems.

Luc Haeberlé, Managing Director
Colibrex GmbH (LS telcom Group)