

UNMANNED AERIAL VEHICLES TRAFFIC MANAGEMENT SYSTEM

The range of civil applications of Unmanned Aerial Vehicles (UAV) is rapidly growing; the main application areas identified up to now are: territorial security, infrastructure monitoring, remote sensing, aerial photography and survey, environmental and natural disasters monitoring, search and rescue operations, video recordings.

UAV basically encompass two aircraft types, hereafter collectively referred as “drones”:

- Remotely Piloted Aircraft Systems (RPAS), UAV operated by a remote pilot from a Ground-Control Station
- Autonomous UAV without remote pilot.

Most drone operations are currently performed outside the controlled airspace, where no air traffic management services are provided. This uncontrolled airspace is the Very Low Level (VLL) volume that usually spans up to 500 feet (150 metres) above the ground. This VLL airspace is shared with other users such as General Aviation, helicopters, gliders, balloons and microlights.

The drones operation in this airspace could endanger the safety, security and privacy of citizens if they are not managed by a system with a high level of automation. Such system is known as UAV Traffic Management (UTM).

UTM

THE SOLUTION

Leonardo, leveraging on its extensive experience in the implementation of Air Traffic Management (ATM) systems, is ready to deploy an UTM automated system, relying on new technologies, to efficiently and safely manage the drones traffic in VLL airspace. Our system can provide, among others, the following services: public register of drones, communication, route and mission planning, conformance monitoring, dynamic geo-fencing, ground based safety nets and contingency management.

The cooperative drones have to be equipped with:

- self-identification and self-positioning facilities
- communication facilities to transmit to the UTM system position data and equipment status.

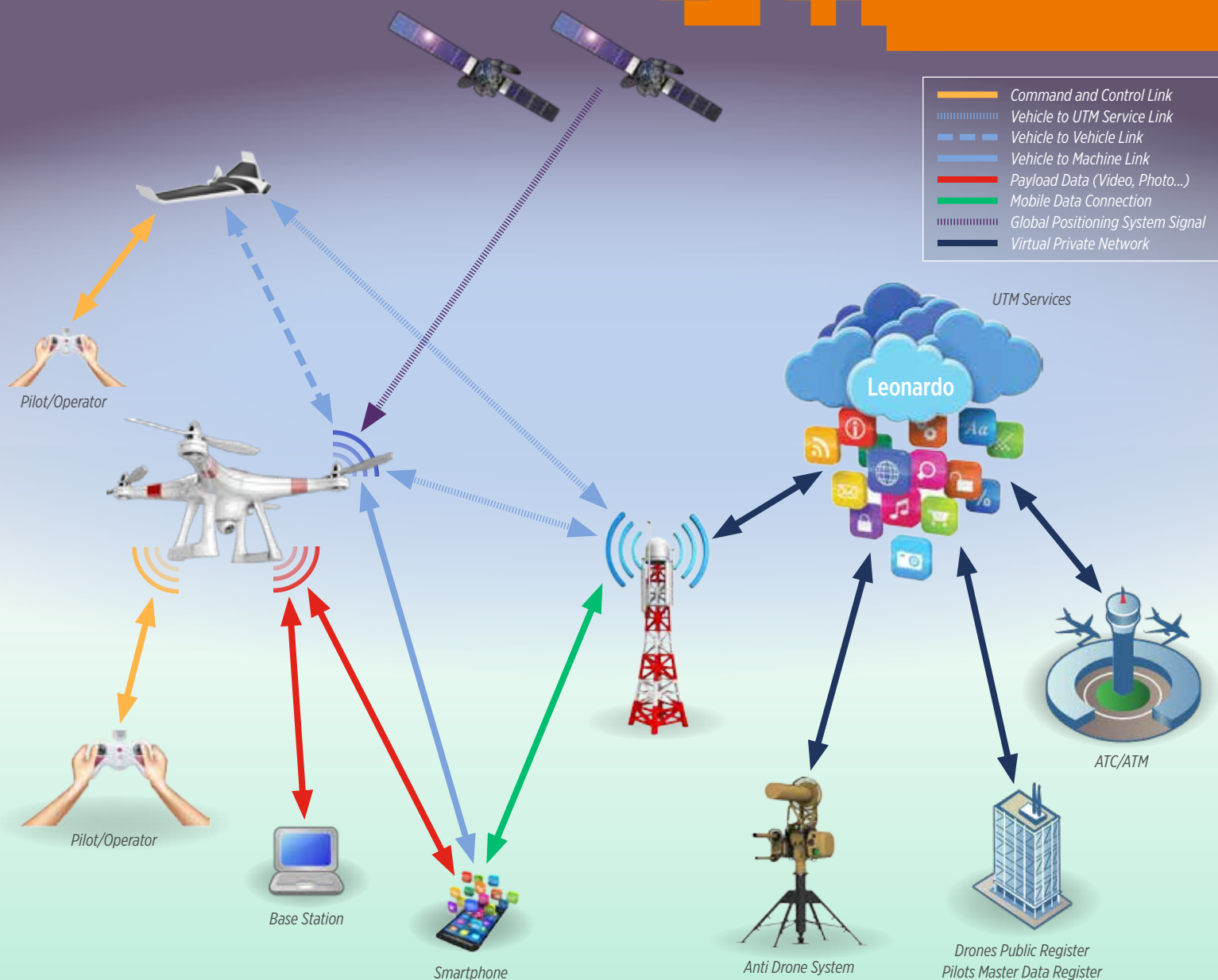
The UTM functionalities are implemented in a scalable cloud platform in order to offer Cloud Service Applications to the various UTM stakeholders, including:

- authorization bodies, for UAV and pilots database
- pilots, for pre-flight mission planning, contextual information and tactical warnings
- drones, for geo-fencing and emergency instructions
- ANSPs, for ATM insertion procedures
- law enforcement bodies, for security warnings, infringements and hostile drones discrimination
- infrastructure protection, for security warnings
- insurances, for incidents investigation.

UTM services are web-based and remotely accessible by the stakeholders, through standard Web Browsers, from two different external applications, one for mobile devices on Apple iOS and one for multi-platform desktops.

During the missions, the UTM platform is connected with pilots and drones through the LTE mobile network using machine-to-machine devices and services, by using an app on smartphone or tablet.





SYSTEM ARCHITECTURE

The UTM is designed as a “Platform as a Service”, able to integrate additional SW solutions such as payload cloud data storage, thus offering full functional applications as “Software as a Service”.

The software components are virtualized and included in a Cloud Architecture using the open source Apache CloudStack platform. This solution provides the necessary:

- scalability to meet the envisaged exponential growth;
- high performance and high availability of the services;
- cost reduction.

Data processing components

The Communication Gateway manages the links with all UTM stakeholders and their secure authentication:

- it gathers the requests of mission validation / authorization and the position reports from drones;
- it provides the end users with warnings and contextual information about the VLL airspace, in point-to-point or in multicast mode.

The pre-flight mission requests are validated by the Public UAV and Pilots Registry (and by the Mission Safety Processor), considering:

- the drone type, the pilot licence and location;
- the potential crossings with restricted areas and geofences;
- the potential conflicts with other planned missions.

During the mission:

- The position reports received from drones are filtered and forwarded in ASTERIX to the **VLL Data Fusion processor** that combines them in a single scenario with other data coming from adjacent UTM or ATM systems and distributes them to remote users through the Communication Gateway.
- The **Mission Safety Processor** uses drones mission data and other relevant information to check flights safety both in medium and short-term, monitoring separation among drones, among drones and aircraft and with respect to restricted portions of airspace. Depending on the safety rules, it either warns the involved stakeholders or acts directly on the drone Flight Management System to activate the “Return To Home” embedded function, when available.
- Both unprocessed and processed data are recorded by **Recording & Data Reduction**, allowing, for example, to retrieve all the missions executed by a given drone and/or pilot, to perform infringements/incidents investigation, to make statistics for billing and airspace configuration improvement.

Users data display applications

The **UTM Working Position** is a Java application to remotely manage the geographic volumes and to display the VLL airspace traffic on an Open Source Geographic Information System (OpenStreetMap).

Through this application the user can, according to its privileges:

- Display the traffic in any geographical area covered by the UTM services;
- Display and edit the restricted areas and geo-fencing;
- View mission data, for example pilot, drone model, equipment and its status.

The **Mobile UTM Interface** is a lightweight and easy-to-use interface unit to access the services provided by the UTM system. Made as an application for Apple iOS mobile devices, it is used for authentication, request for mission authorization, display of the drones tracks, contextual information and warnings.

CONCLUSIONS

Unmanned traffic must be managed and regulated. Stakeholders need to quickly answer to the safety, security and privacy issues embedded in drones innovation.

By facilitating the safe operation of drones through deployment of modern technology, the UTM system is the ready-to-market Leonardo answer.

