MANAGEMENT OF TRANSPORT OF SANITARY MATERIALS AND DRUGS BY MEANS WITHOUT PILOT (DRONES)

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Introduction: The idea of flying is the dream of man for centuries. The concept of "flying" (things and materials) without a pilot is a relatively recent concept. Just this last aspect, which is one of the main reasons for the increasing use of drones, has given us the idea to use flying means without a pilot for the rapid transport, in emergency of basic sanitary materials. use of these means are: 1) Rapid transport of blood and drugs. 2) Transport of test tubes from the place of emergency to the nearest hospital equipped for urgent exams. 3) sampling in the area; In this case, the drone can perform the dual function of a passive vehicle (transport of samples taken from operators in the area) or active (sampling of air or water in unreachable or high-risk areas). 4) Exchange of various materials from infected areas (where the drone is not a possible diffusion vehicle) with a reduction in the number of people subject to contagion risk (amphibian drones can be suitably treated). For these activities it is possible to design high-security cells and use drones with parachutes to minimize the risk of falls.

Materials and methods: In order to realize such an ambitious project and to give it a practical and scientifically correct sense, the only way was to undertake a progressive step process. In practice, we started by structuring a basic theoretical path shared with a reliable partner able to fly professional drones SAPR (Remote Piloted Aircraft Systems) with suitable transport cells. The characteristics of the system are the professionalism of the operators (certified commercial drones, license of flight operators, insurance). The second phase saw us engaged in the experimentation process aimed at achieving a correct qualification of the process, passing from the appropriate ENAC (national civil aviation body) assessments and authorizations. The system is based on intuitive software that is easy to use. The core of the technology is the intelligent capsule that adapts to any drone (allowing to exploit the technological advancement of this industry). Therefore, construct capsules for the required purpose (with related safety systems, temperature monitoring, action tracking and path, etc.) the container necessary for the purpose can be used. For sampling instead, you can use "amphibious" drones with supports for water or air sampling. If the drone is operating in areas where there are routes established for its activity (for example hospitals that regularly send samples), it can use these for the movement automatically (with a BVLOS flight (in essence fpv flight - First-person) view or with similar systems - operations that require piloting beyond the distances that would allow direct visual contact by the pilot with vehicles Apr / Sapr [chapter 24,25,26ENAC regulation section V]), otherwise it can be controlled remotely (with authorized pilots) following the ENAC rules for maxi-emergencies. Drones can be used with variable load capability based on the technology of the chosen vehicle. The intelligent capsule, interchangeable as needed, can be attached to any type of drone in a modular way. The smart capsule is designed to give maximum strength with the lowest possible weight while respecting the standards required by the standards such as, for example, compliance with and traceability of temperature, hermetic closure, easy cleaning. The Software uses advanced commercial and open source flight control systems which must in any case be authorized by ENAC and managed by pilots with a suitable flight license.

Results: Drones reduce delivery times by up to 80% over short distances (up to 10 km) and up to 50% over medium distances (up to 40 km). Their autonomy is currently up to 45minutes flight at 35-40 km / h, (depends on the technology of the drone). Transportation times are much more than halved. If the drone is present at the site can start at zero time even reaching the most disadvantaged hospitals (some examples of critical distances can be: Portoferraio as the crow flies: Livorno 81km (road 150), Cecina 57(93), Piombino 21(45) - to the kilometers one must add an hour by ferry From Volterra: Pontedera 34(43), Livorno 47(72)). The economic analysis, considering the absence of a pilot (H 24), the power supply, the low pollution rate and the relatively low cost of the machine, shows that this type of transport is particularly advantageous and "clean". The purpose of the project was to evaluate the impact of the flight (regardless of the carrier) on hospital facilities in routine situations (sample transport, transport of drugs on isolated, disastrous or difficult to reach areas) or maxi-emergency evaluating the reliability of delivery to the structure of destination (including data tracking, repetitiveness and flight safety) and the security of the material sent (insulation, temperature, etc.) The first step was to carry out a transport risk analysis according to the guidelines expressed by the Good Practice Guidelines. With this in mind, an FMEA form was drawn up in which the "risks" were divided into 2large groups: 1) Organic materials and transported drugs - of health relevance; 2) Flight intended as transport with appropriate carrier - pertaining to the drone operators. The "classical" experimentation started on 21/10/18at Pontedera with the first "study" flight dedicated to the evaluation of temperature variations at height with sensors on board the drone (short-range mission with closed roads, pilot with appropriate license that has always followed the drone (standard scenarios S03ENAC with flight in VLOS in compliance with all the technical requirements of the case)). In this flight, bags of physiological saline were inserted into the container. These tests were repeated for longer and longer distances until the system was stressed at its maximum distance

Conclusions: The transport with Drones surely represents the future of the movement of sanitary and rapid or repetitive drugs. The system (SAPR- done + professional pilot structures) proved to be reliable and precise, keeping expectations about speed and accuracy of delivery. The management software, thanks to the pre-loaded information, is simple and intuitive. The flights in a complex environment (Pontedera, Volterra, Vinci) took place without problems. The desired temperatures have been maintained.The system can be implemented with RFID hardware and software for load and discharge verification

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