Review

Current Regulations for Transporting Medicines Using a Remotely Piloted Aircraft System (RPAS)

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Abstract: The document sets out three differentiated proposals for the transport of medicines through RPAS with their respective regulations, adapted to different operational categories: open category, special category and military scope. In the open category, an economical and efficient solution is prioritized for urban and rural areas, complying with weight and height regulations, in addition to guaranteeing the stability and quality of medications during transportation. The special category allows more complex operations and in more adverse conditions, such as densely populated areas and long routes, incorporating advanced security measures and training for personnel. In the military field, RPAS are used in conflict zones and hard-to-reach areas, ensuring the safe and rapid delivery of medical supplies under extreme conditions. Success stories in different countries are highlighted, demonstrating significant improvements in delivery times and risk reduction for health personnel.

Keywords: RPAS (Remotely Piloted Aircraft Systems); drones; regulations; medication transport; INVIMA (National Institute for Food and Drug Surveillance); UAEAC (Special Administrative Unit of Civil Aeronautics); safe and quick delivery; cold chain; drone delivery; flight and maintenance log; operations manual; manufacturer's manual

I. Introduction

The use of Remotely Piloted Aircraft Systems (RPAS) for the transport of medicines has become an innovative and efficient alternative in various operational categories, from the open and special category to applications in the military field. This document presents a detailed analysis of the proposals for the transport of medicines using RPAS, addressing the regulations, technical and operational requirements necessary to guarantee the safety and effectiveness of the delivery of these vital supplies. Through case studies and concrete proposals, the aim is to demonstrate the viability and benefits of using RPAS in health logistics.

In recent years, the integration of drones in healthcare logistics has gained significant attention. A citation from BMJ Innovations highlights this shift: Drones have been pioneered and used in the military, however, only recently non-military drones have been introduced. The COVID-19 pandemic has brought into focus the potential value of drones in moving medical supplies [1]. This underscores the accelerated adoption of drones in medical logistics, spurred by the urgent need for efficient and rapid delivery of medical supplies during the pandemic.

Furthermore, Health Tech Magazine emphasizes the transformative impact of drones in medical supply delivery, stating, Drones are transforming the delivery of medical supplies, providing rapid and reliable transportation that overcomes traditional logistical barriers [2]. Practical examples abound, such as using drones to deliver blood samples from remote clinics to testing facilities or transporting vaccines to hard-to-reach areas affected by natural disasters. These examples illustrate how drones are revolutionizing healthcare logistics by enhancing speed, accessibility, and efficiency in the delivery of critical medical supplies.

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Moreover, Public Health Reports emphasizes the critical role of drones in public health crises, noting, Drones have played a significant role in public health crises by ensuring timely delivery of medical supplies [3]. This highlights how drones contribute to the resilience of healthcare systems during emergencies, enabling swift responses and ensuring that essential medical resources reach affected populations promptly, thereby potentially saving lives and mitigating the impact of health crises.

II. Theoretical Framework

Over the last few years, aviation has advanced too much, where we have gone from analog systems to digital systems. On the other hand, there has also been progress in aircraft design, thus giving rise to the commonly known Drone, which consists of a remotely controlled unmanned aircraft. This type of aircraft has become popular in recent years because it is versatile and easily, effectively and quickly fulfills the missions assigned to it. Highlighting the importance of medical logistics in various contexts, Health.mil states, The DHA MEDLOG supports DOD's medical readiness mission by enhancing inter-Service medical department cooperation, promoting interoperability, and providing a forum for joint clinical coordination of medical materiel issues [4]. For this reason, the Convention on International Civil Aviation, which is known as the Chicago Convention, considers and admitted the existence of said unmanned aerial vehicles since 2011, where it mentions:

"Article 8.- Pilotless aircraft No aircraft capable of flying without a pilot shall fly without one over the territory of a Contracting State, unless it has special authorization from such State and in accordance with the terms of said authorization. "Each Contracting State undertakes to ensure that the flights of such pilotless aircraft in regions open to the navigation of civil aircraft are controlled in such a way as to avoid any danger to civil aircraft." [5]

Considering the above, the entity in charge of regulating Colombian aviation (Civil Aeronautics) issued a document to regulate the operations of said aircraft, in this way it establishes multiple decisions about the aircraft and situations directly related to them, just as mentioned. In RAC 100, CHAPTER A GENERALITIES AND DEFINITIONS, 100.005 [6] there are certain definitions that must be taken into consideration:

An Unmanned Aircraft, known as (UA) is an aircraft designed to fly without a pilot. On the other hand, there is a term such as Remotely Piloted Aircraft, known as (RPA), which is an unmanned aircraft (UA) piloted remotely from a remote piloting station. In addition, we have Unmanned Aircraft System, UAS for its acronym in English is a set made up of UA and its related elements that allow it to be operated remotely.

An Unmanned Aircraft System (UAS) Flight Authorization consists of an authorization issued by the Special Administrative Unit of Civil Aeronautics (UAEAC) in which it specifies in detail the scope of said flight authorization, which must include: dates, times, operator UA, UAS pilots involved in the operation, UAS involved, type of operation, approved extra-contractual civil liability policy, areas, polygons or flight lines, approved heights and other administrative and operational considerations required for the aerial operation that is planned to be carried out. Addressing the need for regulatory frameworks, Regulation & Governance emphasizes, establishing a robust regulatory framework is crucial for the widespread adoption of medical drones. [7].

UA flight characteristics refers to the physical architecture of the unmanned aircraft, for example, multirotor, fixed wing, VTOL, delta wing, among other things.

The command-and-control link (C2) is a data link between the unmanned or remotely piloted aircraft and the remote piloting station for the purpose of directing the flight. This section also includes UAS technological equipment, which consists of devices, sensors, instruments and/or mechanisms that can be used as a complement to the UAS system that are not integrated, installed permanently or are part of the UAS model. UAS factory. On the other hand, we have the UAS flight management technological system, which is a system that integrates a C2 link, through which the air operation is managed in real time on a geographic information system (GIS). of an unmanned aircraft(s), guaranteeing operational control of the flight, positioning accuracy, separation, location,

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tracking and response based on pre-established procedures to potential events of malfunction of the C2 link and/or UA failure events. In addition, we have the SMS operational safety management system, which gives us a systematic approach to operational safety management that includes the necessary organizational structures, accountability, policies and procedures. Finally, we have the Unified Command Post (PMU), which refers to the physical place where the command function is exercised, which is concentrated and implemented to coordinate the operational matters of a specific incident or event, under the responsibility of a specific civil authority.

The UA flight and maintenance log, this consists of a book that records the flight time of each UA unmanned aircraft registered with the UAEAC, correctly filling out the format determined by the UAS operator, which contains at least: manufacturer of the equipment, flight characteristics and model of the equipment, name of the operator or owner as applicable, type and identification number, date of each flight, takeoff time, landing time, total flight time and name and number of the certificate of suitability of each UAS pilot who performed each flight. Likewise, it incorporates a specific format in which reports of malfunctions, failures or technical anomalies and the maintenance work carried out on the UAS are related, indicating its current state of operational condition (airworthiness).

On the other hand, we have the manuals, where the Manual of Operations (MO), which consists of the UA operations manual issued by a UAS operator of its UAS unmanned aircraft system(s). The second manual is the UAS Manufacturer's Manual, which consists of a document issued by the UAS manufacturer that describes the characteristics of a UA for a specific model, which does not replace or replace the UAS operator's operations manual. Discussing technological advancements, IEEE Spectrum reports, Recent advancements in drone technology have made them more reliable and efficient for medical deliveries. [8].

We also have Cargo transportation, generally known as “Drone Dilivery” which consists of the transportation, reception and/or delivery of objects or merchandise with or without commercial purposes, through the operation of a UA designed and authorized for this purpose. As highlighted by Forbes, 'The integration of drones into the medical delivery system has the potential to revolutionize how quickly and efficiently healthcare can be delivered, especially in remote áreas [9].

Accidents with Unmanned Aircraft. This consists of an event related to the use of an Unmanned Aircraft, which occurs at the moment that said aircraft is ready to carry out its flight and when it stops, at the end of the flight its main propulsion system is turned off, therefore What should be considered: if any person suffers fatal or serious injuries as a result of the accident, the aircraft suffers damage that significantly affects its structure and/or causes significant damage to third parties. Regarding the challenges and opportunities, the Journal of Medical Systems discusses, the primary challenges include regulatory hurdles, safety concerns, and public perception, but the opportunities for improved delivery times and access are substantial [10].

On the other hand, in Colombia in order to transport, store and market medicines, too many things must be taken into consideration. This is why the Ministry of Health of the Colombian Government issued several resolutions on the transportation, storage and marketing of medicines and medical supplies, Therefore, based on Resolution 1403 of 2007 [11] there are certain definitions and circumstances to take into consideration:

Medicines are a pharmaceutical preparation obtained from active ingredients, with or without auxiliary substances, presented in pharmaceutical form that are used for the prevention, relief, diagnosis, treatment, cure, or rehabilitation of the disease. Each medication must contain containers, labels, labels and packaging because it guarantees its quality, stability and proper use. To complement this idea, it must be considered that there are over-the-counter medications, that is, they are medications that the consumer can acquire without the mediation of the prescriber and that are intended for the prevention, treatment or relief of symptoms, signs or minor illnesses. Finally, in order to correctly supply medications to the patient, a prescription, formula or medical order is needed, which is a written order issued by a doctor or health professional authorized by law, so that one or more medications, specified therein, is/are dispensed to a certain person.

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On the other hand, it must be considered that there are Medication Related Problems (DRP), these are any undesirable event experienced by the patient that is associated or suspected to be associated with a therapy carried out with medications or that interferes with the desired result for the patient. These problems can be classified into:

a) Related to the need.
b) Related to effectiveness.
c) Security-related.

In addition, there are Problems Related to the Use of Medications (PRUM) that correspond to preventable causes of DRP, associated with medication errors (prescription, dispensing, administration or use by the user), this includes failures in the drug delivery system. medications, mainly related to the absence in the services of necessary medications, accompanied by the characteristics of effectiveness, safety, quality of information and education necessary for their correct use. These problems can be classified as follows:

a) Relating to availability.
b) Relating to quality.
c) Relating to prescription.
d) Relating to the dispensation.
e) Relating to administration.
f) Relating to use.

The Warehouse is a section dedicated entirely to the orderly and protected conservation of pharmaceutical products and related materials, waiting to be distributed. On the other hand, there are pharmaceutical products that must be kept under special conditions, which translates into the set of indispensable resources that the pharmaceutical service must have in carrying out its activities and/or processes; the absence of these circumstances directly conditions the presence of risks to the health and life of patients.

With respect to medications, they have an International Common Name (INN), which is the name recommended by the World Health Organization (WHO) for each medication, in this way a good identification of each drug can be achieved internationally. Furthermore, a Batch must be considered for each medication, which translates as the defined and homogeneous quantity of raw material, packaging material or a product that has the quality specifications, produced in a specific process or series of processes, performed under constant condition(s).

III. Methodology

This document shows a documentary review, since it consults the requirements that are needed to be able to use an RPAS in Colombia for the transport of medicines, which would come to be known as Drone Delivery, for which the requirements for the transportation, storage and marketing of medicines in Colombian territory and requirements to use an RPAS in Colombia.

I. Requirements for the Transportation, Storage and Marketing of Medicines

First of all, we consulted how it is necessary to store, transport and market medicines, so we consulted: Resolution 1403 of 2007 [11], Resolution 1604 of 2013 (12)[4] and the Procedure for Distribution of Medicines, Medical Devices And Supplies In The E.S.E Hospital San José De La Palma And The San Antonio De Yacopí Health Center [13] where they tell us that:

The National Institute for Food and Drug Surveillance (INVIMA) under its Resolution 1403 of 2007, mentions that:

"ARTICLE 2. SCOPE. The Pharmaceutical Service Management Model and the Manual of Essential Conditions and Procedures, as well as the other provisions contained in this resolution, will apply to any person who carries out one or more activities and/or processes of the pharmaceutical service, especially to those health service providers, including those that operate in any of the exception regimes contemplated in article 279 of Law 100 of 1993 and any pharmaceutical establishment where medications and medical devices are stored, marketed, distributed or dispensed

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or any other type of treatment is carried out. “Other activity and/or process of the pharmaceutical service.”

Therefore, when wanting to offer services such as Drone Delivery, they would be included within this resolution, therefore, they must consider the intra- and extra-hospital conditions of medications, which would be defined as [13]:

- The packaging of medicines must guarantee their transport in a safe and timely manner.
- Medications must be properly stored and properly identified in the area where the service is requested.
- Check that during the distribution of the products, the conditions of stability and quality of the medicine are maintained, especially those that require a cold chain.

Considering this last point, medications that require conservation at a controlled temperature (2-8°C) must be dispensed in a Styrofoam refrigerator with frozen gel that maintains the temperature until the service area where the product will be administered or used. Each transfer or service must have mechanisms that guarantee the conservation of its cold chain.

When transporting and delivering the medication, the following must be considered [13]:

- Have transportation that guarantees the quality and conservation of the product and its content.
- The transport of special control medications will be carried out in such a way as to guarantee their conservation, safety and preservation, and must also have the label “SENSITIVE CONTENT. TRANSPORT, STORE AND USE WITH CAUTION”
- Medications that require the preservation of their temperature (2-8ºC) must be transported in airtight refrigerators, with refrigerating batteries, or any other mechanism that allows the temperature to be preserved. It must be used exclusively for these medications and treated with caution.
- If possible, avoid the transportation of medications, medical devices and supplies with other types of substances or supplies that may generate contamination or deterioration.
- The box that contains the medications in a glass container or a fragile material They must be labeled “HANDLE WITH CAUTION”, “DELICATE”, “MAXIMUM SHELF”.

Apart from the transportation of medicines, the facilities where they are stored until the moment of delivery to the user must be adequate and in the same Resolution it mentions the location conditions, which must have an exclusive physical area for authorized, independent, personnel of restricted circulation and remain clean and orderly. These zones are divided by [11]:

- Floors: These must be made of waterproof, resistant material and have a drainage system that allows easy cleaning and sanitation.
- Walls: Walls and walls must be waterproof, solid, easy to clean and resistant to environmental factors.
- Ceilings: Ceilings and ceilings should be more resistant, uniform and easy to clean and sanitize.
- Storage areas: Areas for storing medications and medical devices must be independent, distinguishable and marked, with controlled environmental conditions, temperature and relative humidity to guarantee their correct storage.
- Lighting: It must have a natural and/or artificial lighting system that allows for the proper conservation and identification of medications, as well as good handling of documents.
- Electrical installations: Ceilings in good condition, sockets, switches and protected wiring.
- Ventilation: It must have a natural and/or artificial ventilation system that guarantees adequate conservation of medications. Natural ventilation should not be understood as open windows and/or doors because it could allow contamination of medications with dust and dirt from the outside.
- Temperature and humidity conditions: The places where medications are stored must have mechanisms that guarantee the temperature and relative humidity conditions recommended by the manufacturer and permanent records of these variables; thermometers, hygrometers or other instruments can be used.
- Storage criteria: Medications will be stored according to pharmacological classification (drugs)

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in alphabetical order or other method as long as order is always guaranteed and confusion, loss and expiration during storage are minimized. This system must guarantee that the batch closest to expiration is the first to be dispensed.

On the other hand, the medication delivery procedure must be carried out observing the current regulatory requirements that regulate the acquisition, reception, storage, distribution, dispensing, information on proper use and transportation of medications. Integrating AI with drones enhances route optimization and delivery efficiency, leading to better healthcare outcomes [14]. It is in this way that the following must be fulfilled [12]:

- Affiliate information: The confidentiality, veracity and updating of the information of its affiliates must be guaranteed, to avoid inconsistencies and impossibility in the provision of medications at the place of residence or workplace with the due authorization of the affiliate.
- Scheduling the delivery of medicines: The delivery of medicines must be scheduled with the member at the place of residence or work when they authorize it. In the event that the member does not authorize the delivery of medications, this must be recorded.
- Personnel carrying out the delivery: The delivery of the medications will be carried out by a professional Pharmaceutical Chemist or a Pharmacy Regency Technologist with the skills to provide information to the user about the proper use of the medication and the importance of pharmacotherapy, among others. This information must be delivered verbally and in writing.

Finally, the transportation of medicines. Transportation activities carried out through the exceptional medication delivery mechanism must be carried out considering the following aspects:

- Personnel: Own or contracted personnel who carry out this activity must have training and education in this regard.
- Documentation: There must be written procedures that describe at least the main operations that may affect the quality of medications, maintenance and cleaning of vehicles and facilities, handling conditions, safety and traceability, among others.
- Traceability: The traceability of medicines must always be guaranteed during all activities carried out for the delivery of medicines.
- Transport vehicles. Transportation must preserve the integrity and safety of the medications, protect them from extreme conditions of temperature, humidity, light or possible contaminants and maintain the conservation conditions at all times, complying with the technical specifications established by their manufacturers.
- Self-inspections. Periodic self-inspections must be carried out on all means of transport used for the delivery of medicines, especially in the risk aspects of the process, complying with current regulations related to these means of transport.

II. Requirements to Use an RPAS

On the other hand, to carry out the Drone Delivery service, the regulations of these in Colombia must be considered, so RAC 100 OPERATION OF UNMANNED AIRCRAFT SYSTEMS UAS, the predecessor of RAC 91 of 2018, was consulted. Ensuring the safety and managing the risks associated with medical drone operations is critical to their successful implementation [15]. In this they mention us What categories are Drones divided into, what operations can they guarantee, what authorizations must be requested to use them and the certificates that companies and pilots must possess to be able to perform the services.

Firstly, as mentioned in Chapter A of RAC 100, the operating rules must be established for all UAS that are used or operated in Colombian territory, this includes and applies to [6]:

- Any natural or legal person, public or private, national or foreign, who plans to carry out UAS operations without profit.
- Any natural or legal person, public or private, national or foreign, that plans to carry out operations with UAS for commercial purposes.
- All military, customs and police entities that, as an integral part of State aviation, require the operation of unmanned aircraft for the development of their missionary activities, unless they

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are involved in public order (OP) operations.

This regulation also establishes the requirements for the registration of UAS and its technological equipment, obtaining certificates as a UAS operator and obtaining UAS flight authorization by a UAS operator.

Starting Chapter B of RAC 100, it mentions that all UAS whose UA weight is greater than 200 gr must be registered with the UAEAC. , the entity will issue the operator a registration certificate, but this will not include the associated technological equipment, but rather these will be listed as an integral part of the database of UAS technological equipment for that operator.

It should be remembered that every UA registered with the UAEAC and with which it intends to carry out operations in the national territory must have a permanently attached label of at least 2cm x 4cm, with Arial text of at least 8 that contains:

- The identification number assigned by the UAEAC
- Full name of the person who registered the UA before the UAEAC
- Email
- UAEAC email

In addition to having at least this information, the label must guarantee permanent adherence to the structure, permanent legibility of the information on it, which does not alter the weight and balance of the UA, a color that makes it easy to read and be visible on the surface. outside the UA.

Having already established this, the operation of the UAS must be categorized, as mentioned in Chapter C. This is divided into 3 sections, depending on its operation and/or employer.

1. **Open Category**: This corresponds to non-commercial operations carried out with UA, with a maximum operating weight of 25 kg gross weight, which includes all elements that are on board and connected during takeoff. It is important to remember that registration of the UAS in the UAEAC database is mandatory.
2. **Specific category:** This corresponds to operations with a UA of any weight not exceeding 250 kg gross weight at takeoff, which includes the elements that are on board and connected to the aircraft, carried out by natural or legal persons, national or foreign, for commercial purposes and public entities that do not belong to state aviation. It is important to remember that the registration of the UAS in the UAEAC database is mandatory, any flight carried out in this category can only be carried out by a UAS pilot, in addition to the fact that said flight must have an issued UAS flight authorization. by the UAEAC and that the manned aviation operation will always have priority over any UAS operation.
3. **Certified Category:** This corresponds to RPAS operations whose flight conditions and purposes of use are similar to those of manned aviation. All RPA will require a type certificate, an airworthiness certificate, will operate in accordance with instrument flight rules and its remote pilots will have a remote pilot license, aeronautical medical certificate and specific training in the RPA that they operate.

Considering the above, it is necessary to consider the types of visual contact with the UA during a flight, in this way the necessary precautions can be considered to carry out a flight.

First, we have visibility line of sight (VLOS). This consists of a flight carried out at a maximum distance of 750 meters horizontally from the fixed position of the UA operator or the UAS pilot without using optical or technological devices other than corrective lenses. It must be considered that a flight cannot be carried out in obstructed airspace, weather conditions that limit the ability to maintain visual contact with the UA. Visual contact with the UA must be maintained at all times; have visual access to the surrounding airspace in which the AU is operating; and Operate the AU below the base of the first cloud layer.

Later we have extended online visibility (EVLOS). This consists of a flight that requires the support of one or more UA observers, extending the range 750 meters measured horizontally from the fixed position of the UAS pilot, without using optical and technological devices. If UA observers are used, the range can be extended to a maximum of 3 kilometers radius measured from the fixed geographical location of the UAS pilot or UA operator, provided that said UA observer guarantees a line-of-sight distance to the UA of less than 750 meters.

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Lastly, we have visibility beyond the BVLOS view. This consists of a flight in which there is no visual contact with the UA, exceeding the VLOS and EVLOS conditions, which requires the use of a UAS flight management technological system and compliance with the specific considerations described in this regulation.

On the other hand, we have special flights, which for their operation take into consideration concept prices and which require certain important characteristics. These are:

- **Night flight:** For open or closed category, the UA must have factory lights that are on and make it visible without exceeding 750 meters measured horizontally from the fixed position of the UA operator and have the support of a UA observer. In the specific category, the UAS pilot must have a night flight addition to his or her certificate of suitability. In addition, this type of flight is not authorized under any circumstances for cargo transportation activities, that is, Drone Delivery.
- **Flight in urban area:** Operations carried out near or within areas with urban infrastructure, populated and/or urbanized, must, in addition to the requirements demanded by the category in which they carry out their operations, comply with the following: The UA cannot be flown to less than 30 meters measured horizontally from a person outside the operation; You may not fly less than 30 horizontal or vertical meters from any building, without exceeding 400 feet (122 m) above the ground; and only VLOS can be operated.
- **Autonomous flight:** In each autonomous flight (asynchronously programmed), the responsibility for the UAS operation and compliance with the applicable conditions of this regulation will fall on the UAS operator and the UAS pilot who designed the flight plan and/or programmed the UA, as well as of whoever takes the control commands, activates and/or deactivates the UA. The ability to take control of the UA and monitor the flight paths and status of the aircraft in real time must be maintained at all times. Autonomous flight operations are limited to a distance of 750 meters measured horizontally from the fixed position of the takeoff or launch point of the UA, considering that the landing point may or may not be the same takeoff or launch point. If the operation requires exceeding this distance, the operator must obtain authorization from the UAEAC for an operation in a specific category. The operator must have a UAS flight management technological system that demonstrates the tracking and command of the UA, which allows measuring the maximum communication delays with the UA.

It must be taken into consideration that the UAEAC can carry out operational inspections. Where any UAS operation may be randomly inspected by the entity, UA operators must have their UA registration certificate with them. In the case of UAS pilots or UAS operators, they must have with them: The UAS registration certificate issued by the UAEAC; Copy of the non-contractual civil liability policy under the terms of this regulation; Certificate of suitability for each UAS pilot participating in the operation, issued by the UAEAC; Copy of the UAS operator certificate issued by the UAEAC; UAS flight authorization issued by the UAEAC; Flight and maintenance log of each UA that is being used in the operation. Finally, every UAS Operator must have the following documents available and updated in their facilities: UAS Operator Certificate issued by the current UAEAC; a copy of this must be displayed in a visible place in the facilities of the UA operator; Registration certificate of each UAS and associated technological equipment issued by the UAEAC; Copy of the current non-contractual civil liability policy for each UAS that is operational and/or related within a UAS flight authorization; Copy of the suitability certificate of each of the UA pilots linked to the operator; Operations Manual (MO); Maintenance Control Manual (MCM); Any other document, record or report that must be kept by virtue of this regulation or the air operation carried out.

In the event that an accident or incident occurs during a flight, the UA operator, owner, UA operator or UAS pilot must formally inform the Accident Investigation Technical Directorate of the UAEAC (DIACC) of any eventuality during the execution of the flight. a UAS operation in which any of the following circumstances have occurred:

- Serious injury to any person or loss of consciousness.
- Collision of the AU against any element of infrastructure or damage to private or public property on the surface.

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- Collision of the AU with another UA.
- Collision of the AU with a manned aircraft, on the ground or in flight.
- Collision of the UA with fauna

The report must be made within the next 48 hours after the occurrence of the event.

Now we must look in more depth at what rules and regulations affect the operation of the open category, as mentioned in Chapter D of RAC 100. This mentions what types of UAS operation in the open category are allowed, which are:

1. Simple image or data capture.
2. Aspersion.
3. Dispersion.
4. Support in response to public calamity, disaster or emergency, in accordance with the provisions of section 100.335 of this regulation.

The operating conditions of a UA in the open category must also be considered. For operation, the UA operator must consider the aforementioned and the following conditions:

- Operations may only be carried out in unrestricted or limited airspace for UAS operations.
- The flight may not exceed 400 feet in height.
- The UA must remain within the VLOS of the person operating the UA, without exceeding, in any case, a distance of 750 meters measured horizontally from the fixed position of the UA operator.
- The operation must be carried out in visual meteorological conditions (VMC) and daylight hours; However, night operations may be carried out as long as the rules established for that condition for each type of operation are met.
- The UA must not be operated within 30 meters, measured horizontally, of any person not directly associated with the operation.
- Any operation whose UA operator flies in first person view (FPV) must have an observer, in order to maintain line of sight with the UA without optical aids, who must maintain constant communication with the UA operator.

On the other hand, the operator must consider the restrictions for the operation of UAS in the open category to carry out a flight. An open category UA may not operate in:

- In a prohibited area.
- In a restricted area.
- In a dangerous area.
- In a training area.
- In a no-drone flight zone – ZNVD.
- In a BVLOS operation area.
- For profit or commercial purposes.
- For carrying out transportation activities, including live animals.
- To throw objects (solid or liquid) from the air.
- To carry out training flights.
- To perform swarm type operations.
- Within a radius of 2 kilometers (1.1 nautical miles) around any place where the President of the Republic is located.
- Less than 2 kilometers (1.1 nautical miles) horizontal distance measured from the perimeter of military or police bases, penitentiary centers and critical infrastructure of the country.
- At an airport and/or within a radius of 9 kilometers (4.8 nautical miles) measured from the aerodrome reference point (ARP), however, between 6 and 9 km measured from the ARP, the open category operation, but the flight height shall not exceed 200 feet (61 m) above the lowest threshold elevation; At a heliport (or helipoint or helideck) and/or within a radius of 3 kilometers (1.6 nautical miles) measured from the heliport reference point (ARH).

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Next, we must look in more depth at what rules and regulations affect the operation of the specific category, as mentioned in Chapter E of RAC 100. This mentions what types of UAS operations in the specific category are allowed, which are:

1. Simple image or data capture.
2. Capture of images or data for surveillance and private security purposes.
3. Capturing images or data for mass media.
4. Aspersion.
5. Dispersion.
6. Swarm.
7. Cargo transportation ("Drone Delivery")
8. Missionary activities of public entities.
9. Instruction.

It must be considered that any UAS operation that involves profit purposes will also require compliance with the provisions of the RAC 5 or RAC 6 standards, as appropriate, with respect to the exploitation of commercial air services. The UAEAC may, at any time, cancel, restrict, deny and/or prohibit any operation or flight condition, even if approved, if it shows any possible risk to operational safety.

The operating conditions of a UA in the specific category must also be considered. For operation, the UA operator must consider the aforementioned and the following conditions:

- Have a UAS operator certificate issued by the UAEAC, whose operation specifications will include the UAS pilots and the UAS equipment with which they are authorized to develop UAS operations.
- Have registered with the UAEAC the technological equipment that is not an integral part of the factory of each of its UA and that is associated with the operation to be developed.
- Have the civil liability policy(s) required by this regulation, in the terms of the second paragraph of article 1901, in accordance with articles 1827, 1835 paragraph 1 and 1842 of the Commercial Code, and other applicable legislation.
- Plan and execute operations in compliance with the stipulations of the UAS operator's MO and the manufacturer's manual(s).
- The UAS operator will designate, through the Chief of UAS Pilots, the personnel required for each operation, assigning the UAS pilot in command, who will be responsible for the entire operation on behalf of the UAS operator.
- Carry out the respective operational safety risk analysis, according to the type of operation and specific flight conditions, including the identification and prioritization of hazards, risk analysis and evaluation along with risk mitigation strategies.
- Obtain the UAS flight authorization issued by the UAEAC for the operation according to the procedure established in this regulation.
- When required, the UAS pilot must have portable air band VHF radio transmitter and receiver equipment in order to establish aeronautical communications with the corresponding ATS units, for which: The ATS unit may indicate an alternative means or the most pertinent communication with a UAS pilot, if necessary; The UAS pilot must comply with the instructions given by the corresponding ATS unit.
- Comply with all operating conditions of the open category and those corresponding to operations in the specific category, according to the type of operation and the expected flight conditions.
- Any certified UAS operator that requires deviation from the provisions for the specific category must send a special request for authorization to the UAEAC indicating the related deviations, the reasons and the technical and operational conditions with which it will manage and mitigate any operational risk that is clear. and previously identified.

Now we will consider the technical conditions for a UA in a specific category, that is, the airworthiness requirements. Every UA that is going to be operated in the specific category must meet, at least, the following technical conditions:

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- Maintain its structural elements and control systems in accordance with the manufacturer's instructions to ensure optimal operation.
- Any modification or alteration in the configuration or technical characteristics that affects in any way the flight and/or operation capabilities or characteristics of the UA must be expressly approved by its manufacturer.
- The remote command and control system must not generate any interference with other aeronautical systems.
- The following systems must be present in the UA and function correctly: A C2 system that complies with what is described in section 100.420 of this regulation; An autopilot system; A satellite navigation system; A launch and/or recovery system (if required), for normal, abnormal and emergency conditions; All factory systems fully functional (including lights, sensors and other original parts).
- All devices installed for the execution of a certain type of operation such as optical sensors, loading and unloading systems, spraying or dispersion systems, among others, must function correctly, in accordance with the manufacturer's specifications.
- For night flight, the UA must have lights (for example, navigation) that make it clearly visible.

As we observed, the C2 link is too important for UAS of a specific category, so the Conditions of the C2 link (command and control) are subject to the validation and acceptance of the UAEAC, for which the UAEAC operator must:

- Submit to the UAEAC a detailed description of the C2 link configuration and the procedures in case of loss or deterioration of communication.
- If using a communications service provider, have a map that supports the coverage of the link service in the area where the operation is planned and during the time it will take.
- Identify the limitations of the C2 link, according to the type of specific operation requested (for example: antenna blocking, range limit, antenna power and radiation pattern, infrastructure that blocks the signal, among others).

When carrying out the validation and acceptance referred to in this section, the UAS operator must include all relevant information in the MO. In addition to the risk mitigation actions for loss of connection defined by the manufacturer and/or the UAS operator, the UAS must focus on minimizing damage in the event of failure of the C2 link.

Now, due to the conditions and nature of the operation to be used, the Special Conditions for air cargo transportation operations (“Drone Delivery”) must be mentioned. Where every UAS operator interested in carrying out cargo transportation operations must comply, in addition to what was mentioned above, with the following:

- Be constituted as a legal entity.
- Have a UAS operator certificate issued by the UAEAC that authorizes you to carry out this type of aerial operation.
- The weight of the load to be transported may not exceed 50 kg and, in any case, the PBMO will not exceed 250 kg; If the cargo weighs more than 50 kg (without exceeding 250 kg of PBMO), the UAS operator must request special flight authorization from the UAEAC, informing about the nature and quantity of the cargo, as well as the route through which will be transported, in order to carry out a special study of said request. In these cases, dangerous goods cannot be transported.
- If the operation is carried out for commercial purposes (profit motive), the UAS operator must have an operating permit for public cargo transportation. If the transport will be carried out as external cargo, the operation permit will refer to special aerial work in that modality, all in accordance with the RAC 5 standard of the Aeronautical Regulations of Colombia.
- The UAS arranged for the operation must be duly registered with the UAEAC.
- The UA(s) will be subject to validation by the UAEAC regarding their technical aptitude for this type of operation, which may be supported by a certification issued by the manufacturer that reports on tests. in cargo transportation (“Drone Delivery”) of at least 250 hours or by the civil aviation authority of an ICAO Member State, for the specific UA model intended to be used.

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- UAS pilots and the Chief UAS Pilot must have training from the manufacturer regarding the operation and handling of the UAS.
- The UAS pilots and the Chief UAS Pilot must have the specific additions to their certificate of suitability required to carry out the cargo transportation operation ("Drone Delivery"), as the development of said operation is planned, as well as additions weight up to 250 kg, BVLOS, as required.
- To transport dangerous goods in an unmanned aircraft, the UAS operator must have a specific authorization in accordance with the provisions of standard RAC 175 of the Aeronautical Regulations of Colombia.
- All UAS operator personnel handling dangerous goods on the ground must have specific certified training of at least 40 hours in the safe transport of dangerous goods by air, as indicated in section 175.316 of the RAC 175 standard, in compliance with the standards of ICAO Annex 18 and the technical instructions on the safe transport of dangerous goods by air determined in ICAO Document 9284.
- All personnel involved in the cargo transportation operation ("Drone Delivery"), including the Chief UAS Pilot, must have specific certified training of at least 20 hours regarding the safe transportation of dangerous goods by air.
- The UAS operator must guarantee the stability and reliability of the C2 links during all flight phases, including emergency maneuvers.
- The UAS pilot in command of the operation must constantly monitor weather conditions throughout the cargo transportation operation ("Drone Delivery"), ensuring that VMC conditions are maintained.
- The operation of multiple aircraft on the same scheduled route (without being considered a swarm) will be evaluated by the UAEAC and will be subject to the respective UAS flight authorization.
- UAS operators who carry out operations other than cargo transportation ("Drone Delivery") must designate a Chief UAS Pilot exclusively for this activity, with a different one for other operations.
- The analysis and management of operational safety risks for the specific cargo transportation operation ("Drone Delivery").
- Description of the droneports, detailing the physical characteristics of the infrastructure that you plan to build and/or use, in accordance with this type of operation.
- Emergency response plan in the cargo transportation operation ("Drone Delivery"), which must describe the activities to be carried out by the personnel involved in the operation in the event of an accident or incident.
- Generate a numbered cargo declaration, guide or manifest, detailing the type of merchandise transported in each UAS operation.
- Comply with all current and applicable regulations on the transportation of cargo or goods by air.
- Have civil liability insurance for loss or damage to the transported goods or assets, in addition to those corresponding to liability for damage to third parties on the surface (RCE) or collision (collision with other aircraft).
- Live animals may not be transported.

It is very important to remember that the MO of the UAS operator certified in the cargo transportation operation ("Drone Delivery") must include, for approval by the UAEAC, detailed procedures on:

1. Flight planning, including the use of specialized software for this type of aerial operation.
2. Pre-flight and preparation of aeronautical, electronic, infrastructure equipment and any element that will be used during the operation.
3. Normal operation for all phases of the flight (takeoff, climb, cruise, descent, approach and landing or recovery) and any other operational condition that, given the nature of this air operation, requires to be described.

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4. Load and unload merchandise, indicating parameters, tools and practices associated with both the equipment and loading, unloading and delivery capacities, as appropriate, considering the following:
   a) The UAS operator must demonstrate to the UAEAC that the merchandise delivery system, both in loading and unloading, is safe and does not represent a risk to operational safety.
   b) The MO must describe in detail the cargo and/or merchandise security systems that guarantee their stability and restraint in all phases of the flight.
   c) If the UA does not have the capacity to perform a hover flight, the MO must consider the procedures and maneuvers necessary to perform holding circuits.
5. Abnormal and emergency operation for all phases of the flight, establishing the different operational considerations for each case, including geographical areas arranged for forced landings.

Finally, any request for a cargo transportation operation ("Drone Delivery") with UAS will be subject to the inspection of the devices to be used for loading and securing the cargo, and to the prior performance of flight tests and validation of the devices. procedures described in this section in the manner provided by the UAEAC.

In order to establish an operational safety management system (SMS) acceptable to the UAEAC as a requirement for obtaining the certificate, the following generalities must be taken into consideration:

- The SMS of a UAS operator must: Be established in accordance with the components and elements of the structure listed in RAC 219; and Adjust to the size of the UAS operator and the complexity of its aviation products or services, proportional to the size of the organization, the nature and complexity of the operation and the dangers and risks associated and inherent to the activities carried out by the operator.
- Every UAS operator must: Develop a plan that facilitates the implementation of the SMS; Collect, analyze and protect, as well as share and exchange data and information on operational safety to the UAEAC; and apply the principles for the protection of data and information on operational security.

Now, to carry out a Risk Analysis for UAS operations, the request for UAS flight authorization must be accompanied by a risk analysis using the format found on the UAEAC website, contemplating the risk management of operational safety of the type of UAS operation and flight condition that it intends to perform, considering:

- Hazard identification. The UAS operator will define and maintain a process to identify the hazards associated with its operations, taking into account, at a minimum and not limited to: Hazards to operational personnel; Dangers to personnel outside the operation; Hazards on land (natural and artificial obstacles); Dangers in the air (due to failures in operation); Strategic dangers (due to interaction in manned aircraft airspace); Dangers due to changes in current applicable regulations; Dangers of change management.
- The evaluation and mitigation of operational security risks. The UAS operator will use the TRE (Technology, Regulation and Training) methodology as the main basis for the implemented defenses and evaluating decision making in accordance with the established risk index and the tolerability matrix.

The UAS operator must define and maintain a process that guarantees the analysis, evaluation and control of operational safety risks associated with the identified hazards. The process may include prediction methods for the analysis of safety data.

Finally, to develop UAS operations in the specific category, every UAS operator must submit a request for flight authorization to the UAEAC in the manner established by it, prior to compliance with the requirements set forth in this regulation. The flight authorization form can be found on the UAEAC website. Once the requirements and conditions established in this regulation for carrying out a UAS operation in the specific category by a certified UAS operator have been met, the UAEAC will issue the respective authorization in accordance with the procedure established by it.

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III. Background

The delivery of medicines by drones has emerged as an innovative solution to improve logistics in the health sector, especially in areas of difficult access, or due to specific circumstances, such as military use. This approach is based on the technological advancement of drones and the need for more efficient and faster distribution of medical supplies; Despite the clear benefits, the adoption of drones in healthcare delivery faces several barriers, including regulatory and technical challenges [16]. The implementation of drones for drug delivery has been driven by several factors, as drone technology has improved significantly, allowing for accurate and safe autonomous flights. These advances have facilitated the development of pilot projects and feasibility studies in various countries. We can keep in mind examples such as the ALE-HOP project at the La Paz University Hospital in Madrid, which seeks to improve hospital logistics through the use of drones. This project is financed by European Regional Development Funds and stands out for its focus on optimizing the distribution of healthcare materials within the hospital environment [17], or the "Pharmadron" project in Aragon [18], this project aims to attract investments, enhance internationalization and create a business model based on drone logistics. It is expected that, with the evolution of regulations, the use of drones for the delivery of medicines will become a common practice, not only in Spain but globally. On the other hand, the Rwanda and Ghana project of the company Zipline [19], a leader in the use of drones for the delivery of medical supplies, especially in Africa. RPA can bring efficiency to the delivery phase of the supply chain. Bots are able to automatically assign delivery partners based on the location of products [20]. Since 2016, Zipline has been delivering blood and medical supplies to remote clinics in Rwanda. The company operates a network of autonomous drones that can fly up to 130 miles round trip, ensuring fast delivery even in difficult terrain. This service has significantly reduced the delivery time of critical supplies and has expanded to Ghana, where it delivers vaccines, blood and other medical products to more than 2,000 health facilities, in the Philippines I also carried out a similar project with WeRobotics [21] already who implemented drones to support remote communities. Its drones have been used to deliver medical supplies and vaccines, drastically reducing delivery times. For example, in the Tawi-Tawi region, drones replaced boat trips that took hours with flights of just a few minutes, showing a 92% improvement in delivery times, in turn, in Italy, in the face of the emergency COVID-19 health crisis, drones were used in Naples, Italy, to transport medical supplies and test kits. The Italian Civil Aviation Authority collaborated with local hospitals to implement this system, reducing delivery times from 35 minutes to just 3 minutes and minimizing the risk of exposure for healthcare workers [22]. In Mexico, a drug delivery system by unmanned aircraft was also implemented, because Mexico DC, known for its severe traffic congestion, Sincronia Logistica [22] used drones to deliver medical supplies to hospitals quickly. This initiative was especially beneficial during emergencies, reducing delivery times by 80% and ensuring timely access to critical supplies, and finally, in the United Kingdom, the National Health Service (NHS) partnered with Zipline and Apian to create a delivery network for medical supplies using drones. This network aims to centralize inventory and provide on-demand deliveries to multiple healthcare facilities, reducing supply chain complexities and improving efficiency. The program highlights the environmental and financial benefits of using drones for medical deliveries [19]

It is necessary to emphasize the importance of drone delivery of medicines offering numerous benefits, such as the ability to reach rural and hard-to-reach areas, improve logistical efficiency in emergency and disaster situations, and provide more equitable access to medicines such as It is proposed in the newspaper "Diario Farma" [18].

The use of drones for the delivery of medicines falls into the specific category of RAC 100, which allows commercial operations. The integration of drones into healthcare supply chains can streamline operations, reduce costs, and improve delivery times [23]. These operations require:

- Additional Documentation: Includes specific courses and certifications, in addition to demonstrating flight hours and registering both the drone and the operator.
- Insurance Policy: Must include a third-party damage policy to cover possible incidents during flight operations.
- Flight Restrictions: Drones must maintain safe distances from urban areas, people and restricted

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areas such as military installations and airports [24,25].

IV. Results

Remotely Piloted Aircraft Systems (RPAS) technology has evolved significantly in recent years, opening new possibilities for various applications, including the transportation of medicines. This innovation promises to improve efficiency and speed of delivery, especially in hard-to-reach areas, emergency situations and conflict zones. In this context, three differentiated proposals are presented for the transport of medicines using RPAS, each one adapted to different operational categories: open category, special category and military scope.

1. Proposal for the Transportation of Medicines through Open Category RPAS

The use of RPAS in the open category for the transportation of medicines seeks to implement an efficient and economical solution for the distribution of medicines in urban and rural areas. These drones can operate on predetermined trajectories and VLOS visual flight conditions, ensuring rapid and accurate delivery of essential medicines.

To comply with the Requirements for Transportation, Storage and Marketing section, the following are taken into consideration:

- **Medication Wrapping:** Medications must be properly packaged to ensure their integrity and safety during transport. This includes the use of containers that maintain the stability of the medication and, if necessary, preserve the cold chain through the use of Styrofoam refrigerators with frozen gel. With the ability to reach hard-to-access areas, drones are poised to fill critical gaps in the healthcare logistics chain [26].
- **Stability and Quality Conditions:** It is crucial that the appropriate temperature and humidity conditions recommended by the manufacturer are maintained during distribution. For medications that require controlled temperature, mechanisms must be used to ensure these conditions until the point of delivery.
- **Documentation and Traceability**: The traceability of medicines must be guaranteed throughout the delivery process. This involves keeping detailed records of transportation and storage conditions, as well as having written procedures that describe operations that may affect the quality of medicines.

To comply with the Requirements section to use an RPAS, the following are taken into consideration:

- **Regulatory Compliance:** RPAS must operate within the regulations established for the open category, which include weight and height restrictions (maximum 400 feet) and the obligation to maintain the operator's VLOS line of sight. Drones offer a greener alternative for medical deliveries, reducing the carbon footprint compared to traditional transportation methods [27].
- **Operator Certification:** Operators must be properly trained and certified to handle RPAS in this category, following established safety and operating procedures.
- **Flight Planning:** Detailed planning of the flight route must be carried out, ensuring that restricted areas are avoided and that the path is safe for the operation of the UA.

2. Proposal for the Transportation of Medicines through Special Category RPAS

In the special category, RPAS can operate beyond BVLOS line of sight and in more complex conditions, such as in densely populated urban areas or on long and remote hauls. These UAs are ideal for emergency situations and for hard-to-reach areas where ground transportation is not viable. Medical drones have been shown to significantly reduce response times in emergency situations, potentially saving lives [28].

To comply with the Requirements for Transportation, Storage and Marketing section, the following are taken into consideration:

- **Packaging and Safety:** In addition to standard packaging requirements, medications must be transported in reinforced containers and labeled as "sensitive contents" to ensure their protection

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and prevent damage during flight. A detailed analysis of how a leading healthcare provider integrated drones into their supply chain, resulting in faster delivery times and reduced costs [29].

- **Temperature and Humidity Control:** For medications that require temperature-controlled storage, containers with integrated refrigeration systems should be used to ensure temperature stability during transport.
- **Training and Procedures:** The personnel in charge of handling and transporting these drones must receive specific training on the safe handling of medications and maintaining the conditions necessary for their conservation.
- **Self-inspections and Safety:** Periodic inspections must be carried out on the drones and containers used to ensure that they comply with current safety and conservation regulations.

To comply with the Requirements section to use an RPAS, the following are taken into consideration:

- **Flight Authorization:** It is mandatory to obtain a flight authorization from the UAEAC and follow a detailed risk analysis that includes the identification and mitigation of hazards. Drones offer a new level of efficiency and reliability in medical supply distribution, particularly in disaster response scenarios [30].
- **Airworthiness Requirements:** Drones must meet strict technical conditions, including control systems, satellite navigation and autopilot. They must also have cargo security systems.
- **Special conditions:** The operator must demonstrate that the delivery system is safe and does not represent operational risks. Additionally, there must be detailed procedures for all phases of the flight and for emergency situations.

3. Proposal for the Transportation of Medications in the Military Field

The use of RPAS in the military field for the transport of medicines is aimed at operations in conflict zones or areas with difficult access where speed and efficiency are crucial. These UAs can operate in extreme conditions and under strict supervision to ensure the safe delivery of medical supplies to troops. The rapid deployment capabilities of drones in emergency medical services can significantly improve patient outcomes in critical situations [31].

To comply with the Requirements for Transportation, Storage and Marketing section, the following are taken into consideration:

- **Militarized Packaging:** Medications must be packed in reinforced containers that are resistant to impacts and adverse conditions, such as sudden changes in temperature and humidity. These containers must be clearly labeled for correct identification and handling.
- **Refrigeration Systems**: To maintain the cold chain for medications that require it, containers must be equipped with advanced refrigeration systems that ensure thermal stability throughout the journey, even in extreme conditions.
- **Protection and security:** Additional security measures should be implemented to protect medications during transport, including real-time tracking systems and contingency procedures in case of emergencies.
- **Rigorous Documentation:** Traceability and documentation must be exhaustive, including detailed records of transport and storage conditions, as well as verification of package integrity upon arrival.

To comply with the Requirements section to use an RPAS, the following are taken into consideration:

- **Advanced Technical Capabilities**: UAs equipped with autonomous flight technology, advanced navigation systems and secure communication capabilities to operate in hostile environments.
- **Security and Resilience**: Redundant systems to ensure mission continuity in the event of technical failures. Detailed procedures for managing emergencies and abnormal operations.
- **Compliance with Military Regulations:** UAs must comply with specific military safety and

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operational regulations, including the need to obtain type and airworthiness certificates.

V. Conclusion

The transport of medicines using RPAS represents a viable and beneficial solution in various operating conditions, offering notable improvements in the efficiency and safety of medical logistics. A detailed cost-benefit analysis shows that drones can reduce healthcare delivery costs while improving service efficiency [32]. The implementation of these technologies requires compliance with strict regulations and procedures that ensure the integrity and quality of the transported medications. It is essential to consider factors such as pressure, temperature and humidity during transportation to maintain the stability and effectiveness of medications. As drone technology continues to advance, its applications in medical delivery are becoming more widespread and sophisticated [33]

Drone delivery of medicines represents a significant advance in healthcare logistics, with the potential to transform the distribution of medical supplies. However, for this technology to be implemented regularly and safely, it is necessary to update and adapt existing regulations to technological advances and new demands in the sector. Staff training, compliance with technical regulations, and detailed operations planning are crucial to the success of these initiatives. The economic benefits of using drones for medical deliveries include reduced transportation costs and improved resource allocation [34].

The case studies presented in the document demonstrate the potential of RPAS to transform the distribution of medical supplies, reducing delivery times and minimizing operational risks. This progress highlights the importance of continuing to develop and adapt these technologies to the specific needs of the health sector, thus ensuring continuous improvement in the efficiency and safety of health logistics. Addressing regulatory, technical, and public perception barriers is essential for the successful implementation of medical drones [35].

Abbreviations

AAAE	State Aviation Aeronautical Authority.
AAC	Civil Aeronautics Authority. In this regulation, it refers to the aeronautical authority of any other ICAO Member State.
AGL	Height above ground level.
ARP	Aerodrome reference point.
ATC	Air traffic control service.
ATS	Air traffic services.
BVLOS	Visibility beyond line of sight.
CDM	Collaborative decision making.
CEAC	Civil Aeronautics Training Center (according to RAC 142).
CIA	Aeronautical training center (according to RAC 2).
CIAC	Civil Aeronautics Training Center (according to RAC 141 and 147).
DCI	International Common Denomination.
DONA	Directorate of Air Navigation Operations.
EVLOS	Extended line-of-sight visibility.
FPV	First Person Vision.
MCM	Maintenance control manual.
MO	Operations Manual.
WHO	World Health Organization
OVA	Virtual learning object.

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PMBO	Maximum Gross Operating Weight.
PMU	Unified Command Post.
PRM	Medication Related Problems
PRUM	Problems Related to the Use of Medications
RACAE	Colombian Aeronautical Regulation of State Aviation.
RCE	Extracontractual Civil Liability.
RPA	Remotely Piloted Aircraft.
RPAS	Remotely Piloted Aircraft System.
SAA	Secretariat of Aeronautical Authority.
SARPS	Standards and Recommended Practices published by ICAO.
SMS	Operational safety management system.
SSNA	Secretariat of Air Navigation Services.
UA	Unmanned aircraft.
UAEAC	Unidad Administrativa Especial de Aeronáutica Civil.
UAS	Unmanned aircraft system.
VLOS	Visibility in line of sight.
VMC	Visual Meteorological Conditions.
VTOL	Vertical takeoff and landing. ZNVD No drone flight zone.

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