Optimization of China Civil UAV Regulations
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Abstract. With the rapid development of China civil Unmanned Aerial Vehicle (UAV) market, the unauthorized civil UAVs have invaded the approaching area and clearance area for several times, it has seriously disturbed the normal operation of civil aviation, and poses a great threat to the people’s life and property. The related administrations have poor power to manage these UAVs, due to the embryonic operation regulations and incongruence between regulations and technology. This paper by comparing the established civil UAV operation regulations in the world, with the help of time series axis, we analyzed the development trend of China civil UAVs and general aviation from aspects of marketing demand, regulations and technology. Base on the above studies, we put forward the optimized regulations system. It filled up the margin of China current civil UAV Regulations.

Introduction
At present, unmanned aerial vehicle (UAV) has a promising future both in civilian and military, due to its flexible and easy operation, countries around the world carry out the development of UAV. And the developed UAVs are widely used in disaster prevention and mitigation, search and rescue, exploration, forest fire prevention, meteorological, environmental protection and other fields. [1] China also attaches great importance to the UAV development, and started much later when compared with the developed countries, but developing rapidly which currently Chinese industries have showed dozens of UAV types. The UAV development present phyletic and various, the diversity of purposes. More than 500 companies have developed and sold drones in China, and more the 70 percent of the world's small and medium-sized drones are made in China. [2] Commercial companies, research institutes and individuals are both hobbyists and users of civil UAVs.
However, the rapid development of civil UAV industrial technology, as well as high penetration rate in China, at the same time, the establishment of the UAV regulations are still in the bud, such factors lead the repeated occurrences of unauthorized civil UAVs invasion to the airport terminal area and clearance area, which seriously interfere with the normal operation of the civil aviation transportation and cause a great threat to people's lives and property. (Fig.1) Optimizing the operational regulations of existing civil UAV is the top priority for ensuring the China civil aviation safety transportation.

Research of World Civil UAV Regulations

As UAVs are a new object in the airspace they pose a potential risk to other airspace users as well as to third parties on the ground. Therefore, a growing number of countries are establishing regulations in order to minimize this risk.

The results reveal that UAV regulations are subject to national legislation and focus upon three key aspects: (1) targeting the regulated use of airspace by UAVs as they pose a serious danger for manned aircrafts; (2) setting operational limitations in order to assure appropriate flights; and (3) tackling administrative procedures of flight permissions, pilot licenses and data collection authorization. [3].

![Figure 2. Analysis of China civil UAV development.](image)

Analysis of China Civil UAV Development

We establish the time series axis and use three periods (past, current, future). We analyze the development trend of China civil UAV based on the three aspects: market, regulations and technology. (Figure 2)

Although the DJ Company is the leader of the international market, at present the global civil small UAV market share of about 70%, nearly eighty percent of the total sales are from the European and...
American countries, DJ company’s products are mainly developed for aerial photography. [4] And such UAV pilots are the chief culprits which invaded the airport terminal aerospace in recent years, due to the relatively low prices and high popularity. The DJ company claims that flight program, which on the UAVs they produced, has all the restrictions on the prohibited aerospace over the China. But other consumer-grade lower-end civil UAV produced by manufacturers are still in unsupervised situations.

Civil UAVs on the market price is on the high side, which for other purposes such as for agriculture and industry, and the level of technology is relatively lagging behind the developed countries. The customers are usually preferred imported from abroad, leading to local civil UAV is very difficult to popularizing in the market. Cost factor is a main cause of the current limited civil UAV market.

At present, market access standards, a specific certification management, operation qualification certification, flight control, related personnel training rules and the aircraft and the requirements of technical parameters need to be optimized. [5,6,7]

Construction of the China Civil Aviation Regulations System

Base on the above researches, we put forward the optimized system of China civil UAV regulation. (Figure 3) There are five main criteria in this regulations system:

![Figure 3. Optimized system of China civil UAV regulations.](image)

**Definition of UAVs Attributes**

In general, UAV regulations only apply for certain scenarios of civil UAVs that are classified and limited by the weight of the UAV and/or the area, operational range or purpose of its utilization. As a matter of the objective of this research, all regulations are applicable for UAVs that are used for both commercial and recreational purposes.

We give the definitions and standards of classifications (Weight, area, visibility), weight limits, required instruments and required level of sense and avoid mechanism.

**Operation Limitations**

As UAVs pose a serious risk for manned aircrafts, they are usually not allowed to fly in controlled airspace and thus in the proximity of places where manned aircrafts land or take off—special authorization might be possible on a case-by-case basis. Another important operational limitation states a safe distance to people, property and vessels that are not associated with the UAV flight itself. These cover restrictions for flight itself and include the following variables: the horizontal distances to people and property, prohibitions to operating over specific areas (Terminal area and prohibited areas for some sensitive purposes), maximum flying altitude in specific areas (Clearance area), dynamic limitations according to the UAV operation visibility, additional limitations and release of prohibited areas and limitations.
Qualification Management
The level of required pilot skills usually depends on the complexity and the risk of the flight mission, and a mature market standard for UAV industry is necessary for regulate quality of UAV production. These refer to the UAV applier and user management and include the following variables: standard training and qualification authentication for UAV apppliers and users.

Administration Management
The amount of effort to apply for flight permission depends on the complexity of the UAV operations. Any kind of commercial or recreational flight operation must be pre-registration which involves a registration number, markings, or an electronic ID plate.

We give a management of temporary admission application: any registered UAV pilots can coordinate a certain area and period with aerospace administration for flight. And operational certificate, aerospace control and need for insurance are included. An insurance basically addresses the subject of a clear liability regime that is able to sufficiently compensate for any harm or damage caused by the flight operation

Safety Management
UAVs can be equipped with multiple payloads such as imaging equipment or transmitters which can easily capture and record data of people, houses or other objects and thus potentially violate privacy and data protection rights of citizen. Based on the outcomes of this comparative analysis, these aspects are barely incorporated and reflected in current UAV regulations.

We bring up a management related to public and privacy right safety, there are clear standards when an information collection happens to individuals or private place.

Summary
In this paper, we optimized the system of China civil UAV operation regulations, by analyzing the current situation of the development of China's civil UAVs, and comparing it to developed existing UAV operation regulations. And there still has room to continue to study on some aspects, such as liability issues of UAVs. To ensure the safety operation of civil aviation transportation it is not enough to rely on a regulations system, and it needs air traffic control departments, research institutes, the ministry of public security, civil UAV companies and UAV users to work together. And with the help of developed computer science such as deep learning and machine learning, there will be more efficient solutions in UAVs management.

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References
