

The Comparative Analysis of Small Unmanned Aircraft System Regulation in Indonesia and USA (case study: for recreation or hobby purpose)

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Abstract: The development of unmanned aircraft systems from military to civilian purpose requires adjusting regulations to ensure public safety. The development of user of small unmanned aircraft system with hobby purpose in Indonesia grow rapidly. Federal Aviation Administration has more complete regulations for small UAS uses in USA. This paper aims to compare the regulation of small UAS in Indonesia and know the aspect that can be adopted to improve public safety. The method is comparative analysis. Indonesia can adopted some rules for the operation of small UAS with recreation or hobby purpose such as drone registration, operator registration and online guidance for operators.

1. Introduction

The Unmanned Aerial Vehicle (UAV) is better known as drones. Drones is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. Officially, FAA changed the term 'Unmanned Aerial Vehicle' to 'Unmanned Aircraft System (UAS)' to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles [14]. In Military, drones are currently used for a number of missions, including reconnaissance and attack roles. A UAS is defined as being capable of controlled, sustained level flight and powered by a jet or reciprocating engine [14]. UAS can also be used for economic commercial. UAS is predicted as the solution for everything such as bringing package from shipper to consignee, taking photography and cinematography, increasing the reach of news coverage (journalism), and even delivering medication or an automated external defibrillator to a remote area.

The government must regulate drones to protect the controlled airspace from foreign object debris (FOD) and ensure that drones are not used in ways that infringe on privacy and are not endangering anyone on the ground. United States Government Accountability Office (GAO) concluded that no suitable technology is currently available to provide unmanned aircraft, particularly small UAVs, for detect, sense, and avoid requirements needed to safely operate within the national airspace system. With no pilot to scan the sky, UAS do not have an on-board capability to directly "see" other aircraft. Consequently, the UAS must possess the capability to sense and avoid an object using on-board equipment, or with the assistance of a of a human on the ground or in a chase aircraft by other means, such as radar [11]. That is case of potential crash of UAS and other aircraft in Phoenix, USA. In may 2016, a Mercy Flight helicopter headed south came within 25 to 50 feet of a drone headed north at 1400 feet AGL. "If it had hit us, it would

have caused substantial damage" said pilot Austin Swan to the local news reports [13].

In addition to risks to other air traffic, unmanned aircraft operations may pose a risk to persons and property on the ground. The risk posed to persons and property on the ground is a function of both crash likelihood and the potential consequences in terms of loss of life, injury, or property damage. UAS may be expected to crash more frequently, the potential for catastrophic consequences is less given that these vehicles do not weight enough or carry enough fuel to cause major damage on the ground. These procedure may include to mitigate flight risks for unmanned aircraft systems; formal risk assessments for certification systems and mission planning; development of ground impact models and mitigation plans to reduce risks to persons and property on the ground and structured training and certification requirements for unmanned aircraft pilots, systems operators, and other safety critical personnel [9]. General civil and criminal laws may apply to acts in relation to UAS that threaten public safety. This may, in some circumstances, result in punishment or at least the credible threat of punishment, for UAS manufactures and operators who cause harm to people or property. In some cases, a party suffering harm may be able to achieve recompence. The risk of liability or punishment is also capable of acting as a deterrent. However, the deterrent is too general, and the uncertainties involves are too great, if the goal is to gain compliance with particular safety and co-ordination norms, such as those associated with air safety [6].

The user development of small unmanned aircraft system or drones in Indonesia grow rapidly. Drones operators gather in a community based on the drones type or the area where the operator lives. One of the biggest drones operators community is Asosiasi Pilot Drone Indonesia (APDI). This association was established in 2015 and has approximately 400 members. The concern of the association is training and developing professional drones operator for its members [2]. In fact, like a professional organization, APDI members must compliance with the code of ethics that is developed by this association. APDI members will be trained with drone competency standards and then take exam to get APDI official competency

certificate [12]. Furthermore there are other small drones communities such as Parrot Bebop Indonesia, Xiro Indonesia official and Semarang Drone community. BukaLapak, one of e-commerce in Indonesia, still develops innovation for logistic service. BukaLapak builds and operates a technology research and development, and its headquarters is located in Bandung, Indonesia. BukaLapak is developing a drones experiment for delivering goods [4].

2. The Methodology

The aim of this paper is to carry out a systematic analysis of the regulation under investigation (i.e. rule of drones in Indonesia), the regulation which have been issued by Indonesia (c.q. Ministry Of Transportation) to regulate the operation of small unmanned Aircraft System, the aspects have not been regulated in the operation of small unmanned Aircraft System in Indonesia. Based on this understanding derive insight as to how improve public safety in the use of small UAS. The methodology involves a three steps proces:

- the first phase involves the identification of International Regulation and Indonesia Regulation for small unmanned aircraft System,
- in the second phase, comparative analysis of rules on the use of small unmanned Aircraft System for recreation/hobby purpose in Indonesia and USA
- finally, recommendations for aspects that need to be regulated to improve public safety in the use of small UAS recreation/hobby purpose.

3. International Regulation for Unmanned Aircraft System

ICAO works with the Convention's 192 Member States and industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs) and policies in support of a safe, efficient, secure, economically sustainable and environmentally responsible civil aviation sector. These SARPs and policies are used by ICAO Member States to ensure that their local civil aviation operations and regulations conform to global norms, which in turn permits more than 100,000 daily flights in aviation's global network to operate safely and reliably in every region in the world [1]. The principal objective of the aviation regulatory framework is to achieve and maintain the highest possible for same level of safety. In the case of UAS, this means ensuring the safety of any other airspace user as well as the safety of persons and property on the ground.

ICAO has not issued yet SARPs Unmanned Aircraft systems but issued ICAO circular 328 Unmanned Aircraft systems in 2011. The purpose of this circular are to: apprise States of the emerging ICAO perspective on the integration of UAS into non-segregated airspace and at aerodromes; consider the fundamental differences from manned aviation that such integration will involve; and encourage States to help with the development of ICAO policy on UAS by providing information on their own experiences associated with these aircraft [5].

ICAO circular 328 regulate all UAS operation. This point is referred to all further issues pertaining to Unmanned Aircraft System and provides the basis for addressing airworthiness, personnel licensing, separation standards, etc. But it does not apply for UAS with recreation or hobby

purpose. It is a part of the subject of national regulation because it falls outside the provision of the Chicago Convention. ICAO circular 328 state that "In the broadest sense, the introduction of UAS does not change any existing distinctions between model aircraft and aircraft. Model aircraft, generally recognized as intended for recreational purposes only, fall outside the provisions of the Chicago Convention, being exclusively the subject of relevant national regulations, if any" [5].

4. Small Unmanned Aircraft System Regulation in Indonesia

Directorat General Civil Aviation (DGCA) of behalf Ministry Of Transportation has authority to regulate all aspects of civil aviation in Indonesia. Unmanned Aircraft System operation in national airspace is regulated in Ministry of Transportation Regulation number PM 180 year 2015 about "The operation control of Unmanned Aircraft System in Indonesian airspace. It contains general provisions and specific provisions in the operation of UAS in Indonesian air space. General provision states that no person can operate UAS in airport area (prohibited area, restricted area dan Obstacle Limitation Surface) and no person can operate UAS in controlled airspace and uncontrolled airspace above 500 feet above ground level (AGL). Specific provision contains information about rules that must be referred while using UAS. The rules is divided by aircraft weight and the purpose of operation [8]. The rules is presented in Table 1.

Ministry of Transportation issues Civil Aviation Safety Regulations part 107 small unmanned aircraft system (CASR 107). It regulates the using of drones in Indonesia. Drones is defined as small unmanned aircraft. The unmanned aircraft weight is less than 55 pounds including everything on the aircraft. Small unmanned aircraft system (small UAS) means a small unmanned aircraft and its associated elements (including communication links and the components that control the small unmanned aircraft) that are required for the safe and efficient operation of the small unmanned aircraft in the national airspace system. CASR 107 applies to the registration, airman certification and operation of civil small unmanned aircraft systems within the Republic of Indonesia. CASR 107 does not apply for air carrier operations, any aircraft conducting an external load operation, any aircraft towing another aircraft or object, any aircraft that does not meet the criteria specified in CASR part 47 aircraft registration (civil aircraft), moored balloons, kites, unmanned rockets, unmanned free balloons, and UAS for recreation or hobby [7]. However, CASR 107 still regulate The operational rules for UAS for recreation or hobby.

Table 1. Document which is required and Operational regulations based on PM 180 Year 2015

Purpose	Weight	Document		Operation	
		controlled airspace	Uncontrolled airspace < 500 AGL	controlled airspace	Uncontrolled airspace < 500 AGL
hobby	< 15 lbs	prohibited	no document required	prohibited	CASR part 107
Special purpose dan condition *)	< 55 lbs	CASR 107 and permit from DGCA with recommendation from institution which manage the airspace		CASR 107	
other purpose	< 55 lbs	prohibited	CASR 107	prohibited	CASR 107
research and development, crew training and market survey	> 55 lbs	prohibited	experimental certificate (CASR part 21 section 21.293), operator licence, UAS operation	prohibited	CASR 91 section 91.319
production flight testing new production aircraft	> 55 lbs	prohibited	special flight permit (CASR part 21 section 21.199), operator licence, UAS operation	prohibited	CASR part 91
Purpose as CASR 21 sub section 21.25b **)	< 55 lbs and out of operational regulation CASR 107, > 55 lbs	aircraft certificate with restricted aircraft categories, operator licence, UAS operation, and permit from DGCA with recommendation from institution which manage the airspace		not yet	

*) territories border surveillance, weather observation, observation of plant and animal activities in national park, survey, photography, cinematography, cartography.

**) agricultural (spraying, dusting, and seeding, and livestock and predatory animal control), forest and wildlife conservatioan; aerial surveying (photography, mapping, and oil and mineral exploration), patrolling (pipelines, power lines, and canals), weather control (cloud seeding), aerial advertising (skywriting, banner towing, airborne signs and public address systems) and any other operation specified by the DGCA

5. Comparative Analysis for small UAS for recreation/hobby purpose

Federal Aviation Administration has more complete regulations for small UAS uses in USA. FAA issues 14 CFR part 107- Small Unmanned Aircraft System to regulate the operation of Small UAS in USA [10]. This phase compares regulation for small UAS for recreation/hobby purpose in Indonesia and USA. Small UAS with recreation/hobby purpose is better known as drones. The comparison is showed in table 2.

Table 2. Comparative Analysis between Indonesia and USA

Indicator	Indonesia	USA
Weight	< 15 lbs	< 55 lbs
Drone registration	No	Yes, operator registration number is marked on the drones. in case it gets lost or stolen. Registration costs \$5 and is valid for 3 years.
Operator Registration	No	Yes with requirement: at least 13 years old . If operator is less then 13 years old, a responsible adult must register in his place
Join communities	the drones is operated in accordance with a community –based organization	Follow the safety guidelines of a model aircraft community-based organization
Airspace area	Uncontrolled airspace below 500 ft, The minimum distance of the drones from clouds must be no less than 500 feet (150 meters) below the cloud and 2000 feet (600 meters) horizontally away from the clouds.	Uncontrolled airspace below 400 ft
Operation in airspace other than Class G	prohibited	Operations in Class B, C, D and E airspace are allowed with the required ATC permission
visibility	The minimum flight visibility, as observed from the location of the ground station must be no less than 3 statute miles (4.8 kilometers)	Minimum weather visibility of 3 miles from control station
speed	The airspeed of the drones may not exceed 87 knots (100mile per hour) calibrated airspeed at full power in level hight	Maximum groundspeed of 100 mph (87 knots).
Safety	No person may operate a drones over a human being who is: not directly participating in the operation of the drones;or not located under a covered structure than can provide reasonable protection from a falling drones no person allow an object to be dropped from a drones if such action endangers the life or another property	never fly over groups of people, public events, or stadiums full of people. Never fly near or over emergency response efforts.
Flight Procedure	With vision that is unaided by any device other than corrective lenses, the operator or visual observer must be able to the the drones throughout the entire flight in order to: know the drones location; determine the drones attitude, altitude and direction; observe the airspace for other air traffic or hazards; and determine that drones does not endanger the life or another property	Fly within visual line-of-sight, meaning you as the drone operator use your own eyes and needed contacts or glasses (without binoculars), to ensure you can see your drone at all times

Daylight Operation	No person may operate a drones except between the hours of official sunrise and sunset	Daylight-only operations, or civil twilight (30 minutes before official sunrise to 30 minutes after official sunset, local time) with appropriate anti-collision lighting.
Responsibility of operator	<ol style="list-style-type: none"> 1. the operator is directly responsible for, and is the final authority as to the operation of the drones 2. no person may operate a drones in a careless or reckless anner so as to endanger the life or another property 3. the drones does not be operated for a moving aircraft or a moving vehicle unless that vehicle is moving on water. 4. A person may not act as a operator or visual observer in thr operation of more than one drones at the same time. 5. no person allow an object to be dropped from a drones if such action endangers the life or another property 	<ol style="list-style-type: none"> 1. Small unmanned aircraft may not operate over any persons not directly participating in the operation, not under a covered structure, and not inside a covered stationary vehicle. 2. No careless or reckless operations. 3. No operations from a moving aircraft, No operations from a moving vehicle unless the operation is over a sparsely populated area 4. No person may act as a remote pilot in command or VO for more than one unmanned aircraft operation at one time. 5. No carriage of hazardous materials
Online guidance for operator	No	B4UFLY Mobile App. It helps drone operators learn where they can and can't fly. The Information are: clear "status" indicator that immediately informs the operator about the current or planned location, Information on the parameters that drive the status indicator , A "Planner Mode" for future flights in different locations, Informative and interactive maps with filtering options, and links to other FAA drone resources and regulatory information

Table 2 shows that some indicators have not yet been regulated in Indonesia. The first indicator is drones registration. Registration and identification have not applied for small UAS for recreation or hobby purpose but it applies for other purpose. If the design and construction is similar, it means that it has the same potential risk for public safety. Drones registration data can help the authority (DGCA) to monitor the development of the use of drones in Indonesia. Drones registration data can be used as one of the basis of regulatory adjustments or evaluation when there is a potential risk that arises due to the use of the latest drone types. DGCA needs to extend the scope of their drones register, at least for type of drones that rises significant risks.

The second indicator is operator registration. Operator registration does not apply for small UAS for recreation or hobby purpose but operator certification is needed for small UAS with other purpose. FAA limits the

age of the drones user, which is at least 13 years old. This is necessary to ensure that the operator is mature and can be responsible for his action. DGCA needs to extend the scope of their operator register, at least for type of drones that rises to significant risks. If operator registration requires a drone operator licencing, it will be more perfect. This is to ensure that the operator has skills to operate the drones.

The last indicator is online guidance for operator. Indonesia has not yet this mobile apps platform. It will help the operator to know the safe location to operate the drones. FAA has B4UFLY mobile apps to help people safely fly unmanned aircraft and to provide situational awareness by letting them know where they should and should not fly and where there might be conflicts [3].

6. Conclusion

The development of unmanned aircraft systems from military to civilian purpose requires adjusting regulations

to ensure public safety. The Ministry of Transportation Indonesia (c.q. Direktorat General Civil Aviation) can adopt several regulations from other countries that can be applied in Indonesia. Federal Aviation Administration has more complete regulations for small UAS uses in USA. Indonesia can get lesson learned and adopt some rules for the operation of small UAS for recreation or hobby purpose such as drone registration, operator registration and online guidance for operators. Drone registration data can be used as one of the basis of regulatory adjustments/evaluation when there is a potential risk that arises due to the using of the latest drone types. Operator registration is necessary to ensure that the operator is mature and can be responsible for its actions. If operator registration requires a drone operator licencing, it will be more perfect. This is to ensure that the operator has skills to operate the drones. Online guidance is important to help operator safely fly and provide real time situational awareness.

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