LEGAL LIABILITY FOR DAMAGE ARISING FROM DRONES*

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Abstract

Due to unavoidable interaction between humans and drones in various ways for extended period of times, these kinds of robots have been developed along with the technological advancement. Particularly, Artificial Intelligence is the technology in which its special characteristics enable the imitation of human behaviors by learning, training and analyzing input data, which results in an autonomous decision through different levels of automation without the human intervention. The increasing use of pilotless aircrafts or drones could simultaneously expose the damage caused by aforementioned autonomous systems but the existing liability regimes in Thailand are assumed to deal with damage caused by human operators and manufacturers. The author surveys different liability regimes from the United States of America (USA) and Italy including relevant regulations of European Union (EU) and suggests that the strict liability with less burden of proof is currently an appropriate liability regime and implemented acts of EU should be adopted in order to ensure the compensation for injured persons.

Keywords: Pilotless Aircrafts, Liability, Artificial Intelligence, Automation

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1. Introduction

In today's world, the use of unmanned aerial vehicles (UAVs[1]) or drones has increased to assist humans in performing defined tasks. This industry has been developed along with technological advancement of AI which enables the self-adaptive capability through learning and training under certain circumstances. As a result, UAVs could independently make its own decision without the human intervention in the UAVs operations.

In this regard, according to different levels of automation adopted with UAVs, an increasing degree of automation appears to be constantly in contrast to those of any human intervention which shall be reduced to a minimum. Various autonomous systems can be largely categorized into two models, which are semi-autonomous and fully-autonomous. The criterion for classification is the human involvement in maintaining the authority and responsibility over the operation.

According to legislation in Thailand, there is no specific legal provision for dealing with the damage caused by an autonomous system embedded in UAVs. Under Thai Civil and Commercial Code (CCC), the UAVs operator could be regarded as assumed liable person. In addition, the damage may be caused by the defect of UAVs in which the manufacturer who manufactures the vehicle containing a computer program shall also be assumed as another liable person under the Product Liability Act B.E. 2551 (PLA). Nevertheless, due to an unforeseeable and inexplicable behavior addressed by AI tools in higher level of automation, it generally causes a challenging issue for existing liability rules to find an appropriate liability model including additional measures to ensure the compensation to injured persons.

[1] The term of UAVs used in this article may not be consistent with the term used in formal instrument of civil aviation law accepted by Thailand.

2. Basic concept of Unmanned Aerial Vehicles (UAVs)

The development of UAVs has derived from the simple notion that humans would like to fly in the air like a bird, therefore, the first flying machine shall be invented with wings by imitating the action of flying bird. The design has inspired many inventors for adopting the technological innovation in manufacturing processes to ensure that the capability of unmanned flight in new models can be demonstrated. However, due to the aim to protect humans from any danger arising from the device control, the doctrine of pilotless aircraft occurs including the evolution of UAVs from primary use for military purposes to a variety of either commercial or non-commercial purposes. UAVs or drones are simply defined as unpiloted vehicles which could be essentially remotely piloted or autonomously operated with various degrees of autonomy[2]. A system designed for supporting an autonomous operation has been furtherly developed, for example, Amazon Company has launched Amazon Prime Air as the first fully autonomous UAVs for delivery services of products to customers in Cambridge, England in 2016[3].

3. Artificial Intelligence (AI)

The advancement of computer science has addressed intelligent human characteristics to UAVs which results in the capabilities of thinking, learning and making a decision for solving complicated problems in different situations. The operation of human brain shall be simulated based on input in the form of datasets and knowledges influencing its processing and a further appropriate decision made by UAVs in which it is assumed to be unforeseeable and inexplicable through machine learning processes. It could be either supervised learning program pre-determined by the

[2] Malek Murison, 'Defining Drones: What is a Drone?', (DroneFlyers, 27 August 2019) <https://www.droneflyers.com/defining-drones-what-does-drone-mean/> accessed 27 September 2020

[3] Amazon, 'Amazon Prime Air', <https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011> accessed 27 September 2020

programmer or unsupervised one with more complexity but less predictability.

4. UAVs based on AI capabilities

According to the following various levels of automation based on the Society of Automotive Engineers (SAE)[4], the degree of human involvement shall be in contrast to increasing autonomous level embedded in UAVs.

(1) Level 0: No Automation

UAVs shall be operated without any degree of automation. The entire system of devices is solely under human's full manual remote control whose operator must be trained and skilled. The example of UAVs in this level are usually racing model aircrafts in which most of them do not have flight assistance[5].

(2) Level 1: Pilot Assistance

An autonomous capability shall be provided for assisting the human operator in an operational function of UAVs for mission accomplishments. However, the operation and safety function remains wholly in control of UAVs operator either acceleration or flight path. Autopilot program could be primarily supportive in navigating and global positioning satellite (GPS). For example, in case of long range of distance for purpose of detection, inspection and maintenance, UAVs operators could

[4] Miriam McNabb, 'DRONEII: Tech Talk – Unraveling 5 Levels of Drone Autonomy', (dronelife, 11 March 2019) <https://dronelife.com/2019/03/11/droneii-tech-talk-unraveling-5-levels-of-drone-autonomy/> accessed 28 September 2020

[5] Jonathan Feist, 'Buying a racing drone? Things to know before you fly', (DroneRush, 5 November 2020) <https://dronerush.com/buying-racing-drone-safety-accessories-tools-6860/> accessed 6 November 2020.

execute cruise function[6] to relieve the operator's overall concentration on the operation all times.

(3) Level 2: Partial Automation

Under certain conditions, the routine flight shall be normally automated in that UAVs have capabilities to control the operation concerning speed and altitude itself but the operator still has the important role to be in charge of ensuring safety operation regarding airspace monitor and response to any emergency circumstances[7]. The vehicle also have a built-in automated take-off and landing features. If the computer system has sensed any obstacles, the operator shall be immediately alerted about them. The author's opinion is that UAVs adopting this autonomous level cannot be fully operated by the system. Despite in automation mode applied, the aircraft must be under the operator's surveillance in any time.

(4) Level 3: Conditional Automation

Autonomously adaptive capabilities could be found in this high degree of UAVs, for example, on-board sensor shall be installed for detecting any obstacles during its flight route and the UAVs is capable of stopping its operation. However, the manual control of the operator shall be addressed to correct the device's further movement prior to its continuous compliance with the pre-determined route, for example, Amazon Prime Air which provided delivery service and also adopt sophisticated "sense and avoid"[8] function shall be fallen under the definition of this autonomous level.

(5) Level 4: High Automation

UAVs can be controlled but not required by the operator. The device needs the back-up system to be operational in case the failure of main systems. With increasing self-adaptive capabilities, the UAVs can

[6] Aeronyde Corporation, 'Self-Flying Drones: Who will be in the pilot's seat?', (Aeronyde, 28 August 2018) <https://aeronyde.com/2018/08/28/2018-8-28-self-flying-drones-who-will-be-in-the-pilots-seat-1/> accessed 1 November 2020.

[7] supra note 4

[8] supra note 4

navigate without the input from human operators by automatically diverting the flight path to avoid the interaction when facing any obstacles. The example of this kind of device is mostly used for the purposes of photography and filming to capture various perspectives of nature and forest[9].

(6) Level 5: Full Automation

Although it might be likely the futuristic model, the UAVs can operate itself under all circumstances along with moving under any conditions without any human intervention. Full automation system might be considered as authentic AI which shall include autonomous learning process from previous environmental situations by algorithm and machine learning through processing with the modification ability resulting in unforeseeable self-managed and automated operation. The physical harm of high risk of dangerous operation in high densified airspace shall be solved with this imaginable UAVs model. Unfortunately, there is no current production on this highest degree of UAVs automation[10].

According to different levels of autonomation adopted, the human intervention in the UAVs operation shall be directly decreased upon higher degrees of automation. Accordingly, this situation could demonstrate the legal significance into liability issues.

5. Foreign Laws on Liability for Damage arising from UAVs

There are different types of liability adopted with the damage caused by UAVs. The author shall classify them as fault-based and strict liability. Besides, the study shall focus on the UAVs operator and manufacturer. To this end, related liability regimes of two countries and one international organization shall be provided as follows:

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[9] AltiGator Unmanned Solutions, 'Aerial photography and filming for cinema & television' <https://altigator.com/aerial-photography-and-filming-for-cinema-or-television/> accessed 2 November 2020.

[10] supra note 4

5.1 USA

In addition to the regulations of the Federal Aviation Administration (FAA) for the UAVs weighing less than 55 pounds[11], USA adopted negligence regime as common law principles with other bigger UAVs for imposing fault-based liability. In order for the injured persons to hold the UAVs operator liable, four elements must be satisfied; namely, (1) the existence of duty of care; (2) a breach of such duty; (3) injuries caused to the victims; and (4) a causation between a breach and injuries. Although the UAVs operator owed such duty to individuals for safe operation, it becomes more complicated to recognize and assess an unforeseeable decision by fully autonomous capabilities and it shall inevitably break the causation between human operators and injuries caused.

Based on strict liability regime without fault, the UAVs manufacturer could be held liable for the damage caused by defects irrespective of the exercise of reasonable duty of care. Aforementioned defects could be divided as three categories: (1) manufacturing defects; (2) design defects; and (3) failure to instruct and warn. Unexpected outcomes beyond its original set of rules owing to the incorporation between algorithms and machine learning could cause an accident that the manufacturer shall improbably foresee or warn.

5.2 Italy

Governed by the Rome Convention of 1952, Italy extends the strict liability rules imposed to UAVs operator for the damage caused by UAVs operation[12]. Thanks to no specific liability regime, the Italian Navigation Code shall be applied for either general remotely piloted aircraft system or

[11] Federal Aviation Administration, 'Fact Sheet–Small Unmanned Aircraft Systems (UAS) Regulations (Part 107)', 6 October 2020 <https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=22615> accessed 2 November 2020.

[12] Studio Pierallini, 'Drone Regulation in Italy' (Lexology, 10 December 2019) <https://www.lexology.com/library/detail.aspx?g=68903659-fba4-47d5-bdb7-0a8a7ea3cf39> accessed 2 November 2020.

autonomous unmanned aircraft system. In order to be entitled for compensation, the injured person is required to prove the causal link between the damage caused and UAVs operation.

5.3 European Union (EU)

Even though the Regulation (EU) of 2018/1139 of the European Parliament (RCA) has given a minimum safety standard as common rules of UAVs operation, there is no any liability rules enacted for the human operator. Nevertheless, under the Product Liability Directive (PLD), UAVs are regarded as a product since they are movable properties[13]. PLD imposes liability on the UAVs manufacturer[14]. In order to claim for compensation, the person injured by the defective condition of UAVs is required to prove the damage, the defect and a causal link between the first two elements[15].

In order to ensure the compensation as result of the damage caused by fully autonomous systems embedded in UAVs, EU has subsequently implemented the recommendations[16] introducing compulsory insurance schemes among relevant UAVs parties including the necessity of compensation fund in case that the UAVs are not insured or the liable person cannot be identified along with the privilege of proportionate limited liability.

[13] Article 2, PLD.

[14] Article 1, PLD.

[15] Article 4, PLD.

[16] European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics <https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html?redirect> accessed 30 September 2020

6. The Problems on the Current Liability Regime on UAVs in Thailand

Owing to a lack of specific provisions related to the liability for damage caused by automation systems in UAVs, The Thai Civil and Commercial Code (CCC) shall be applicable. However, tort law cannot be effectively enforced because it is difficult to determine the authentic cause of damage and the liable person on unforeseeable and inexplicable UAVs operation notwithstanding the relief from proving a fault of UAVs operators under strict liability regimes.

Even though being able to be regarded as the vehicle's controller who is responsible for preventing the damage caused under section 437 of CCC[17], the UAVs operator should not be considered as presumed liable person in case of the operation propelled by fully autonomous systems without any control over UAVs by the human operator.

Besides, the UAVs could also be considered as a product under the Product Liability Act B.E. 2551 (PLA) which imposes the liability caused by the defective condition of UAVs on the manufacturer[18]. Nevertheless, there are two different opinions whether the computer program operating UAVs shall be interpreted as a product for the applicability of PLA to ensure the compensation in addition to CCC. In this context, the damage could also be variously caused by machine learning including algorithm involved with the designer and developer of this intelligent science which might be considered as the direct cause of unforeseeable actions of UAVs.

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[17] Jit Setabutr, Lak Kod Mai Phaeng Laksana La Mert [Principles of Civil Law on Torts] (8th edition, Faculty of Law, Thammasat University, 2013) (จิ๊ด เศรษฐบุตร, หลักกฎหมายแพ่งลักษณะละเมิด (พิมพ์ครั้งที่ 8, คณะนิติศาสตร์ มหาวิทยาลัยธรรมศาสตร์, 2556)), p.264.

[18] Pongdech Vanichkittikul, Kham Athibai Pra Rat Cha Ban Yat Kham Rab Phit Tor Kham Sia Hai Thi Koet Khuen Chak Sin Kha Mai Plot Phai [Explanations of Product Liability Act] (Bangkok: Rungslip Printing Co., Ltd., 2009) พงษ์เดช วานิชกิตติกูล), คำอธิบายพระราชบัญญัติความรับผิดต่อความเสียหายที่เกิดขึ้นจากสินค้าไม่ปลอดภัย กรุงเทพ): บริษัท รุ่งศิลป์การพิมพ์ จำกัด, 2552)), p.5.

In order to claim for a compensation under PLA, it is difficult to prove the use or preservation of UAVs by its nature, especially for injured persons because this technical knowledge is beyond their acknowledgement which may cause them eventually uncompensated.

7. Conclusion

Currently, an appropriate liability model to be adopted for the damage caused by an autonomous system with AI capabilities is a strict liability regardless of burden of proof on misconduct which is more beneficial than fault-based ones. In order for the effective applicability under CCC, the term "controller" should cover only the case of semi-autonomous level in which the human operator has the authority over the operation. Besides, in order to ensure the compensation, the implemented approach such as compulsory insurance schemes and compensation fund recommended by EU should be adopted as well. To be concluded, this advanced disruptive technology shall be unstoppably developed and the existing liability rules might no longer be appropriate for the upcoming damage in the future.

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