Investigation on the Legal Framework of UAV Regulation for Nuclear Facilities

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1. Introduction

Unmanned Aircraft Vehicles (UAV) have been predominantly used in military field. In recent years, an exponential growth of UAV industry has been identified in the civilian market for public and recreational use. As reacted to the emerging demand, various industries have developed and researched the countermeasures to defend UAV to protect people or security infrastructures. The Counter-UAV (C-UAV) is specifically designed to detect, track and response UAV and the technology is developing rapidly. As UAV application range was extended from military missions to public and recreational purposes including airstrikes, defending against UAV is regulated by either domestic or international law, and the legal framework that needs to be applied.

In this point of view, legislation and policies related to defend UAV were reviewed in this paper in order to identify the threats, protection targets and set protection goals for nuclear facilities. In particular, it included trends related to UAV protection guide provide by the International Atomic Energy Agency (IAEA) and US Nuclear Regulatory Commission (NRC) and ROK's legal framework.

2. International and ROK's UAV Regulation

2.1 International UAV Regulation

Currently, no requirement or regulation on physical protection against airstrikes using UAV is identified in the US NRC regulation guide, in specific at Part73. In addition, US NRC announced "Drones would not be able to exploit security vulnerabilities at nuclear reactors or other facilities or provide and surveillance capabilities beyond what potential adversaries are already assumed to have and the Transportation Security Administration (TSA) is responsible for protecting the nuclear facilities from the aircrafts."

The ROK is a member of the IAEA, and the Convention on the Protection of Nuclear Material (CPPNM) which aims at preventing risks arising from illegal acquisition and use of nuclear materials. As a member state, the protection requirements shall be observed when transporting, using, or storing nuclear materials according to Physical Protection of Nuclear Facilities (INFCIRC/225/Rev.5, Nuclear Security Series No. 13) [1].

> *REQUIREMENTS FOR PHYSICAL PROTECTION AGAINST SABOTAGE AT NUCLEAR FACILITIES*
>
> *5.30. Vehicle barriers should be installed at an appropriate distance from the vital area to prevent the penetration of unauthorized land and waterborne vehicles specified in the design basis threat that could be used by an adversary for committing a malicious act. Attention should be given to providing protection measures against any airborne threat specified in the design basis threat for the operator.*

INFCIRC/225/Rev.5 stipulates that countermeasures against air threats should be reflected in the design basis threat (DBT). The air threat has been used as a part of DBT for large aircraft to the reactor containment building. INFCIRC/225/Rev.5 came into force which seems to take into account the impact of large aircraft when UAV is not as common and the threat of UAV is not significant. However, it needs a flexible interpretation to deal with air threats.

The necessity of verifying the validity of DBT according to new technologies and evolving threats, re-evaluating threats and the current system, and redesigning the response system to new DBT are also reflected in the IAEA standards [2].

> *8. MAINTAINING THE DESIGN BASIS THREAT*
>
> *8.1 INPUT*
> *A formal review process should be established to maintain the validity of a DBT The process should also include an assessment of quickly evolving threats that have to be dealt with urgently*
>
> *8.3 OUTPUT*
> *The update of the DBT should be followed by an assessment of the adequacy of the existing physical protection system with regard to the new DBT and appropriate measures should be taken as required.*

Table I indicates the UAV regulation of the ROK, USA, China, Japan. As shown, the capital of each country is designated as the flight restricted area for public safety. The ROK's lighter standard of registration than other countries is considered as the weakness of physical protection against UAV because the database of registered UAV can be applied for identifying the UAV whether it is approved of not.

Table I: UAV regulation of the ROK, USA, China, Japan

Classification	ROK	USA	China	Japan
Need for Registration	Business purpose or >2kg	Business purpose or >250g	>250g	>200g
Operational Certificate	Business purpose or >250g	Business purpose	>7kg	Submission supporting document for flight approval
Height Limits(Max)	<150m	<120m	<120m	<150m
Restricted Area	Seoul, Airport (9.3km) NPP (18.5km)	Washington Airport (9.3km) NPP (5.65km) Stadium (5.6km)	Beijing Airport Stadium	Tokyo NPP
Speed Limits(Max)	-	<161km/h	<100km/h	-

2.2 ROK's UAV Regulation Legal Framework

With the advancement of UAV technology, performance, UAV application range was extended widely such as agriculture, entertainment, shipping and delivery, search and rescue. At the same time, however, the cases of UAV misuse is also increasing. Therefore, laws and regulations related to control and govern UAV are being strengthened in ROK to prevent accidents.

Table II: UAV law and policy in ROK

Classific-ation	Title	Contents	Organization
Act	Aviation Safety Act	Safe and efficient navigation of aircraft and the obligations	Ministry of Land, Infrastructure and Transport (2020.12.08.)
	Radio Waves Act	Including blocking the radio waves of UAV	Ministry of Science and ICT (2020.06.09.)
	Act on Promotion of Utilization of Drones and Creation of Infrastructure Therefor	Promoting the utilization of drones, and the operation and management of drone systems.	Ministry of Land, Infrastructure and Transport (2020.05.01.)
Guide	Guideline for Approval of Civilian UAV in Military Area	Flight approval process in military area	Ministry of National Defense (2020.07.01.)
Guide	Drone Safety Management Guide	UAV navigation	Seoul Regional Office of Aviation (2020.08.)

Physical protection of nuclear facilities in ROK is planned, operated, and managed based on 'Act on Physical Protection and Radiological Emergency' and 'United Defense Act'. There are no security requirements for UAV under those Acts, however the protection goals of nuclear facilities are defined.

The UAV flight regulation for nuclear facilities is based on the Aviation Safety Act. As nuclear facilities are classified into national security facilities, they are designated as restricted flight zones ranging from 2NM (3.7km) to 10NM (18.5km) for security and safety reasons. Accordingly, UAV navigation cannot be carried out without permission in the airspace.

Under the recently revised Radio Wave Act (November 10, 2020), Article 29 of the Act permits the use of radio cut-off devices for illegal means of threatening public safety such as UAV and explosives. This allows the use of radio wave cut-off devices such as jamming guns in nuclear facilities by reducing or exempting criminal liability when there is no intentional or gross negligence due to the inevitable use of radio wave cut-off devices. However, the security personnel of the facility have no authority to shoot jamming gun towards UAV outside facility which is the military district. In this point of view, the relative law or policy should be revised for the security personnel in the facility to have authority to response UAV in a timely manner. Furthermore, legal regulations on UAV flight restrictions or bans exists, however, there are no physical protection measures against UAV threats compared to detailed security and physical protection system requirements for existing national security and nuclear facilities.

3. Conclusions

As a result of reviewing the legal framework and policies for UAV regulation, it is required to evaluated the current physical protection system according to evolving threat to develop security requirements for the response system in nuclear facilities.

This is the key component in future attempts to overcome these limits. In future research, UAV threat scenarios, risk assessment will be conducted to derive security requirements for UAV response.

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[1] IAEA, Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Revision 5), IAEA Nuclear Security Series No. 13, 2011.
[2] IAEA, Development, Use and Maintenance of the Design Basis Threat, IAEA Nuclear Security Series No.10, 2009.