Development of "Understanding of Drone Threats and Identification" training course for security personnel at nuclear facility

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1. Introduction

Drone-related technologies are rapidly developed with the 4th Industrial Cooperation Revolution, and are widely used in various fields such as defense, distribution, leisure, and broadcasting, etc. However, according to the development of drone technology, illegal activities such as flight in restricted area and unauthorized video recording are frequently occurred. Furthermore, as terrorisms using drones are also increased in the international community, the oil refinery in Saudi Arabia were attacked by drone in 2019 [1].

In Korea, various drone threats aimed at nuclear power plants are steadily increased. Especially over the past five years, a total of 26 illegal drone flights have been detected around nuclear power plants, of which 9 (34%) have not been punished because drone pilots have not been found [2]. Therefore, it can be seen that domestic nuclear power plants are no longer safe zones for drone threats.

These recent increase of drone threats has led to education needs for nuclear facility security personnel to raise awareness of drone threats.

This paper describes the development process and effectiveness of "Understanding of Drone Threats and Identification" training course developed by KINAC/INSA (Korea Institute of Nuclear Nonproliferation and Control/International nuclear Nonproliferation and Security Academy).

2. Development process

This section describes the training course design of "Understanding of Drone Threats and Identification", practical scenarios development and the composition of benchmarking program of advanced PPS (Physical Protection System) for enhancing educational effectiveness.

2.1 Training course design

In order to develop "Understanding of Drone Threats and Identification" training course, total 6 advisory meetings were held with experts working at "Hanbit Drone corporation" that is an integrated drone solution company. Through advisory meetings, curriculum composition, course materials and practical scenarios were developed during 10 months.

The curriculum has basic contents such as the history and operation of drones including cases of use and abuse of drones as well as related laws and regulations that security personnel at nuclear facilities must know. In addition, some practices for drone detection and identification were included to enhance applicability of training course to workplace and various case videos were also actively used to improve the course immersion.

The new training course was four hours long and consisted of two hours of classroom training and two hours of practical training.

1st class (60min)	[Module 1] Introduction of "What is Drone?" – Definition and type of drone – Structure, operation and characteristics of drones – Drone-related laws and regulations	Classroom training
2nd class (60min)	[Module 2] Drone Threats and Countermeasures – Threats and abuse of drones – Drone threats near nuclear power plants – Countermeasures against drone threats	Classroom training
3rd~4thclass (120min)	[Module 3] Introduction to Drone Detection System –Demonstrate drone detection equipment *Using Aeroscope [Module 4] Simulation of terrorism situations & Drone identification practice – Simulation of terrorism situations *Drop simulated solid and liquid explosives – Identification of drones according to altitude	Demonstration and practical training

[Details of training course design]

[Course materials development]

2.2 Major equipment and practical scenarios

Domestic nuclear facilities do not yet have a detection system for illegal drone flights in restricted area, and physical counterattacks like shooting down and GPS disturbances (as a way to respond to drone threats) are prohibited by law. Therefore, security personnel's "visual identification" is currently the only and most important method to detect drone threats.

For these reasons, some practical training scenarios have been developed for trainees to experience

simulated contingency situations such as some dangerous explosives dropped from drones as well as identification drones according to type and altitude.

The details of practical training scenarios are as follows:

	
•Model: MATRICE600 PRO •Size: 1668mm×1518mm×727mm •Weight:10kg •Flight time: about 20 min •Maximum speed: 65km/s	•Dropping of simulated solid explosives by altitude •Drone identification by altitude •Flight altitude: 50m~100m •Flight distance: radius of 200m

[Demonstration of dropping simulated solid explosives and drone identification]

	
•Model: MG-1P •Size: 1400mm×1400mm×500mm •Weight:10kg •Flight time: about 20 min •Maximum speed: 18km/s	•Spraying of simulated harmful liquid chemicals by altitude •Drone identification by altitude •Flight altitude: 50m~100m •Flight distance: radius of 200m

[Demonstration of spraying simulated liquid chemicals and drone identification]

	
•Model: MILVUS •Size: 2000mm×770mm×350mm •Weight:4.5kg •Flight time: about 60 min •Maximum speed: 20km/s	•Switch fixed and rotary wings mode •Vertical take-off and landing(rotary wings) •Drone identification by altitude, distance and speed(fixed wings) •Flight altitude: 50m~100m •Flight distance: radius of 500m

[Demonstration of simulated military drone flight]

2.3 Benchmarking Program of Advanced Physical Protection System

Trainees of physical protection training courses have consistently wanted to visit the "Incheon International Airport Corporation" for benchmarking advanced PPS. This is because “Incheon Airport” had established and operated the Korea's best physical protection system in the field of security search, detection and counterterrorism.

As this "Understanding of Drone Threats and Identification" training course was held in Incheon where “Incheon Airport” is located, that was good chance to reflect the needs of trainees. As a result, "Advanced Physical Protection System Benchmarking Program" was add on the second day of the course.

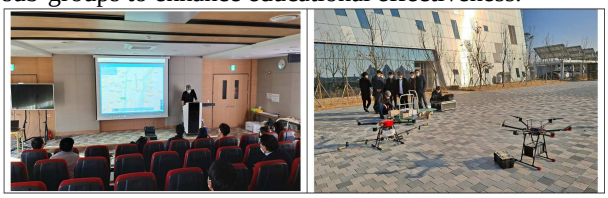
The program consisted of an introduction of Incheon Airport’s counterterrorism system, facility tour and seminar. In particular, the seminar was designed for nuclear security personnel to provide free discussion on PPS with counterterrorism experts.

1st class (60min)	[Module 1] Introduction of “Terrorism Response System of Incheon International Airport”
2nd class (60min)	[Module 2] Introduction of advanced security equipments & facility tour – Latest security equipment (x-ray scanner, full body scanner, explosive trace detecter, liquid explosive detecter, etc.) – Security search procedures, etc.
3rd class (60min)	[Module 3] Seminar on Advanced PPS for nuclear facilities – Discussion on the application of advanced PPS for nuclear facilities – QnA related to facility protection and security search, etc.

[Details of benchmarking program]

3. Operation results and effectiveness of training course

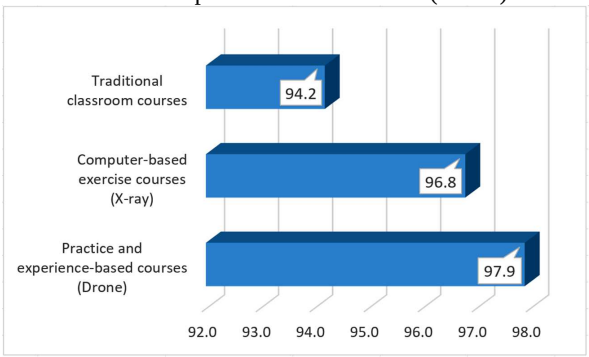
The "Understanding of Drone Threats and Identification" training course was held for two days from November 12 (Thu) to 13 (Fri) 2020, with a total of 14 trainees. On the 1st day, main course was held at “Incheon robot land robot tower” and benchmarking program was held at “Incheon Airport” on the next day. Especially all practical modules were conducted in 2 sub-groups to enhance educational effectiveness.



[Course operation]

After the end of the course, the survey was conducted to measure overall educational satisfaction. And then the results were compared to satisfaction score of other physical protection training courses held in 2020 as follows [3].

- Traditional classroom courses: 56 times
- Computer-based exercise courses (X-ray): 5 times
- Practice and experience-based courses (Drone): 1 time



[Comparison of Training courses satisfaction]

The result of the training course satisfaction shows that the "Understanding and identifying drones" course’s satisfaction score is the highest and Computer based exercise courses (X-ray) is on 2nd place. This

means that practice and experience-based training courses, which reflect the needs of trainees, is the most effective way for training course and high applicability to the workplace can be expected as well.

As a result, "Understanding of Drone Threats and Identification" training course achieved more than expected, thus KINAC/INSA decided to continue to hold this new training course steadily after 2021. The next training will be held in November 2021.

4. Conclusions

All security personnel working at nuclear facilities shall complete compulsory training course for at least two hours each year. KINAC/INSA is not only institution in Korea that provides physical protection compulsory training course but also responsible for developing and operating appropriate education programs in response to changes of the nuclear security environment and educational needs.

In addition, training course shall be designed based on needs of trainees and it can also be expected to have a circular effect of high applicability to the workplace.

KINAC/INSA will continue to apply changing nuclear security situations in the domestic and international communities to training courses and develop various forms of training courses for security personnel to promote and strengthen the domestic nuclear nonproliferation and security regime.

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