Transactions of the Korean Nuclear Society Autumn Meeting
Changwon, Korea, October 20-21, 2022

A Study on UAV Threat Scenarios for Nuclear Facilities

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1. Introduction

An Unmanned Aerial Vehicle(UAV) operates without a pilot located in the craft. UAVs can operate autonomously with pre-set programming, inertial navigation, or can be guided remotely by an operator. The use of pre-set autonomous programming, cameras, or GPS location allows them to be used beyond a typical line of sight. As an UAV is one of the emerging threat in nuclear security, we investigated the generic scenarios of UAVs in nuclear facilities.

2. Methods and Results

2.1. Considerations for scenario development

To determine reasonable scenarios, the total numbers of and limits for UAVs provided in the Design Basis Threat(DBT), as well as total adversary numbers previously provided for the computer modeling and simulation can be considered. These scenarios are general and would be developed to aid in the deliberation of Counter-UAV strategies to be discussed later. Other elements, including target set changes with various plant modes of operation and the ability of a UAV to reach an area previously considered to be too difficult for a ground-based adversary team (such as roof tops and large equipment hatches opened during outages) can be also considered in these UAV threat scenarios. With a maximum range and altitude of one kilometer, local terrain immediately surrounding a nuclear site is no longer a deterrent as an avenue of approach. Rocky or mountainous paths, or those crossing a river or lake, which would have deterred a ground-based assault are not obstacles for the aerial path of a UAV.

Operators can remain outside of these natural barriers and operate UAVs directly to the site over them. Additionally, UAVs can drop a payload onto a target or fly directly into a target. With camera systems and obstacle avoidance systems (available on many UAVs) typical site obstacles such as the high voltage electrical lines can also be avoided.

2.2. Generic scenario categories

A total of four generic scenario categories related to potential UAV use by an adversary were developed. Of these, one is a surveillance only activity and three are related to use of UAVs directly in a physical attack [1]. These categories are valid in all plant operating modes.

Scenario Category 1 – 'Surveillance Only' – Use of UAVs equipped with cameras or geo-location equipment only, for the purpose of gaining intelligence on site characteristics and guard force locations and movement in preparation for a future attack.

Scenario Category 2 – 'UAV Standalone Attack' – Use of UAVs equipped with explosives or sabotage equipment for the purpose of damaging or attempting to damage site components to gain a release or to degrade the public trust in the nuclear industry. With no accompanied ground attack.

Scenario Category 3 – 'UAV Attack in Conjunction with a Ground Attack' – Use of UAVs equipped with explosives or sabotage for the purpose of damaging or attempting to damage site components to gain a release or to degrade the public trust in the nuclear industry. This UAV attack is combined with a ground assault by adversaries.

Scenario Category 4 – 'UAV Attack as a Diversion for a Ground Attack' – Use of UAVs which can be equipped with small offensive weapons, smoke, flash, or other distraction devices for the purpose of diversion of site responders to allow ground-based adversaries to damage or attempt to damage site components to gain a release or to degrade the public trust in the nuclear industry. This UAV attack is combined with a ground assault by adversaries.

3. Conclusions

This study is to determine the design for generic UAV threat scenarios of nuclear facilities. Using the four generic scenarios noted above, a more detailed examples of how UAV attacks against nuclear facilities could be accomplished from the generic scenario categories should be developed including event timeline, potential outcomes.

REFERENCES

[1] R. J. Wallace, and J.M. Loffi, Examining Unmanned Aerial System Threats&Defenses: A Conceptual Analysis, Aviation, Aeronautics, and Aerospace, Vol.2, pp. 7-10, 2015.