

Risk Assessment of UAV-Aided Port Operations

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Abstract: Seaports play a key role in international trade because over 90% of international commerce moves over the ocean. Therefore, port authorities have to increase their operational efficiency. The National Airspace System and various other industries have been adapting UAV-aided operations for over 20 years. UAV-aided operations increase the efficiency while reducing the expected service costs. However, minimizing the risks associated with UAV-operations becomes a challenge due to the complexity of complex port operations. To validate the operational feasibility of UAV-aided port operations, Port of Houston is taken as a case study example. First of all, we conduct risk assessment of UAV-aided port operations. Secondly, the answer of “What can go wrong when using UAVs in port operations” is identified. Particularly, we determine hurricane disruption scenarios and evacuation scenarios which are applicable to chemical tankers carrying hazardous substances.

1. Introduction

Unmanned Aerial Vehicles (UAVs) have been operated in the National Airspace System and many other industries. Recent technological improvements, and implementation of UAVs in civil and commercial applications have proven the effect of UAV-aided operations on efficiency and productivity of systems [1]. Even though, UAV-aided operations are considered effective and productive, implementing an unmanned aerial system brings risk and safety related challenges to the port operations. Background of UAV-aided operations in different industries has been reviewed, and the risk factors of UAV-aided operations identified as preliminary study. Quantification of the risk assessment of UAV-aided port operations will be addressed in future study.

2. Objective

The overall objective of this study is to understand and determine risk associated challenges of future port system using unmanned aerial system (UAS), and evaluate possible risk scenarios during hurricane disasters. Risk analysis and resiliency study have been conducted on various safety and security problems that may arise when UAS operations in the port environment.

3. Materials and Methods

In this study, risk associated future UAV-aided port operations were assessed, and risk factors of UAV-aided port operations were identified, considering three major hazard factors: Indigenous, Exogenous, and Human-Triggered Factors as shown in Figure 1 [1]. From the results of identification, a general framework of evaluating the factors, and possible risk scenarios will be determined [2].

4. Result and Discussion

The answer of “What can go wrong when using UAVs in port operations?” is identified.

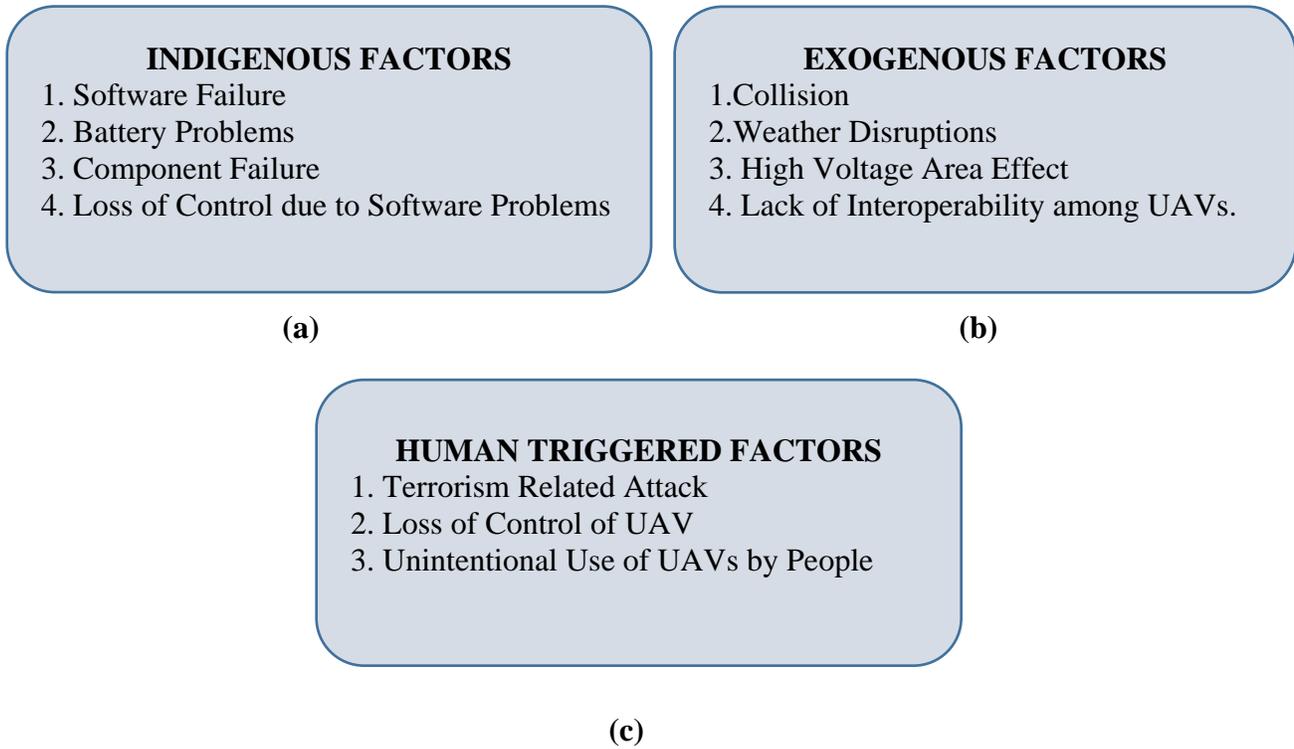


Figure 1: General risk factors in UAV-aided port operations (a, b, and c)

5. Conclusions

In this case study of Port of Houston, identified risk factors and possible risk scenarios for hurricane disasters were conducted. Quantification of identified risk factors will be focused in future study.

6. Acknowledgment

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7. References

[1] Weibel, R. and Hansman, R.J., “Safety Considerations for Operation of Unmanned Aerial Vehicles in the National Airspace System,” MIT International Center for Air Transportation Report, No. ICAT 2005-01, Cambridge, MA, March 2005.

[2] Gheorghe, Adrian V., and Ersin Ancel. "Unmanned aerial systems integration to National Airspace System." In Infrastructure Systems and Services: Building Networks for a Brighter Future (INFRA), 2008 First International Conference on, pp. 1-5. IEEE, 2008.