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The Center for Education and Research in Information Assurance and Security

Cyber Attacks on Avionics Networks in Digital Twin Environment: Detection and Defense

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Problem Statement

- The discussion of cyber attack vectors specific to avionics networks is limited within academia
- The synergy of computer science and civil aviation technology creates an opportunity for the development of new approaches to the solutions of the cyber security problems in aviation

Research Goal

- To add to the discussion by meeting the research objectives of the Data Mine course in Cyber Security (TDM 51100-037/110)

RESEARCH OBJECTIVES

- Construct VM-based digital twin for avionics network
- Provide security analysis identifying malicious adversaries
- Propose defense solutions of potential threat vectors

CONNECTIVITY DOMAINS

(Huffaker, 2022)

DIGITAL TWIN
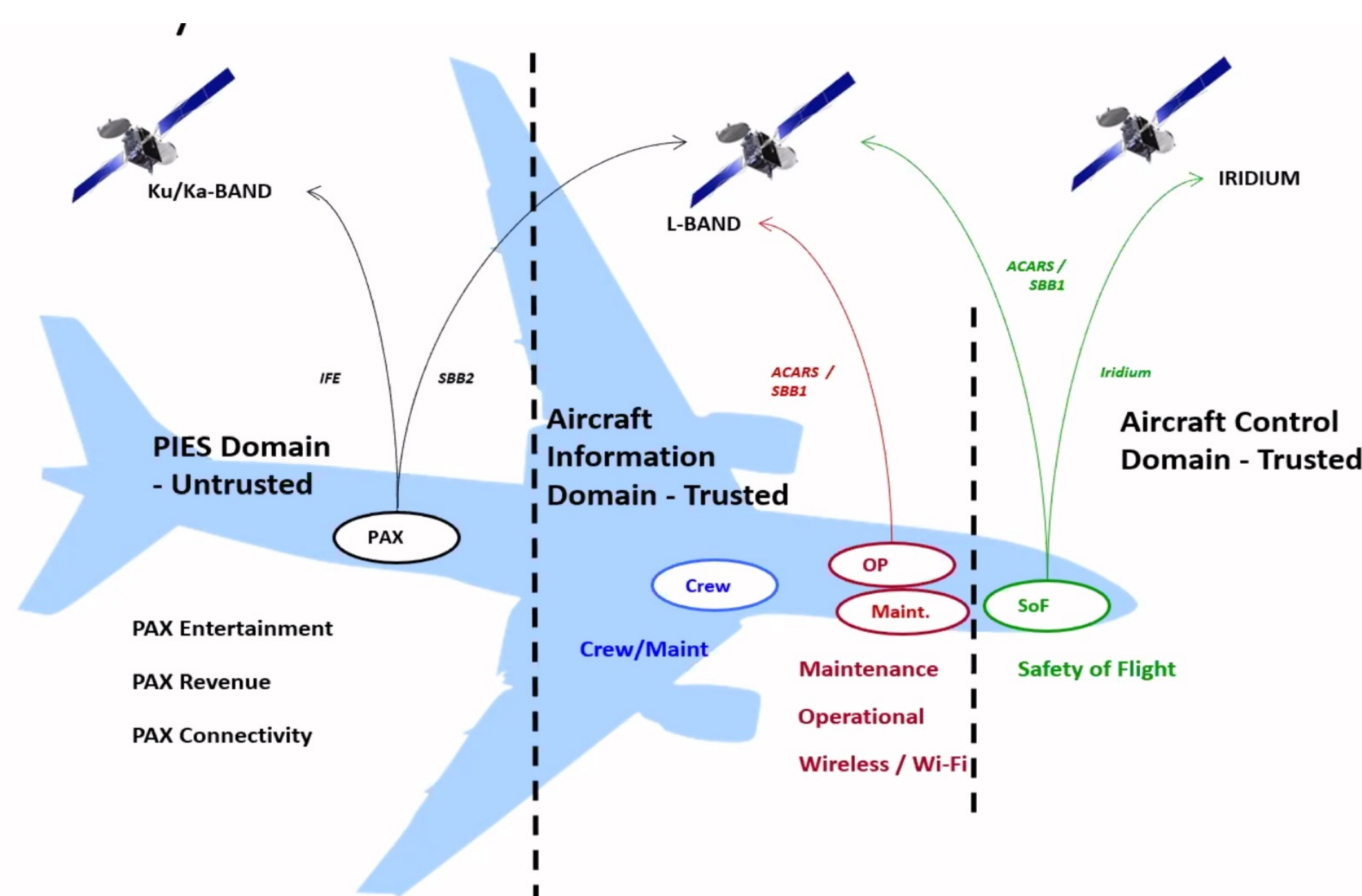
ATTACK VECTORS

- Access Control From Offboard (AIS): Can send maliciously manipulated passenger manifest through unstable offboard connection
- Mimicry of ADS-B Transponder: ACAS Injection triggers TCAS System
- Entertainment System Corruption: Buffer Overflow exploits IFE exposing essential IFE info

CHALLENGES

- Emulating Aircraft System within blocks of code (system functions)
- Generating input/outputs for digital twin showcasing communication
- Limited scope within public access of aircraft security and system information
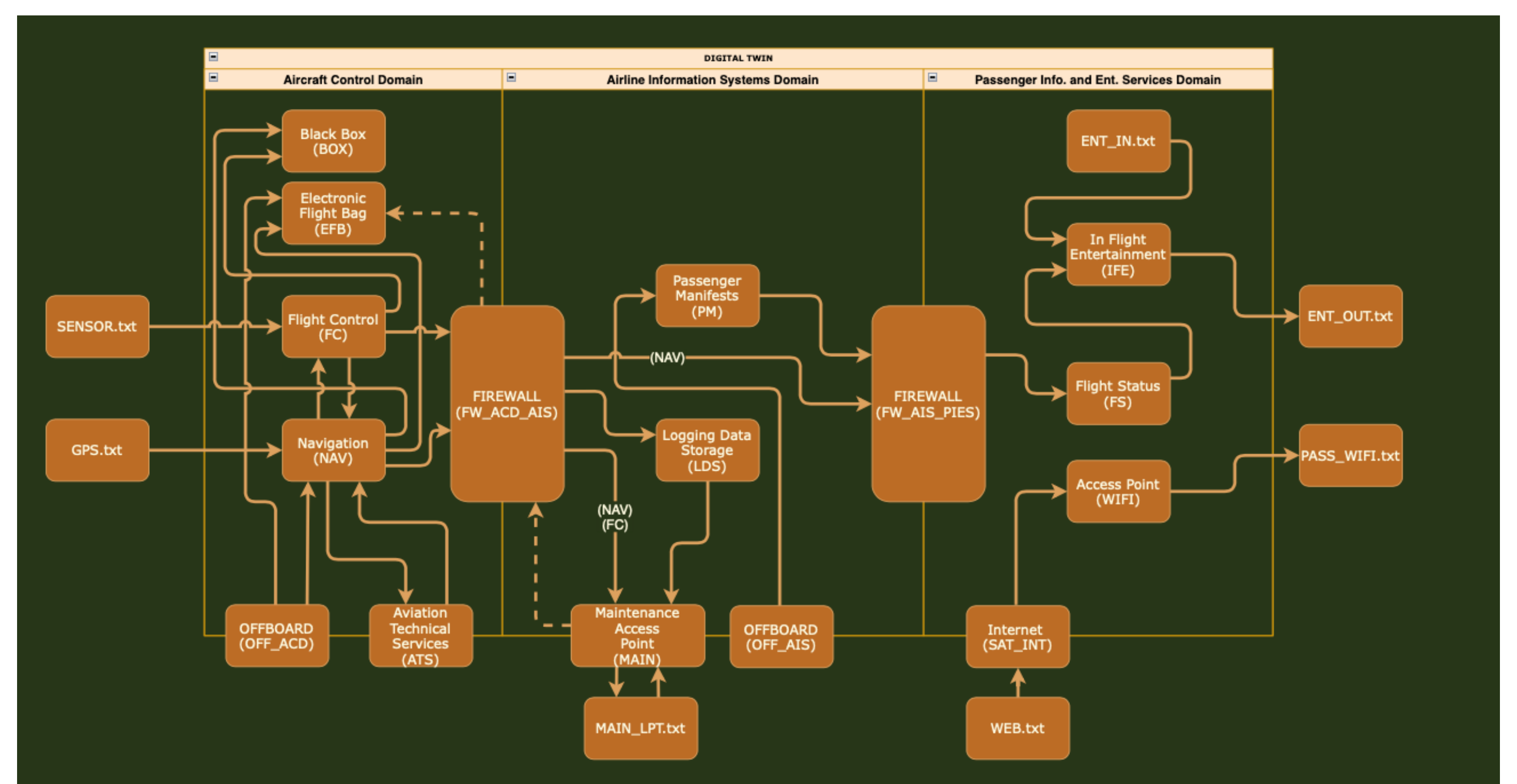
DEFENSES

- Access Control From Offboard (AIS): The airline sends MAC (Message Authentication Code) to aircraft verifying the authenticity of the passenger manifest
- Mimicry of ADS-B Transponder: Surveillance on typical flight trajectory and past flight trajectory to identify mismatches between positions. Can also use Kalman Filter to examine differences between predicted vs. actual locations
- Entertainment System Corruption: Implement authentication mechanism such as hashing within the IFE to load files securely with encryption

References:

Huffaker, J. (2022, September 14). *Cyber Security in Aviation* [Seminar]. CERIAS Security Seminar Series, Purdue University, West Lafayette, IN, USA.
https://engineering.purdue.edu/AAEFlightPlanNews/news/events/cerias-security-seminar-series-presents-james-huffaker-914

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