

**Synthetic Network Generation and Vulnerability Analysis  
of Internet Infrastructure Systems in the United States Virgin Islands**

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In September 2017, Category-5 Hurricanes Irma and Maria struck the U.S. Virgin Islands (USVI) within a two-week period and collectively devastated homes, businesses, and infrastructure throughout the Territory. In particular, the loss of hardline telecommunications infrastructure during the storms significantly impacted emergency response and recovery operations. The operation and management of the Territory's telecommunication network is, unfortunately, spread out over a mixture of public and private entities who have considerable economic incentive to hide or obscure information about their systems. As a result, there is no organization or community with operational view of the USVI telecommunication system which makes vulnerability analyses of the system challenging.

This thesis focuses on overcoming these challenges by creating a synthetic model of the USVI hardline internet backbone that facilitates operational resiliency analysis. Synthetic networks embed the characteristics and function of the actual system for analysis by incorporating generic or functionalized information to avoid issues with proprietary information. The goal of this thesis is to:

- Produce a curated geospatial data set that aggregates public and private telecommunications systems data into a single repository for modeling and analysis.
- Develop a synthetic network model that produces realistic internet network maps.
- Conduct network and vulnerability analysis on those models.

This work is in support of Federal Emergency Management Agency (FEMA) response and recovery activities and part of a broader FEMA-funded effort by the Naval Postgraduate School (NPS) to assess and improve the resilience of interdependent USVI lifeline infrastructure systems [1]. This thesis additionally supports several other complementary efforts with the University of the Virgin Islands (UVI) to develop a next-generation Hazard Mitigation and Resilience Plan for the Territory.

The following is a proposed timeline of events to support this project:

- February 2020- Site visit to USVI to collect primary data on hardline internet systems, Curate data into geospatial data sets useful for synthetic network generation
- April 2020- Generate initial synthetic networks for USVI internet systems; Conduct vulnerability analysis for initial case study and develop analysis methods
- June 2020- Finalize model analysis; Present results to USVI telecommunication stakeholders; Graduation

References:

1. Alderson D, Bunn B, Eisenberg D, Howard A, Nussbaum D, and Templeton, J (2018) Interdependent Infrastructure Resilience in the U.S. Virgin Islands: Preliminary Assessment, Naval Postgraduate School Technical Report NPS-OR-18-005, December.