An Operational Model of the Critical Supply Chain for St. Thomas and St. John

M.S. Thesis in Operations Research (Sept. 2020, expected), Naval Postgraduate School, Monterey, CA
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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. The damage wrought by these two events prevented effective distribution of supplies and critical materials during the hurricanes, and combined with government mandated curfews, prevented community access to supplies for months after the disasters. To prepare for future catastrophic events, the key attributes and essential interdependencies of the USVI food supply chain and transportation system require more effective emergency response plans.

Building on previous work by Good [1], this thesis focuses on the capacity of the transportation systems of St. Thomas and St. John to deliver food and materials via ports and surface roads. The goal is to assess how food supply chains and transportation systems perform during normal and post-hurricane conditions, and to identify emergency relief stations across the two islands that minimize household travel time, maximize supply chain access, and support faster recovery.

Our model is based on an *operational view* of critical infrastructure [2] that is rooted in "how things work" before and after the 2017 hurricanes to ensure model accuracy and quickly turn results into action. Focusing on ports of entry and surface road transportation, our analysis requires descriptions of installed infrastructure, infrastructure condition, system structure, system function, operational plans, and tensions involving the ongoing management of these systems.

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) and Department of Energy (DOE) to assess and improve the resilience of interdependent USVI lifeline infrastructure systems [3,4]. 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 with presentation of notional infrastructure model
- June 2020 - Complete infrastructure model; presentation to Military Operations Research Society (MORS) Symposium
- August 2020 - Final visit to USVI to present findings and recommendations
- September 2020 – Graduation

1. Good J (2019) An Operational Model of Critical Supply Chain for the U.S. Virgin Islands. Master's thesis, NPS.
2. Alderson D, Brown G, Carlyle, W (2015) Operational Models of Infrastructure Resilience. *Risk Analysis* 35(4).
3. 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, Technical Report NPS-OR-18-005.
4. Bunn B (2018) An Operational Model of Interdependent Water and Power Distribution Infrastructure Systems, Master's thesis, NPS.