WARGAMING THE IMPACT OF EXTERNAL RISKS TO THE FUEL SUPPLY CHAIN

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Abstract

This project conducts a thorough analysis of U.S. fuel supply chain vulnerabilities, with a specific focus on countering the impact of cyberattacks on oil refineries. Utilizing Resilinc software, the research employs large-scale simulations, informed by real-world data from sources like the U.S. Energy Information Administration and Resilinc's capabilities. Recent attacks on the colonial pipeline highlight the urgency of fortifying the fuel supply chain against diverse external threats. The simulations provide accurate representations of the complexities in the U.S. fuel supply chain, enabling participants in a wargame exercise to assess various disruption events comprehensively. Through multiple simulations and the subsequent wargame, collaborative decision-making is facilitated, offering insights into mitigation strategies and resource allocation efforts. The project's outcomes will significantly influence the formulation of risk management strategies, providing a robust framework equipped to address future fuel supply distribution events by identifying vulnerabilities, testing response efforts and strategies, and facilitating communication. The paper and the simulation have been cleared at the unclassified non-CUI Level.

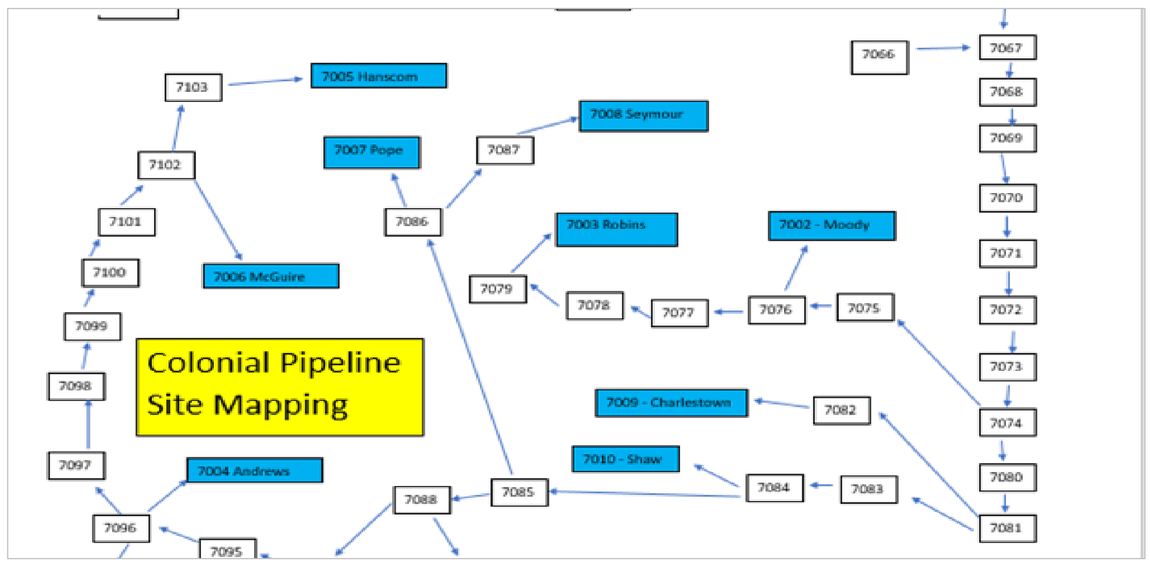

Figure 1. Linked Colonial Pipeline Infrastructure to Air Force bases

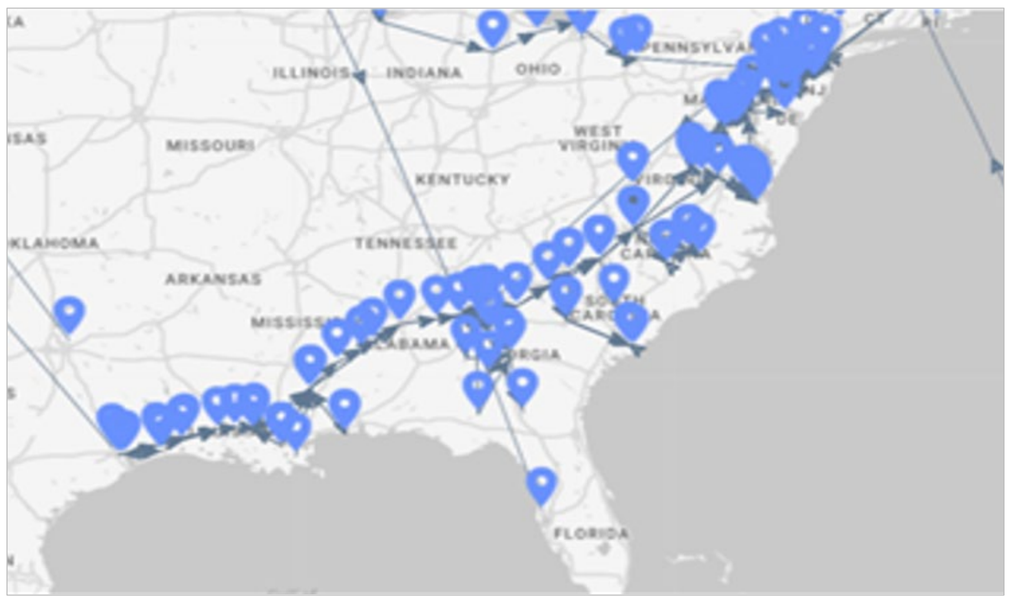

Figure 2. Resilinc – Mapping the Supply Chain

Methods

- Collected the Data (Website: EIA.gov)
  - Infrastructure Locations
  - Pipeline Routes
  - Daily Demands (Air Force Bases)
  - Refinery Capacity
- Linked the Pipeline Infrastructure to the Air Force Bases (Figure 1)
- Linked the Supply Chain Data
- Mapped the Supply Chain in Resilinc (Figure 2)
- Developed the Wargame Scenario (Figure 3)
  - Simulated Disruptions include 3x Cyber Attacks, 1x Chemical Spill and 2x Kinetic Attack, and 2x Explosions (Figure 4)
- Testing the Data (Table 1)
- Analyzing the results (Table 1)

Results & Their Impact

This capstone simulator, co-developed with Resilinc software, provides AF Operational Energy with the following capabilities:

- Dynamic Simulation
- Multi-Scenario Analysis
- Link between Theory and Application

AF Operational Energy now has a platform that can create accurate, scalable, and flexible simulations with a user-friendly interface that can assist students and leaders alike in making informed decisions about mitigating supply chain disruptions.

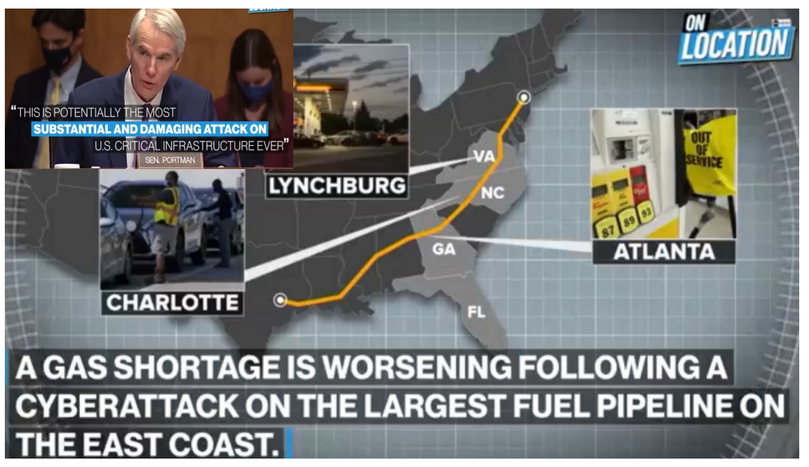

Figure 3. Wargame Scenario

Recommendations

- Develop customized scenarios that will test multiple supply chain disruption mitigation strategies and theories but also support the development of new ones.

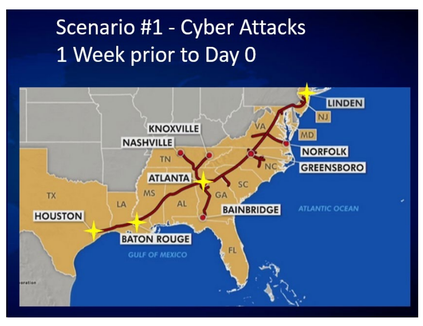

Figure 4. Scenario

- Analyze the data output to identify strengths, weaknesses, opportunities, and threats.
- Such as weighing the costs and benefits of having alternate sites

Part	Recovery Time	Avg. Alt. Site Bring-up Time	Max Alt. Site Bring-up Time	Sites	Kinetic Attack	Cyber Attack	Natural Disaster	Sourcing
BP12345678	16.48 weeks	0.00000 weeks	0.00000 weeks	19	3.5	8	5.55	8
BP12345678	16.48 weeks	0.00000 weeks	0.00000 weeks	19	3.5	8	5.55	8
CP12345678	17.32 weeks	0.00000 weeks	0.00000 weeks	58	5	8	6.2	8
CP12345678	17.32 weeks	0.00000 weeks	0.00000 weeks	58	5	8	6.2	8
PP12345678	16.93 weeks	0.52174 weeks	14.00000 weeks	42	5	8	6	8
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Table 1. Data

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