Enterprise Resilience of Maritime Container Ports to Pandemic and Other Emergent Conditions
(Technical Report)

Weather-Related Mitigation Strategies and Technologies Used by the Federal Aviation Administration in the Presence of Hazardous Weather Conditions
(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Sciences
University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree
Bachelor of Science in Systems and Information Engineering

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May 01, 2020

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SocioTechnical Synthesis

Technical Topic

Emergent and future conditions that influence the global container port industry include

pandemics, regulations, markets, technologies, environments, organizations, energy resources,

workforces, supply-chain partners, and others. It is critical to simultaneously formulate and adapt

multiple strategic plans of individual ports to the above stressors. The Port of Virginia (POV)

generates 400,000 jobs, or roughly 11% of jobs across Virginia, and has an overall annual

economic impact of $92 billion. POV is currently investing $800 million to expand its annual

container throughput capacity by 40 percent by the end of 2020. This investment supports

initiatives outlined in the port's 2065 master plan through the investigation of different scenarios

that impact emergent and future port conditions. This paper describes the most and least

disruptive scenarios of emergent and future conditions, including hybrid scenarios involving the

COVID-19 pandemic. The degree of disruption is measured by the changes in priorities of a

port's strategic plan, in particular for the rank order of investments by their individual

contributions to the strategic goals of the port. The analysis described herein includes sixteen

strategic goals, 31 strategic plan investments, and several dozen emergent and future conditions.

The analysis assembles the emergent conditions into scenarios. The most disruptive scenarios are

selected for contingency planning, enterprise risk management, and research & development.

Seven scenarios are available for future exploration in detail: (1) Funding Decrease (2) Natural

Disaster (3) Green Technologies (4) Pandemic (5) Increased Automation (6) Alternative

Financing (7) Population Changes. Green Technologies, Pandemic and Alternative Financing are

explored in detail in this paper. The results of this paper are thus both a methodology for any port

to address its emergent and future conditions via its strategic plans, and also a case study of

enterprise resilience of a major container port of the United States. The results will be of interest to port owners and operators, risk managers, transportation agencies, regulators, freight shippers, human resource managers, the military, and others.

STS Topic

Hazardous weather conditions in the National Air Space (NAS) cause 70% of all delays with an hourly delay cost ranging from $1400 - $4500 for a given airline. In 1977, one of the most fatal accidents was the crash of two Boeing 747 aircrafts, Pan Am Flight 1736 and KLM Flight 4805, due to foggy weather conditions. The Federal Aviation Administration (FAA) has acknowledged most of these accidents are fatal due to difficulty detecting hazardous weather conditions. This is where technology can help detect such conditions. Thus, my research question is *what are weather-related technologies and strategies the Federal Aviation Administration uses in the presence of hazardous weather conditions?* I will explore evidence of weather-related technologies, understand the overall motivation behind developing these technologies, and analyze the use of these technologies in the Air Traffic Control (ATC) system. Current and emerging technologies developed through the NextGen program are important for supporting this research while considering some human and social implications. Within the ATC system, some human-to-human interactions include pilots communicating with controllers, pilots communicating with passengers, and even the flight crew communicating with passengers. Introducing newer technologies into the system leads to non-human interactions between the pilot and the technical medium, impacts pilot task performance, and affects the pilot operating environment.

To evaluate the technologies and their social implications, I will frame my research primarily through *Actor Network Theory* by Bruno Latour. Actor Network Theory will facilitate

the analysis of how actors adapt to new technology. I will use evidence from prior literature and content analysis to inform case studies. The evidence I collect from the NASA Langley and Glenn Research Center, Federal Aviation Administration, and NCAR Research Applications Laboratory will highlight important technologies and algorithms used in the ATC system. I will then analyze several National Transportation Safety Board (NTSB) case studies such as Pan Am Airways Flight 759, Delta Airlines Flight 191, and USAir Flight 1016 to provide a background of fatal aviation accidents, motivation for research, and connection to resulting technological developments. I expect to establish a connection between significant historical aircraft disasters and resultant weather-related technologies, while considering the social implications of these technologies within the ATC system. Recent aircraft disasters such as the crash of Pegasus Airlines on February 6, 2020 due to thunderstorm conditions and the crash of Kobe Bryant's helicopter January 26, 2020 due to foggy conditions still motivate continual research in technology to reduce risk of future weather-related accidents. In an evolving ATC system, this kind of motivation is important for progressing research through FAA's NextGen program.