Thesis Project Portfolio

American Institute of Aeronautics and Astronautics: Aerial Firefighting Aircraft Design Competition

(Technical Report)

Implementation of Autonomous Vehicles into Society in the United States

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Wildfires are of environmental concern as they spread quickly over combustible vegetation and destroy large amounts of land. Controlling these wildfires is a global issue, the concern stemming from the increasing number of acres of land that are burned annually in the past 30 years, despite the slight decrease in the number of annual wildfires. In light of these issues, the technical project attempts to design a custom firefighting aircraft in response to the American Institute of Aeronautics and Astronautics (AIAA) 2022 undergraduate design challenge. Aircraft that are used to fight fires today are either commercial or military aircraft that have been modified for firefighting applications, usually involving the addition of an external tank to hold fire retardant. A specialized aircraft could result in an overall increase in efficiency and effectiveness of the mission through weight reduction and easily repairable structures. It is important to consider the human and social dimensions of the technology to ensure that in the attempt to fight wildfires and the negative impacts on the surrounding environments and communities, the development and operation of the aircraft is not additionally causing harm in other areas. One important design factor to consider is autonomy, which is a major goal for the next generation of aircraft so that they can launch anytime into an environment that is too risky to send pilots into and execute the mission remotely. However, issues arise when considering the implications of a malfunction of an autonomous aircraft, pilots losing jobs, or a cyber attack.

While the focus of the technical work is on the development of a specialized firefighting aircraft, the STS research will explore the implementation of autonomous vehicles into society in the United States. The research was conducted through the lens of Bruno Latour's Actor Network Theory to determine how autonomous vehicles might control or shape human actions. The paper addresses the question: Should autonomous vehicles be implemented into society in the United States? This question was broken down into focused questions that corresponded to

each of the theory's analytical elements. In light of these questions, a literature review was conducted and various individuals knowledgeable in the field were interviewed in order to develop a better understanding of the benefits and drawbacks associated with the technology. Through the research, it was found that autonomous vehicles should continue to be developed for implementation into society in the United States. Although this research is focused on autonomous vehicles, the research approach can be directly applied to the development of a custom firefighting aircraft. The STS-focused questions can be asked of any technology to ensure that it is not harming or constraining any group within society. While a firefighting aircraft may be designed to fight wildfires and help the surrounding environment, these types of questions must be asked to ensure that no harm is being done through the development and deployment of the technology.