THESIS PROJECT PORTFOLIO

AIAA 2021-2022 UNDERGRADUATE RESPONSIVE AERIAL FIREFIGHTING AIRCRAFT

(Technical Report)

A DISCUSSION OF THE CURRENT STATE OF WILDLAND FIREFIGHTING IN THE UNITED STATES

(STS Research Paper)

An Undergraduate Thesis

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My technical and STS projects address socio-technical challenges of the increasing rate of wildfires occurring throughout the world. The results of both projects will simultaneously find a solution to both fight against and reduce the rate of wildfires. Independently solving one of the two problems will not be effective if the other problem is disregarded at the same time. Solely designing new firefighting aircraft for wildfires, which are only increasing in size and intensity, will not be able to keep up with how drastic the fires can become just a few years from now. On the other hand, only reassessing the current social situation with wildfires using actor-network theory alone will likely be a multiple-year transformation. Without any sort of solution, we may be at an extreme loss in lives, land, and supplies in the near future.

The technical project that was set forward outlined a design which will have a better ability to fight modern wildfires than modern aircraft do right now - following multiple project requirements set by the American Institute of Aeronautics and Astronautics (AIAA). A lot of firefighting aircraft today are transformed from regular commercial or military aircraft, as it is cheaper to modify a pre-built aircraft rather than designing an entire new one for a specific task (such as aerial firefighting). However, due to the rapid increase in wildfires throughout the world, there has never been a better time than now to design an aircraft solely for aerial firefighting. The design my team and I proposed is capable of fighting modern wildfires more effectively than other aircraft that are intended to be designed for commercial and military purposes. Additionally, it is capable of autonomous flight, which can be extremely useful for pilots as they can focus more on communication during firefighting rather than flying and controlling the aircraft.

The STS project set out in the research paper addresses global warming's significance to the occurrence of wildfires. Increases in temperature have caused multiple areas throughout the

planet to get drier, making it easier for combustion to happen, a chemical reaction that can start fires. There are a lot of factors that are contributing to this problem, such as people, governmental laws, and the fire fighting system in place right now. It is difficult to point the blame at just one specific area, so I used actor-network theory to study the firefighting system in place, specifically in California, and determined what has gone wrong throughout multiple parts of the existing network. The intention of my research was to figure out how the current firefighting system in place is flawed and to look into the disruptions of the sociotechnical system of wildland firefighting. It turned out lots of the problems found were related to the US governmental and other political figures. There were problems within other groups, but it was never in their control and instead stemmed towards the higher government powers.

After simultaneously working on both my technical project and STS project, I became more knowledgeable in both the field of firefighting aircraft and the environmental causes and effects of wildfires. Working on the technical project helped me fully understand both the complex aircraft design process and how much the aircraft industry has been due for an aircraft intended for aerial firefighting. Working on the STS project gave me a better understanding of the environmental issues that contribute to wildfires. There was a lot of information about some of the subjects that I did research on, such as the problems with the wildland firefighting system and climate change. However, I really wish there was more open information about aerial firefighting technology and internal decisions in the government about climate control laws. There was only so much information about both of these as a lot of it is required to remain confidential, which is something I didn't really expect going into conducting my research for this paper. For the technical project, time was our biggest constraint and I feel like we could have had a much more efficient design with more time than we had. However, researchers and engineers

can use the results from both projects to improve the overall system of wildland firefighting by improving both technical portions and socio-technical portions of the network.