

**Thesis Project Portfolio**

**Conceptual Design Report of a Firefighting Very-Large-Air Tanker “Material Girl”**

(Technical Report)

**Negative Implications of the Production of Aircraft on Society**

(STS Research Paper)

An Undergraduate Thesis

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## Sociotechnical Synthesis

Aerial firefighting aircraft have become an essential part of the world today; they help on-ground firefighting crews battle worsening wildfires in a safer, and more efficient manner. The goal for these aircraft are to efficiently battle fires, complete full missions, be easy to maintain, and be as sustainable as possible. There is a multitude of possible aircraft that can be utilized for this exact use; they could be small, military-style, with capabilities to maneuver into more restricted areas, or they could be large, commercial-style, with capabilities to fly over a bigger range and altitude and carry more fire retardant per mission.

This technology is of the utmost importance in our society today, especially as wildfires are becoming more damaging, worldwide. Therefore, this year's competition for the American Institute of Aeronautics and Astronautics is to design an aerial firefighting aircraft that fits the following requirements:

- Must be entered into service by the year 2030
- Must use existing engine(s) or one that is in development (that will be in service by 2028 or two years prior to the entry into service)
- Must have assumptions on specific fuel consumption/efficiency, thrust/power. And weight documented
- Must carry at least 4000 gallons of fire retardant, have a multi-drop capability of at least 2000 gal/drop, have a fire retardant reload of  $\geq 500$  gal/min, and a retardant density of at least 9 lbs./gal
- Must have a drop speed of maximum 150 kts and a drop altitude of maximum 300 ft AGL
- Must have a full payload design radius of 200 n-mi and an empty payload design ferry range of 2000 n-mi

- Must have a dash speed of at least 300 kts
- Must of a balanced field length of maximum 8000 ft @ 5000 ft MSL elevation on +35-degree F hot day
- Must be capable of VFR and IFR flight with an autopilot
- Must be capable of flight in known icing conditions
- Must meet applicable certification rules in FAA 14 CFR Part 25

By following these requirements, the goal is to build an optimal and efficient firefighting aircraft that helps complete the task of containing a wildfire. This project is to be completed in a group of eight, utilizing several professional aerospace programs to help students get a feel for what aerospace engineering really encompasses.

The STS portion of this project looks at the social implications of this technology. The aviation industry overall has truly helped the world today, and its benefits can be seen. Aerial firefighting is of huge importance when it comes to controlling fires, especially as they have worsened due to the impacts of global climate change. The STS portion of this project analyzes this specific topic and compares it to the negative implications of this industry. Each technology ever engineered can be associated with both bad and good politics and it is important to look at both entities to analyze how these politics have influenced societies around the world. From there it can be seen if a technology and its system need to be sent back to the drawing board.

Aircraft are very resource heavy technologies; the resources that they require have been very damaging to societies. The metals that are used to build them are known as conflict minerals, which are extracted from the Democratic Republic of Congo. Gasoline and oil are then used to fuel and fly the aircraft; these resources are extracted from the Middle East. Both

resources were obtained through unethical means of imperialism, neo-colonialism, and war. People's lives and homes were destroyed for the purpose of gaining access to the resources discussed above.

The STS portion of this project analyzes this exact relationship, concluding that the aviation industry is in fact one of unethical practices. No institution recognizes the wrongs that are being committed due to the imperialistic mindset, and little value for other's lives. If the industry's goal is to continue bringing the world together and aiding societies, than their engineering practices need to change to reflect that mindset. Much work and dedication are required to enforce changes, but they are possible. For it to happen, imperialistic entities, and the public, must realize that imperialist actions are both inherently wrong and harmful. Education is the first step. As mindsets change, real physical change will follow. For example, extra research can be done to find more sustainable sources and there can be legal accountability for how these sources are extracted. This is not an easy road and there will be many bumps and much resistance, but as this paper shows, change can surely happen with the right amount of dedication.