

**Thesis Project Portfolio**

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

(Technical Report)

**The Data Analytics Controversy in European Soccer**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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## **Sociotechnical Synthesis**

### Technical Capstone:

The technical capstone's main objective was to design a firefighting aircraft. The aircraft design must be produced and have an entry service date by 2030. The work produced by the team features in depth analysis of the flight envelope and expected calculations for costs and operation. The overall project was limited to specific design constraints and requirements for operation. Furthermore, there were additional objectives that could be met within the design. These objectives varied from either new technology integration or improvements on the original requirements. Within the technical report each section explains how the team met the requirements and objectives. Each aerodynamic structure was evaluated for optimization. The main aerodynamic structures included in the report are the fuselage, wing, empennage (tail section), engines, and landing gear. These sections will include the design and modeling of each part. Each structure will have accompanying trade studies in which the team will discuss why the design was chosen. Trade studies are an effective method of optimization used by aerospace engineers. Essentially, trade studies weigh the pros and cons of different designs and sizing until an optimal point is found. Every part of the aircraft affects other parts of the aircraft so trade studies were done for each individual structure as well as combined structures. These methods would continue until we combined all the parts and achieve the desired results. The sizing of the overall aircraft was also included in these sections. The other sections that can be found involve other mission critical aspects and production. Mission critical aspects include the payload method and mission profile. The mission profile is an expected itinerary of a flight in which time, fuel consumption, speed, and altitude are predicted. Under the guidelines given the mission profile is a firefighting mission. The production section includes cost analysis and predictions. These range from costs of parts of the plane, operations, upgrades, and maintenance. Advanced

avionics and unmanned capabilities were included within the objectives and would be included within the potential upgrades our aircraft could receive. The overall technical section of the Thesis will be explaining our reasoning for the design choices and how we met the objectives and requirements.

### Sociotechnical Capstone:

The sociotechnical capstone project dives into the sport of European soccer and the changes and overall effects of digital methods. Since 2000 the use of digital methods has increased exponentially. Naturally, digital methods have been both criticized and praised by various actors surrounding the sport. The research solely focuses on the effects of digital methods and different participants opinions on the changes. This paper does not attempt to advocate for or against digital methods usage. The goal is to present substantial research using direct quotes and analysis to show the varying opinions and objectives towards the digital methods movement. Rather than advocating for or against the paper allows the reader to develop their own conclusions on digital methods usage in the sport. The participants chosen include, data firms, refereeing organizations, individual clubs, broadcasters, governing bodies, and specific fan groups. Each group had various methods of research information from articles, press releases, and statements taken from social media platforms. As stated above, each participant was analyzed to discover how they use and their opinions of digital methods. From the research each group had varying opinions on digital methods integration in the sport. Currently the most dividing use of digital methods is how referees have incorporated. Referees have incorporated digital methods through the use of VAR (Video Assistant Referees). The VAR tool allows referees to reverse decisions and act as an additional referee. The goal of the tool is to allow for better officiating; however, this continues to divide opinions. The debate on VAR is not the only area of soccer that is causing changes and differing opinions. Governing bodies within the sport have had to implement data protection laws and

methods to protect individual players from harmful and exposing digital methods. As digital methods usage in the sport continues to rise these debates may become all the more frequent. Digital methods have changed the sport of European soccer in many ways and will continue to. The overall game is evolving and digital methods are accelerating this process to the praise of some and the dismay of others.