Light Attack Aircraft Design Competition

(Technical Paper)

Militarism in American Culture

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

My capstone project focuses specifically on a competition created by the American Institute of Aeronautics and Astronautics. Our main objective as a group is to design a light attack aircraft that reaches requirements set by the AIAA, is affordable, and can specifically take off from an austere field. This capstone projects bridges to STS research through the scope of how militarism has evolved culturally, and how it effects everyday life, specifically looking at how militarism has weeded into sports culture. The timeframe of this research will be centered around the terrorist attacks from 9/11, as there are clear indications of change pre and post 9/11. As militarism has creeped its way into our culture, especially sports culture many things have changed. Is it necessary to fly a Stealth Bomber over a stadium before a sporting event? Is it necessary to play the National Anthem before a game, when leagues are diverse and many players are not from the United States? Is the NFL's salute to service campaign a coverup to sneak militarism into the sporting world? My research will dive into these ideas and attack why flyovers are almost a must for most modern sports teams, and how this militarism rooted in sports culture is practically covered up by our love and passion for games and teams. It is important to be self-aware of what is feeding into our culture, and through the use of scholarly journals and articles, I hope to come to a conclusion on whether or not militarism has seeped dangerously into our sports culture, or if militarism is just a side addition to the sports world and something that carries very little impactful meaning and persuasion behind it.

Technical Topic

As said before, my technical capstone project is built around designing an attack aircraft to certain specifications. Our full objective as a group is to design an affordable light attack aircraft that can operate from short, austere fields near the front lines to provide close air support to ground forces at short notice and complete some missions currently only feasible with attack helicopters. There are two big takeaways from this objective, first, the aircraft needs to be affordable. This is because the current best fighter jet, the F-35, is predicted to cost $82.4 million in 2020 and only slightly drop to $77.9 million by 2022 (Stone). Second, taking off from an austere field, which is generally just flat, packed earth for a plane to takeoff from rather than a paved runway (Laststandonzombieisland). This technical capstone project is guided by Professor Jesse Quinlan, who is a part time professor at UVa as well as a Senior Aerospace Engineer at the NASA Langley Research Center. My capstone group consists of seven aerospace engineers as well, who are named above. The requirements and mission itinerary are laid out straight forward in the request for proposal released by the AIAA. The mandatory requirements and goals are laid out in the following figure, Figure 1.

General Requirements

The requirements and objectives below are applicable to both aircraft within the family.

- [R] Austere Field Performance: Takeoff and landing over a 50 ft obstacle in ≤ 4,000 ft when operating from austere fields at density altitude up to 6,000 ft with semi-prepared runways such as grass or dirt surfaces with California Bearing Ratio of 5
- [O] Survivability: Consideration for survivability, such as armor for the cockpit and engine, reduced infrared and visual signatures, and countermeasures (chaff, flares, etc.).
- [R] Payload: 3000 lbs of armament
- [O] Provisions for carrying/deploying a variety of weapons, including rail-launched missiles, rockets, and 500 lb (maximum) bombs
- [R] Integrated gun for ground targets
- [R] Service life: 15,000 hours over 25 years
- [R] Service ceiling: ≥ 30,000 ft
- [R] Crew: Two, both with zero-zero ejection seats

Figure 1: General Requirements for Design

In these general requirements the [R] denotes something that is required in design, while the [O] indicates just and objective or goal of the design. Both tables below show the itinerary for two specific missions; Design mission (Table 1) and Ferry Mission (Table 2).

Table 1: Design Mission Itinerary

1	Warm Up/ Taxi	5 minutes
2	Take Off	Austere field, 50 ft. obstacles, less than 4000 ft.
3	Climb	To cruise altitude, greater than 10000 ft; with range credit
4	Cruise	100 nautical miles
5	Descent	To 3000 ft; no range credit; completed within 20 minutes of the initial climb
6	Loiter	On station, four hours, no stores drop
7	Climb	To cruise altitude, greater than 10000 ft; with range credit
8	Cruise	100 nautical miles
9	Descent/ Landing	To austere field over 50 ft obstacle in less than 4000 ft.
10	Taxi/ Shutdown	5 minutes

11	Reserves	Sufficient for climb to 3000 ft. and loiter for 45 minutes

Table 2: Ferry Mission Itinerary

1	Warm Up/ Taxi	5 minutes
2	Take Off	Auster field, 50 ft. obstacle, less than 4000 ft.
3	Climb	To cruise altitude; with range credit
4	Cruise	At best range speed/ altitude 900 nautical miles
5	Descent/ Landing	To austere field over 50 ft. obstacle

6	Taxi/ Shutdown	5 minutes
7	Reserves	Sufficient for climb to 3000 ft. and loiter for 45 minutes.

The metrics of success can be seen below in figure 2, and the AIAA Technical Committee that developed the RFP will serves as the judges of the design's final reports.

1. **Technical Content (35 points)**
   This concerns the correctness of theory, validity of reasoning used, apparent understanding and grasp of the subject, etc. Are all major factors considered and reasonably accurate evaluation of these factors presented?

2. **Organization and Presentation (20 points)**
   The description of the design as an instrument of communication is a strong factor in judging. Organization of written design, clarity, and inclusion of pertinent information are major factors.

3. **Originality (20 points)**
   The design proposal should avoid standard textbook information, and should show independence of thinking or a fresh approach to the project. Does the method and treatment of the problem show imagination? Does the approach show an adaptation or creation of automated design tools?

4. **Practical Application and Feasibility (25 points)**
   The proposal should present conclusions or recommendations that are feasible and practical, and not merely lead the evaluators into further difficult or insolvable problems.

Figure 2: Success Metrics

The need for an affordable light attack aircraft comes from the lack of a light attack aircraft program currently in the US Air Force. The best fighting jet at the US military's disposal currently is the F-35 Raptor, but as strong as this aircraft is, it cannot perform basic light attack aircraft functionalities such as loitering and close air support. Although the US doesn't build and distribute light attack aircraft, they are in the business of buying, and in their fiscal 2021 budget is to purchase four light attack aircraft, two AT-6's and two A-29's (Insinna 2020). These two planes are very similar in capability and their price point, so they are being put to the test by the

Air Force to determine where to put their money. Finding a light attack aircraft is important because of its superiority in air-to-ground combat, and its maneuverability versus an attack helicopter. This is very helpful with combat in the middle east, and generally where ground troops could get into a sticky situation. The middle east is specifically where the Air Force would like to use this light attack aircraft as it can execute combat missions better than an attack helicopter and fighter jet, as said before, and it comes at a much cheaper price point than current military fighter jet (Insinna 2018).

As a team we have only made it as far and establishing the concept down selection using IRMA methods and a Morphological Matrix. Using these two methods our team has decided to shift away from a design more similar to the AT-6 and the A-29, and instead reach outside the box and design our own tilt-wing aircraft similar to what Rolls-Royce is designing as an eVTOL (Figure 3). What brought us to this decision was the ability of a tilt-wing design to give the aircraft takeoff, landing, and loiter properties similar to that of an attack helicopter when the wings are in the upright position, but when they are down the aircraft then competes with the statistics and capabilities of the AT-6 and A-29, seemingly making this aircraft have the best of both worlds, if the design permits.

Figure 3: Rolls-Royce Tilt Wing eVTOL (Garret-Glaser)

I have no specific role within the team, and the only true role we have is team leader. As a group of seven we generally work on everything together and at the same time so that we can bounce ideas back and forth and make progress quickly. This makes my overall responsibilities within the team determined by our team workload and what is due for the project on a weekly basis.

STS Topic

The relation between military aircraft and ongoing militarism increasing in daily culture comes from an STS connection of the advancing technology of our military paired with changes in our overall society. Kathy Ferguson, from the University of Hawaii, poses an example of how militarism can seep into daily life in her journal, *"The Sublime Object of Militarism"*. She argues that this diffusion of militarism occurs by normalizing military technology, such as guns, surveillance equipment, etc. She also notes how generally in today's world, war goes on while the world and the country simultaneously move forward, in time, saturating our feelings with having a war going on and letting a militaristic world continue to coexist with daily life (Ferguson). Where this relates back to the National Football League (NFL) and the militarism there is how the NFL uses military technology to appease an audience. This comes mainly in the form of flyovers and the "Salute to Service" campaign. By heavily advertising "Salute to Service" and by having flyovers at most home football games, the NFL is oversaturating their league with a militaristic presence.

To understand how the "Salute to Service" campaign allows increasing militarism into the game, its first important to understand what exactly the "Salute to Service" campaign is. This campaign started in 2011 (NFL HONORS), after the events of 9/11, and the campaign is set to honor veterans, military personnel, and the US military in general. This is done by showcasing military members during games, at least one big flyover for every team at a designated home game, and special jerseys and merchandise, which benefit charity through the proceeds (Press). While this seems like a great campaign, and don't get me wrong, it is always nice to help charity out, especially through a sporting event or game where millions are tuning in and can contribute, however, this campaign does slightly more than that by allowing a diffused military presence to

enter the NFL. Adam Rugg also touches on this thought in his journal *"America's Game: The NFL's "Salute to Service" campaign, the diffused military presence, and the corporate social responsibility"*. Rugg mentions that the event does what it is intended to do by highlighting the US military and celebrating veterans and military personnel, but he goes on to say this produces an extreme saturation of military symbolism and iconography around regular season games. He claims that this leads to a "diffused military presence", which casually incorporates the military into everyday life via this entertainment provided by the league, and turns the campaign away from a unique "mega-event" of military celebration and appreciation. Finally, he adds that because of this the league takes on the ideology of being an authoritative public institution rather than acting as a corporate citizen (Rugg). This tiredness and obnoxiousness of military presence was very recently brought up by two of FOX Sport's broadcasters Joe Buck and Troy Aikman before a game on October 18th. Sent in by an anonymous tipster, Joe Buck says, "Welcome to Big Noon Saturday!" seconds before a flyover occurs. Shortly after Troy Aikman replies with, "That's a lot of jet fuel just to do a little flyover." The conversation is basically finished with Joe Buck giving a sarcastic response to Aikman and saying, "That's your hard-earned money and your tax dollars at work!" This small exchange exemplifies how many fans feel about this ongoing diffused military presence in the NFL that has been going on for years (Even).

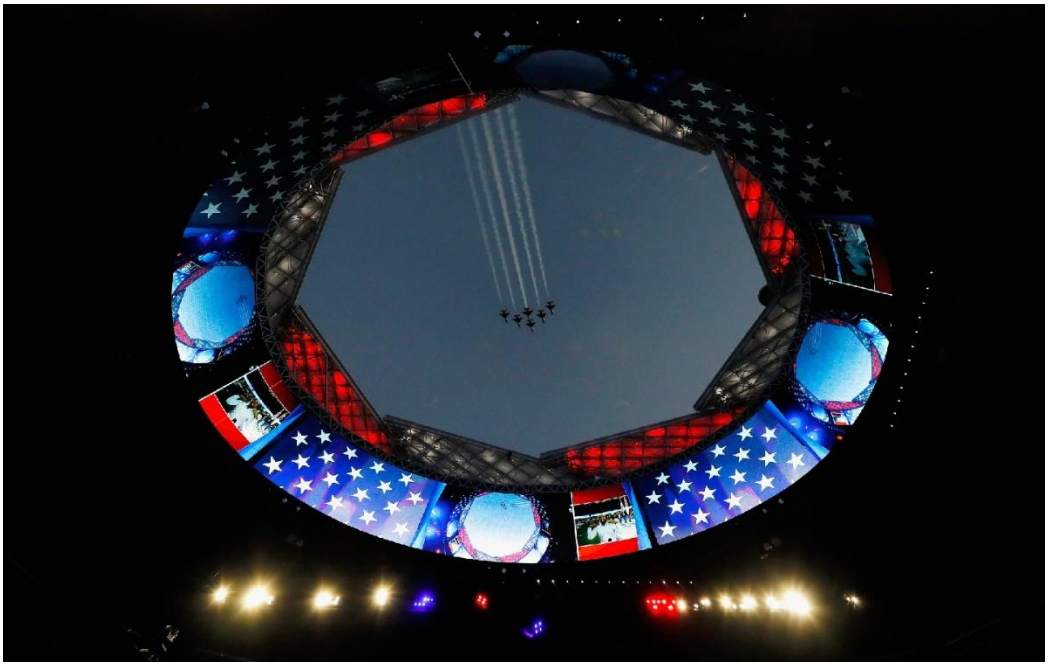

Figure 4: Military Flyover Picture at stadium with on a small portion of the roof open (Zirin)

What Joe Buck and Troy Aikman said pregame go hand in hand with the opinions laid out by Adam Rugg regarding ongoing militarism in the National Football League. Buck and Aikman are prime-time broadcasting partners and have called hundreds of games in their time together probably seen their fair share of flyovers. They understand that this is a utilitarian action and that the cost is outrageous, and all they see is a handful of fighter jets scream across the sky for five seconds. In specific the flyover pictured above in Figure 4 was at the Mercedes-Benz Stadium in Atlanta. This stadium is a dome with a small retractable roof at the top. There is no reason to showcase a flyover at a stadium with a domed roof for obvious reasons. Every team has a least one flyover a year at a home game to comply with the “Salute to Service” campaign, so again as Rugg said above, this heavily disperses the main event of the charity involved with the campaign and makes it more about military presence and military display.

As I continue my research, I want to continue to break down this barrier linking militarism with the NFL's "Salute to Service" campaign. Doing this will require more empirical evidence into financials of the campaign, how much a flyover potentially costs, and even a more in depth look at how all this came to fruition post 9/11. The big stakeholders in this scenario are the US military, the NFL, and the American public. The US military and NFL raising the bar for ongoing militarism, while the American public is trying to fight against it. Hopefully my further research will bring me to an exact number for the cost of an NFL flyover, dependent on aircraft used, this will allow me to not only make a militarism argument against the act, but also an economic argument. Once I complete further research and dive a little deeper into the stakeholders and actants in the situation, the question I posed above about militarism seeping dangerously into our culture should be able to be answered.

Next Steps

- Do more research on militarism influence on culture and society outside the sports world. Right now, I am looking at militarism focused solely on sports, and there is a lot more out there that can be related to society, such as militarism in schooling.
- Try and find more examples of changes pre and post 9/11, especially changes with more military appreciation jerseys, or how the NFL has expanded its “Salute to Service” campaign.
- Break down more scholarly articles and decipher which data and opinions are most important to move forward with, and build this into a more coherent thesis and less of a philosophical remark.
- Try to break down the research and data and come to an intelligible solution.

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