

# **Thesis Project Portfolio**

## **Project Kestrel**

(Technical Report)

## **The Road to the F-35**

(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**

Military aircraft development is a very time intensive and expensive process, with each decision greatly affecting the potential sustainment and efficiency of a program. Incorporating affordability as a design objective and maintaining a focus on cost effective solutions throughout the life cycle of an aircraft is as important as the aircraft's capability on the battlefield. Understanding how design and analysis influence the cost of an aircraft will be critical to a future of justified and supported defense acquisition.

My technical thesis overviews the design of a light attack aircraft in response to a request for proposal by the American Institute of Aeronautics and Astronautics (AIAA). The objective of the project 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. The technical proposal presents the design of the aircraft with a full description of features, performance capabilities, and operational limits. Our final solution is a tiltwing light attack aircraft concept named the Kestrel. Justification for the selected configuration and corresponding methods for analysis are also included in the proposal.

My STS research consisted of determining the underlying reasons for why there is a push for new and affordable light attack aircraft. My search led me to the F-35 Joint Strike Fighter, the most expensive aircraft program

in the history of the United States military. I was curious as to what led the Department of Defense to develop an aircraft that would be used by multiple services of the military. I also hoped to determine what drove innovation in the past to see what had or had not changed with the F-35 program.

Because motivation to reduce cost is not fueled by competition between the military services in the joint service approach, affordability becomes more of a challenge. A case study of the F-35 reveals how a sole-source environment and a lack of comprehensive analysis contributed to sustainment issues.

My capstone team was successful in completing a light attack aircraft design that meets the mission requirements and objectives outlined in the AIAA request for proposal. My STS research explored the root cause of affordability and readiness issues with current defense acquisition specifically in the case of the F-35. I conclude with a discussion of performance-based logistics as a potential strategy for continuing to reduce cost with the F-35. Exploring the practicality of this strategy with thorough analysis would serve as the basis for any future work.

I would like to thank Professor Jesse Quinlan and Professor Sean Ferguson for guiding me in my technical project and STS research. I also would like to thank my entire capstone team for it has been an honor and a pleasure working with all of you.