



Component Improvement for the F35 Fighter Jet

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Introduction

During the 2024 summer, I interned at the Turbofan/Turbojet Design Branch at Pax River Naval Air Base. This branch is devoted to the continued improvement and upkeep of active military aircraft engines. The general term used is the component improvement program (CIP), which takes field data and facility component re-design to fix issues encountered in the field. The branch as a whole covers all aircraft engines, but I was specifically assigned to the F135 engine, which is used in the F35 fighter jet.



<https://www.flightglobal.com/pandw-details-success-with-f135-engine-stovl-tests/96381.article>

Activities:

The F135 engine comes in three different variants and is one of the most complex engines in the fleet. With this comes unexpected in-field failures that need to be addressed for the continued flight of the F35. My job was to complete a degraders analysis on the F135 engine. This analyzes field data, such as service logs or flight records, to determine the components that contribute to aircraft downtime. I then ranked the components by severity of failure and total aircraft downtime. The information was formatted into a presentation that gave a concise summary of the top degraders our team needs to be concerned about.



<https://www.ainonline.com/aviation-news/defense/2011-06-27/pratt-and-whitney-f-35b-engine-problems-solved>

Impact

The degrader analysis assists the CIP in deciding what components need to be redesigned to prevent further engine failure in the field. The data collected will be shared with the component manufacturers and compiled with the manufacturers' data, guiding them in determining the most optimal redesign. This redesign is then presented back to the CIP before being distributed to the fleet. Personally, the degrader analysis has opened my eyes to the iterative process of engineering design. Once a design is finished, the design process isn't done. Constant redesign and improvement have to be made based on the results found through intended use. The degrader analysis also inspired me to pursue a master's degree in vibration, as it is a common failure mode that is hard to account for in initial designs.



Future Work

I will continue interning for the Turbofan/Turbojet Design Branch for the summer of 2025. Component redesign often takes years before it is fully integrated into the fleet. In the upcoming summer, I will be monitoring the progress of redesign efforts for the components revealed by the degrader analysis. Additionally, the degrader analysis is not a one-time thing but happens annually, compiling the field data collected over the past year. I will likely be performing another degrader analysis to eventually prevent F135 engine failures from occurring.

Site Information:

Name of Site: PAX River Naval Air Base

Address: 47123 Buse Rd #540, Patuxent River, MD 20670

Your supervisor: Alex Fleck

The site mission: To support the war effort with continued improvement and sustainability of the F135 jet engine.

Acknowledgments:

I would like to acknowledge everyone in the Turbofan/Turbojet Design Branch for being so welcoming and supportive. I want to give a special thanks to Alex Fleck, Jesse Cummings, and James Kirker for guiding me through my internship and providing vital assistance with the degrader analysis. I would also like to thank Drs. Holtz & Merck for guiding me through my first year of college and providing vital knowledge about the world we call home.

