Rapid shift in Rolls Royce North America's Supply Chain Structure

(Technical Paper)

A Change in the Global conditions of the Aerospace Industry

(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

In recent years, corporations and global businesses have bloomed into unprecedented states. Businesses are now more complex and interconnected than they have ever been before. Global Trade hit a record high of $28.5 trillion in 2021 (UNCTAD, 2022). These changes caused the importance of the supply chain to an elevated level. Most prominent engineering companies no longer produce their own parts, they use a global network of connections to create their products. Before delving further into the application of the supply chain it is important to understand what supply chain is. In its simplest form the supply chain is a network of individuals, organizations and resources involved in the creation of a product. The supply chain involves everything from sourcing materials all the way to the delivery of parts and eventual integration into the product. In the aerospace industry supply chain is used on the global scale. Companies such as Boeing, General Electric, Rolls-Royce, and Airbus acquire parts and materials from various nations around the world. The utilization of supply chains on a global scale allows for these businesses to stay profitable and deliver quality products at an efficient pace. However, political, environmental, and social factors all affect the supply chain. For example, Rolls-Royce, a jet engine producer, would source materials such as titanium from Russia and various other parts from China. Due to increasing tension with China and Russia, military contractors such as Boeing, Rolls Royce, and Lockheed Martin have all had to restructure their supply chains to adapt to global situations.

Rapid Shift in Rolls Royce North America's Supply Chain Structure

I was a product management intern for the B-52/f130 program at Rolls-Royce last summer. As mentioned in the introduction section, Rolls-Royce (RR) as a company, is still

adapting to the recent global changes. When it came to supply chain, the restrictions in trade with China and Russia have caused RR to look for other vendors and companies to make up for the deficiencies in supply. The decrease in trade with Russia and China especially affected the production of parts utilizing titanium. Russia is the third-largest producer of titanium globally, according to the U.S. Geological Survey, accounting for between 15% and 20% of total output. China is the largest producer, at more than half, while Japan is the second largest. A halt to titanium exports from Russia could constrain plane production (Root, 2022). In looking for various other vendors, a common issue that arose is the purchase of tooling. For companies that produce jet engines or jet engine parts, tooling is a critical topic since most companies will strive for the highest quality parts that give the most value in terms of monetary cost. Today, the development of machining solutions is focused on improving the quality of aerospace manufacturing tools while lowering related costs (Pacific Aerospace Corp, 2021).

I was tasked with creating a comprehensive tool that can assess the best possible method for buying tooling and parts. The main task of the tool was to compare short term and long-term purchases. The projected time frame for this project was two and a half months. Initially, I had extraordinarily little knowledge of the supply chain, so I utilized a multi-stage plan to set myself up for success. The plan consisted of six stages; research/brainstorming stage, initial design, initial feedback stage, updated design, secondary feedback stage, and final product. Initially, I knew I lacked the knowledge required to create an excellent product, so my plan placed heavy emphasis on understanding the topic and the wants of the end user, hence the multiple feedback stages. My plan was successful as I had a general understanding of how I wanted to resolve the issue after my initial research/brainstorming stage. I intended to create an integrated flow map and net present value tool that would guide the user toward an optimal decision when purchasing

components or tooling. During the initial design phase, I created the general framework for the general supply chain process. Soon after, I used the initial feedback stage to ensure my mapping of the process was accurate and logical. This was done by speaking with various members of the supply chain team. In the initial feedback stage, I was able to learn and correct many assumptions I made on supply chain based on my own logic. For example, I decided to streamline the supply chain process into major milestones and action items that occur independently rather than over complicating the process. Supply chain is an overly complicated process to map and would have taken too much time without much benefit to fully map. During the secondary design stage, I implemented the improvements I learned from the feedback stage, created the net present value tool (NPV), and finally integrated the tool into the flow map. Net present value is a comparison between present cash inflows and outflows. My product will utilize net present value to compare short-term and long-term purchases. At the end of this stage, my flow map accurately mapped the supply chain process by asking a series of questions aimed toward the thought process behind each action. My product would ask for various inputs such as raw material cost, tooling cost, along with various other costs to then output the piece part cost of both a short-term bulk purchase and a long-term constant supply purchase. This stage took by far the greatest amount of time as the bulk of the product was created during this time. At the end of the secondary design stage, my product had all the necessary core functions. The final feedback stage was aimed at gaining information that would help to perfect my product. In this stage, I focused heavily on ensuring the end users were satisfied with the product and its function. In this stage, I learned about a few issues regarding the transfer of data from the flow map to the NPV tool. I adjusted my product to account for the discrepancies in the tool and finalized it. I presented the final product to the supply chain team, my manager, and the program executive.

The product was received very well, but I wanted to ensure my product had a long-term benefit. At the end of the internship, I transferred my product to a supply chain member with various goals such as creating a more interactive and adaptive experience in mind. This ensured that my product would continue to grow well into the future. Overall, the project pushed me to utilize all my skillset and adapt my engineering knowledge to a different topic. My product will provide immense value to Rolls-Royce as it continues to adapt to the changing global structure and will continue to provide value at any time a part must be purchased.

A Change in the Global Conditions of the Aerospace Industry

The concept of flying has been something that humans have been trying to grasp for centuries. Throughout history, there have been many attempts to fly. However, it was not until the Wright brothers took flight in an airplane that humanity reached a major turning point. Within a century of the Wright brothers' achievement, the concept of flight had been well established and feats unimaginable to previous generations had been accomplished. Humans not only learned how to fly but they learned to fly faster than the speed of sounds. They learned to fly higher than the boundaries of earth and land on the moon. But as with all things in life, there are trade-offs that must be made. The trade-off for the achievements of humanity was the burning of fossil-fuels and emission of carbon dioxide, which have had a detrimental effect on the climate. With climate issues continuing to worsen, there has been a large shift toward hybrid electric and fully electric aircraft. My STS discussion will research the potential implications of hybrid electric aircraft. My study will focus on the future market, current progress, advantages, and potential dangers of the push toward a fully electric aviation industry. All-electric aircraft can reduce the environmental impact of aviation (Schäfer et al., 2018). The benefits and potential

for all electric aircraft are immense, however, there are many hidden issues regarding fully electric aircraft such as dangers in battery technology. This topic will affect not only aerospace but also the general population as we move toward an unknown future. The topic is aimed toward helping both the aerospace industry and the general person look at the topic at a more neutral stance rather than the positive light the media usually shows.

Research Question and Method

In my STS research, I look to analyze the effects of the introduction of hybrid electric aircraft in the aerospace industry. It is an undeniable fact that electric, and hybrid electric aircraft will dominate the future of the industry, but there are still yet many uncertainties to be cleared. My research will look to clarify many of these uncertainties by first gaining an understanding of electric/hybrid electric aircraft and their advantages. After understanding the various types of hybrid electric aircraft, my research will focus on understanding the current and future progress of hybrid electric technology. This will also involve understanding the challenges that the aerospace industry faces with hybridization and the progress of other technology affecting the implementation of electric aircraft. Limitations in battery technology mean electric planes' batteries are still far less efficient than jet fuel (DeGeurin, 2021). Additionally, any potential dangers of hybridization including dangers of battery technology, battery disposal, and safety concerns will be examined. These various subtopics within the STS discussion will create a solid foundation of knowledge on the shift towards hybrid and full electric aircraft.

Conclusion

The STS discussion and the technical discussion are both topics that revolve around the changing global landscape. Both topics are a direct result of shifts in political and industrial climate. Although the two topics are inherently quite different, they are still topics that provide many people, including myself, with valuable information on current events that will shape the near future. Understanding a range of factors regarding the topics can allow for deeper knowledge on the implications of these global phenomena.

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