Engine Blade Shop Inventory

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ISYE 6644

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ABSTRACT

This project simulates the movement of blades in and out of the blade shop in a manufacturing shop. In the shop, blades are brought in to be refurbished and kept in stock until they are needed for a new engine. However, blades can only be refurbished twice before they have to be scraped, by industry standards. This simulation will track how many workers are needed to successfully run the blade shop, due to the heightened COVID restrictions on number of workers on the floor at one time, based on the changing demand for blades.

BACKGROUND

I work in the materials management department for a major airline based in Atlanta. It is my team's job to track the inventory of all parts for engines and components that are used and needed for any maintenance, repairs, and overhauls. One of the shops we deal with is the blade and vane shop, and they have two main responsibilities. They work to refurbish used blades and then store blades until they are needed. Blades can come from engines that are being decommissioned and subsequently part-out, also known as torn down, or they can come from the purchase of new blade sets. The airline would like to know how few workers they can have in this shop to keep up with the demand. While the world opens back up slowly over the rest of this year, the demand for flights will grow, leading to more engine repairs, more blades to refurbish, and more demand for new blades as they are scraped after being refurbished twice. An accurate simulation could help strike that balance of answering to the increasing demand in the Blade and Vane shop, while restricting the number of workers until COVID restrictions have completely lifted in the USA.

MAIN FINDINGS

For this simulation, I could not use any real data from the airline materials management subsidy to find the rate at which blades come into the shop to be refurbished or the rate at which engines need blades as part of their repair process. For both of these rates, a triangular distribution was used, since you can reasonably estimate how many blades are needed per engine repair, how many engines repairs are done per day, and how many part-out engines are done per month. For purchasing new blade sets, this is done when the stock level fall below to a certain level. Stock for each type of engine blade is kept separately, both for this simulation, all blades are treated as the same. Blades can only be refurbished twice before that have to be sold, so once a blade passes through the shop a third time, it mut be scrapped. From there, scraps can be sold to third-party companies. Lastly, the rate at which the shop can refurbish a blade is also a triangular distribution. There are different minimums, maximums, and averages based on whether there are two, three, or four workers working in the shop at one time. So, different runs were performed to estimate the workload outputs for each of the three scenarios. There are three shifts in the maintenance shop, so I measured the output when there were two workers for each shift, working approximately seven hours during each shift. Then three workers on each shift, and then four workers working.

CONCLUSION

This simulation showcased how blades move in, are stored, and move out of the blade and vane shop in an airline maintenance facility. It allowed us to see the effects of the different number of workers on each shift and how that impacts the production of refurbished blades that can go back on engines. Going further with this model, we could introduce the type of blade, and keep track of the different inventory levels based on blades coming in, from old engines and new sets. This would allow us to further customize the reorder levels for each type of blade, as there are a much greater number of some types of engines, leading to a high turnover of blades, verses the smaller number of some engines, for smaller planes for example. We could also look into the total cost that's being saved, from each refurbish done to selling the scrap pieces, based on output levels of the shop. All in all, this simulation is a great start to visualize this process, but can be much more defined and detailed in order to find the best ways to optimize this process overall.