

# **Artificial Intelligence (AI): Improved DoD Maintenance Responsiveness for Greater Warfighter Readiness and Lethality**

## **Problem Statement:**

Identify and eliminate operating wastes such as scrap, rework, excess tooling set-up time and costs that hinder maintenance response times and limit warfighter capabilities, mission readiness and lethality. These waste challenges are faced everyday across the DoD ... in Fleet Readiness Centers (FRCs), Air Logistics Centers (ALCs), maintenance and repair depots supporting our nation's Air, Land and Sea forces.

## **Technology Description:**

Artificial Intelligence (AI) rapidly analyzes massive quantities of data ("Big Data") using the speed of Cloud Computing to discover previously hidden patterns of waste that constrain higher maintenance productivity and throughput. AI Neural Networks are being successfully used to instantaneously compute all possible sequences (potentially hundreds of thousands) for machining numerous part numbers while identifying the optimal sequence with the lowest total setup time waste. Total number of tooling change-outs are significantly reduced while also lowering the probability of defects (i.e. scrap and rework) and improving process capability ( $C_{pk}$  quality metric). AI dynamically computes remaining process lead time (PLT) throughout the router of each part number in production; thus, allowing for suitable countermeasures using real time work-in-process (WIP) data to ensure on time delivery of vital maintenance and logistics parts and components. These capabilities are now possible with the application of artificial intelligence to manufacturing enabled by Cloud Computing.

## **Technology Development Status:**

An AI Proof of Concept has been prototyped and successfully demonstrated at Kessington Aerospace in Elkhart IN, a manufacturer of high precision machined parts for aircraft engines and landing gears. The performance of the AI solution is being further optimized for large scale depot application and is nearing completion. The application of AI has led to improved on-time delivery from 52% to >95%, despite Kessington's preponderance of low volume, high mix parts ... similar, but on a smaller scale as compared to larger DoD depots (e.g. FRC SE and OC-ALC). Before application of AI it was unknown that the low volume parts, which accounted for only 19% of total parts volume, were in fact responsible for 75% of all factory setup time ... consuming as much time in setup (waste) as in value-add machining and responsible for almost all late customer deliveries.

## **Supporting Data for Performance Claims:**

Again, overall on-time delivery has improved from 52% to >95%. Overall costs have been reduced by 23%, scrap reduced from 8% to 3%, and operating profits improved from -3% to >20% in less than 18 months. We believe these results to be highly transferable to DoD maintenance environments.

## **Next Steps / Potential Benefits:**

Artificial Intelligence will arm DoD depot maintenance environments with a most formidable weapon for achieving greater production capacity and throughput, cost-wise mission readiness and lethality. AI can be effectively deployed with fundamental Lean Six Sigma (LSS) methods and tools (e.g. pull systems) to achieve the following:

- Production capacity increase of >20% with no manpower increase
- Cycle time reduction of >30%, and
- On-time delivery-to-promise date >90% with no increase in inventory