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Abstract

The intent of this paper was to create a proposal that could be implemented to improve the communication process during the shift turnover process that is currently in use. The current process documentation was reviewed, and observational data was collected to create an accurate current-state process map. The observational data was analyzed so that it may be utilized as a comparison when process changes are implemented.

From the current-state process map, steps were identified that do not add value to the process of passing information from the outgoing to the incoming shift. By making adjustments to the process, the passage of information can be improved without increasing the resources that must be dedicated to the shift turnover process. The implementation of the recommendations of this study resulted in a future state process map that is more efficient.

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Chapter I: Introduction

As the modern business environment continues to evolve, so to must the tools that an organization uses to maintain, or increase, their competitive advantages. One of the tools that exist is the utilization of an aircraft to move personal and material across great distances rapidly. In the business aviation industry, the aircraft itself is viewed as a tool, able to deliver the exact personnel to the exact location, at the exact time to further the businesses' goals and needs. It is this competitive advantage that is applied by several of the leading corporations and individuals across the globe.

The business aircraft, like any other piece of equipment that an operation may utilize, requires the attention of highly skilled, and well-trained, maintenance professionals to remain in an operational state. The organization that this study is based upon, at their request will be referred to as Company XYZ in order to protect their identity and confidentially, is a large manufacturer of these business aircraft. Company XYZ has built a world-wide support network that is able to provide maintenance, repairs and spare parts when and where it is needed by the customer in order to keep the aircraft available for their use. It is the need to maintain the business aircraft that has created an entire network of service centers that are able to service these business tools during both scheduled and unscheduled maintenance events.

One of the strategies that several service centers have adapted to increase the number of aircraft that may be served at any given time is the utilization of multiple shifts. This allows maximum production to be realized during every day of operation. Given the complexity and amount of time that is required to accomplish the maintenance and repair of a modern business aircraft, it is often necessary to utilize multiple individuals, working several shifts, to minimize the downtime of the aircraft that is experienced by the customer. Increasing the number of

individuals and number of different shifts will also increase the possibility of missing a piece of technical data during a shift turnover, resulting in inefficiency for Company XYZ's service centers.

It is because of the complex nature of aircraft maintenance, coupled with the management of using multiple shifts that organizations run the risk of inefficiencies and errors directly related to shift change errors. While these errors are often the result of human factors, many organizations will seek methods to mitigate the effects of these shift turnover errors.

As an example of the effects of the importance of the passage of accurate information between shifts in 2005 a British Petroleum refinery in Texas City caught fire and was subsequently damaged. The fire was attributed to several factors including a lack of critical information being passed between individuals during a shift turnover (United States Chemical Safety and Hazard Investigation Board, 2007). It was noted that British Petroleum did not have a standardized procedure for shift turnover communications in place at the time.

The example of the 2005 Texas City fire is an extreme example of the consequences of several errors that were compounded together. Company XYZ has experienced financial inefficiencies due to rework that must be accomplished because that exact status of a maintenance action is unknown. These financial inefficiencies should be avoided to reduce the possibility of eroding the confidence that the customer has placed in Company XYZ's service center and to increase the likelihood of the customer returning to the service center for their future need.

Statement of the Problem

Currently, there is a standard practice that has been established utilizing an electronic format for the passage of shift turnover information within the operation, but there are

opportunities to improve the process. Because of the complex operations that occur when the service centers of Company XYZ work with the customers' business aircraft, an error when passing information between shifts can have catastrophic consequences. These consequences may be as benign as a financial loss to the service center because of duplicated work or rework or be as serious as the loss of an aircraft and all those onboard.

Purpose of the Study

The purpose of this study was to develop a proposal that could be presented to the management team at Company XYZ's service center that would improve the current shift turnover process. This study was only intended to identify what makes an effective method of passing information between shifts, rather than the format of the turnover log that the organization decided to use in the process that is already being utilized.

Assumptions of the Study

This study assumed that in order to maintain the continuity of work flow of a given project within the Company XYZ service center, management has committed to utilizing all three separate shifts to reduce the number of days that a customer's aircraft must be in the service center. Currently, the standard shifts are the day shift, night shift and the weekend shift, with a slight overlap to allow for the passage of information between shifts. Project management occurs primarily during the day shift, with instructions being given to the second and weekend shifts as to what tasks need to be carried out and the order to be completed in for the greatest efficiencies for a project. The division of labor is also noted to be unequal, with approximately 60% of the available labor available during the first shift, with the remaining 40% available during the other two off-shifts. Project management occurs at two distinct levels within the organization. First is a single front-line manager who is assigned several individual projects at a

time and is responsible for scheduling to which projects the available labor is applied and the accomplishment of the major milestones of the project. Second, a team lead is responsible for directing the distribution of individual maintenance tasks to the individual technicians.

Definition of Terms

While working on this study, several industry specific terms were encountered and are provided below.

Human factors. The multidisciplinary study about the limitations and capabilities of individuals, and the application of this knowledge to increase the individual performance and reduce the potential for errors with the ultimate goal of maintaining, and potentially increasing, aviation safety (Gong, Zhang, Tang, & Lu, 2014).

Incidental work. Process that does not add value to the finished product or service, but is necessary in the current system (Chen, Li, & Shady, 2010).

Lean. A customer focused approach to reduce waste and improve the quality of a process (Fercoq, Lamouri, & Carbone, 2016).

Maintenance, repair and overhaul (MRO). The process of maintaining an aircraft to the established standards. This includes the Company XYZ's service centers, as well as coordination with outside vendors that the service center may utilize during the course of a given project.

Standardized work. A documented process consisting of the same repetitive steps or actions to be carried out at a specific point in a process or during a project (Lean Enterprise Institute, n.d.).

Waste (Muda). Process that does not add value to the finished product or service and is not required by the current system (Chen et al., 2010).

Limitations of the Study

Because the scope of the project was limited to techniques that can be used to reduce the potential errors associated with the shift turnover process, there were several areas that were not considered. The existing shift structure, as well as the individuals who are assigned to the specific shifts, was not considered because this is an organizational concern. The current structure that is in place with regards to the management of the individual projects was also not considered because this is a part of a larger operational process and outside the scope of this project.

Methodology

This project was conducted based upon the analysis of the current state of Company XYZ's shift turnover process, as well as an application of the Lean methodology. The introduction of Lean in the analysis results in looking for a way to effectively remove the waste, or non-value added aspects of an operation, from the process. The passage of incorrect information, or no passage of information at all, could result in the increased expenditure of resources and subsequently increase in costs for an organization through the need for repeated steps. By identifying the non-value added steps, techniques or concepts were identified that could be implemented to create a Standardized Work Process. This would improve the way that information was passed between project management and the individuals performing the tasks, or between individuals completing the same task across different shifts.

Observations were made of current shift turnover process at Company XYZ. The observer noted information such as the amount of time that was allocated to the preparation of the shift turnover information, which incoming individuals were present to receive the prepared turnover data, and how much time, if any, was dedicated to a verbal summation of the written

turnover. These observations were used to create a current state map of the shift turnover process, which was visually represented by a flow chart. This current state map was compared to the written procedures that were developed by the organization regarding the passage of information during the shift turnover process.

From the current state map, Lean methodology was then employed to determine which steps had value for the process, which steps were incidental work, meaning steps that had no value but were still necessary, and which steps had no, or insufficient, value. The detailed analysis of the process was used to develop a series of recommendations that could be implemented to improve to passage of information between the existing individuals and the established shifts within Company XYZ.

Current literature was reviewed to identify techniques and strategies from various industries that could be applied to this specific situation. This literature was focused primarily upon the Aviation and Health Care industries to identify techniques that had been successfully implemented in other settings that could be applied to this specific organizational model. Because of the criticality of the information that must be conveyed in these industries, techniques successful in one industry are also effective in another.

Summary

The intent of this project is to identify techniques that will be utilized to improve the standard practices that are currently in place within the organization to aid in the passage of information during the shift turnover process. By increasing the accuracy and efficiency of this passage of information, the organization will be able to reduce the amount of resources that must be dedicated to a given project, improve customer satisfaction and increase the efficiencies of the operation. Improving the turnover process, in addition to the improved performance of the

service center, will also reduce the likelihood of financial loss due to the potential damage to a customer's aircraft caused by missing or improper information passage.

While outwardly they may seem very different, there were several similarities noted between the MRO organization that was studied and the Health Care industry about the timely passage of accurate information between shifts. Both industries have the potential to result in the loss of life if accurate information is not passed on during time-critical phases of the operation. Many of the techniques that have been developed by the Heath Care industry for use during the shift turnover process can be applied to other industries with similar results.

Chapter II: Literature Review

In many industries, the passage of information between groups of employees is essential for continuity as work must continue beyond a single working shift. A breakdown in this passage of information may be catastrophic, and lead to the inadvertent loss of either the customer's property, or in more extreme cases, the loss of life. The criticality of this information passage is not restrictive to the aviation industry but can be found in numerous other industries.

Establishing the Need for a Shift Turnover

When it is determined by the organization that information must be passed from one shift to another, an effective medium must be used. A written, well-structured turnover is one common method that could be used to effectively pass information, including any relevant information relating to the care of the patients, between the incoming and outgoing shifts (Plocher, Yin, Laberge, Thompson & Telner, 2011). In addition to creating a written record that can be reviewed at any point, a written log allows for relevant employees to review the information as necessary.

In one instance on an oil refining platform in 1988, a relief valve was removed on an offshore platform, with no record of the valve's removal made in either the control room or in the written maintenance logs (Plocher et al., 2011). During the subsequent informal shift handover process, no mention of the relief valve's removal was made. When the affected system was restarted by the next shift of individuals, the leak resulted in an explosion that led to the destruction of the platform. This instance, though it is not related directly to the aviation maintenance industry, shows the devastating effects that an improper shift turnover process can have on an operation (Plocher et al., 2011). A written, structured log is not the only method that may be utilized. It was found that a verbal turnover, in addition to the written logs was useful in

passing subtle nuances associated with the operation that may not be adequately transferred in the written log (Plocher et al., 2011). While the addition of a verbal, as well as the written turnover, will require more time, and subsequently increase labor costs during this transition, the increased information passed may reduce the likelihood of damage to company or customer property.

The health care industry, where the correct information can have a direct impact upon a patient's health, can also benefit from an effective shift turnover process. Over the course of a study that took place in the early 1990's regarding the medical field in the United Kingdom, 98,000 patients experienced a serious injury because of a medical error (Malekzadeh, Mazloum, Etezadi & Tasseri, 2013). While it was not discussed exactly how many of these errors were related to the shift turnover errors, there is certainly an opportunity to reduce through an improved process.

In nursing, the implementation of a standardized and well-structured shift turnover procedure was found to increase the nurse's ability to care for their patients because of the improvement in the information passed to the incoming shift (Malekzadeh et al., 2013). This increase was attributed to the ability of the health-care professional to properly treat a patient, rather than spend valuable time learning the patient's history or treatment history that could be covered in a properly designed turnover.

The creation of an effective procedure or protocol for the passage of information between incoming and outgoing shift personnel, is expected to lead to a decrease in medical errors through the passage of more accurate information, though it is virtually impossible to quantify an exact number (Malekzadeh et al., 2013). It would be expected that any reduction in errors in an operation, regardless of the industry, would be the goal from both the organization's viewpoint,

but more importantly, from the patient's perspective, reducing operational costs because of fewer resources required.

Along with the proper application of a shift turnover procedure, the operation must also have an adequate staffing level to make proper use of the information (Coverdill et al., 2010). While many organizations have a system in place where a physician is required to sign-out at the end of their shift, there must be the appropriate personnel on the incoming shift to receive it. Even a perfectly designed and implemented turnover system will yield only minimal improvements if the incoming team does not have to appropriate staffing levels to effectively utilize this information (Coverdill et al., 2010). In the healthcare field, the patients' well-being is often dependent upon the passage of information. Information between doctors, between nurses, and the information that is passed between the patient and the medical staff is responsible for providing the correct treatment in the appropriate time frame. The protocols and procedures that are used to pass this information is vital to the effectiveness of the shift turnover process. The same principles apply to aviation maintenance, where the passage of information is crucial for the proper maintenance of an aircraft.

Results of Improper Shift Turnover Procedures

On September 11, 1991, Continental Express Flight 2574 crashed near Eagle Lake, Texas, resulting in the loss of all 14 people onboard the aircraft (National Transportation Safety Board, 1992). The crash was the direct result of an inflight structural failure, the likes of which the crew was unable to recover from. Post-accident investigation revealed that the structural failure emanated from the horizontal stabilizer. Investigation into the accident quickly focused upon the maintenance that was performed prior to the accident flight (National Transportation Safety Board, 1992).

During the events leading up to the accident flight, Britt Airways, d/b/a/Continental Express, was focused upon the replacement of the leading edge de-icing boots in preparation for the upcoming winter operations (National Transportation Safety Board, 1992). An earlier routine inspection revealed that the horizontal stabilizer de-icing boots on the accident aircraft were discrepant and would require replacement. The de-icing boots are utilized to shed the accumulation of ice from the leading edges of the aircraft during winter weather. The operations maintenance control had scheduled the replacement of the de-icing boots for the evening of September 10, 1991.

Replacement of the de-icing boots on this aircraft requires the removal of the horizontal stabilizer leading edge assembly, replacement of the de-icing boot, and then reinstallation of the leading edge assembly to the horizontal stabilizer (National Transportation Safety Board, 1992). The second shift supervisor that night assigned two mechanics, as well as an inspector, the task of replacing the left and right horizontal stabilizer de-icing boots. While the mechanics were working to remove the right horizontal stabilizer leading edge and replace the de-icing boot, the inspector began by removing the upper most row of screws securing the right horizontal leading edge, then by removing the upper row of screws from the left horizontal leading edge. This row of screws, because of its location, is not visible from the ground. The right horizontal leading edge was subsequently removed, and the de-icing boot was replaced on a work bench in the hangar (National Transportation Safety Board, 1992).

As the next shift began, it became necessary to reposition the aircraft because of the work that was required for other aircraft that evening. The aircraft was moved outside, onto the parking ramp, in an area with minimal lighting. The incoming third shift mechanics subsequently reinstalled the previously removed right horizontal leading edge before returning

the aircraft to service for the next days scheduled operations, with the single row of fasteners on the upper surface of the left horizontal leading edge missing (National Transportation Safety Board, 1992).

During the night in question, the second shift inspector did use the established shift turnover procedures and made an entry in the log regarding the removal of the right horizontal stabilizer leading edge and the removal of the left horizontal stabilizer leading edge upper fasteners (National Transportation Safety Board, 1992). However, when the incoming inspector reviewed the turnover log, the entry had not yet been made and the third-shift inspector and mechanics were unaware that the fasteners had been removed from the left horizontal stabilizer leading edge. Because the aircraft was positioned outside in the dark, when the third-shift mechanics reinstalled the right horizontal stabilizer leading edge, they did not note the missing fasteners from the left side.

In addition to the turnover log that was utilized by the incoming and outgoing inspectors, verbal shift turnover reports were given between the second-shift mechanic that had completed the work and the third-shift mechanic that had initially been assigned to take over the task in question. However, circumstances necessitated the assignment of a mechanic who had not received the verbal turnover report to continue the replacement of the de-icing boots (National Transportation Safety Board, 1992).

It was this missing row of approximately 47 fasteners on the left had horizontal stabilizer leading edge, combined with the aerodynamic forces exhibited during flight, that led to the separation of the leading edge (National Transportation Safety Board, 1992). This separation from the left hand horizontal stabilizer induced a sudden nose-down pitching motion and subsequent increase in airspeed of the aircraft. The combination of these forces that caused the

aerodynamic loading to result in the in-flight breakup of the aircraft, and subsequent loss of life of all those on board (National Transportation Safety Board, 1992).

While the NTSB identified several factors within the organization that were inconsistent with industry standards, including discouraging the inspectors from actively performing maintenance and having an established Required Inspection Item (RII) program to ensure that flight critical components receive extra scrutiny, it was the unstructured turnover that led to the accident (National Transportation Safety Board, 1992). Even though the second shift inspector included the information relating to the left horizontal stabilizer leading edge in his turnover report, it was not received by the incoming third shift inspector.

If this information had been passed directly to the third shift inspector, then the extra effort to inspect that area would have been conducted. Likewise, if the outgoing second shift mechanic would have given his verbal turnover report to the incoming third shift mechanic that performed the work on the accident aircraft, the incident may also have been avoided. While these hypothetical situations could have been alleviated by the adherence to an effective, well-structured shift turnover protocol. This single incident highlighted the need for an effective shift turnover in any aviation maintenance organization.

In the aviation maintenance industry, as in either the refining or health care industries, unintentional errors can lead to catastrophic events. While not the only source of these catastrophic events, shift turnover errors are one area where proper methods can mitigate these errors before they happen. It was noted in another study that missing information in the shift turnover process can produce deaths (Campos, Martins & Soares, 2012). In this instance, a defective part was removed from an operational aircraft, and following an ineffective shift turnover process, the same defective part was reinstalled. While this instance did not result in

the loss of life or aircraft, the installation of an ineffective component could easily lead to damage to the aircraft.

The study recommended that a personal meeting be made between the incoming and outgoing individuals directly involved in the tasks (Campos et al., 2012). This in-person shift turnover process is something that the organization would have to embrace, because it involves many levels of the operation to coordinate during the process. The supervisor responsible for assigning work assignments needs to ensure that the incoming individual and outgoing individual meet for a turnover meeting in person and attempt to not let developing circumstances reassign the incoming mechanic to another project.

This effort will also result in an increased amount of time that the affected individuals will have to spend together. From the customers' perspective, this time is not necessarily value-added, though the circumstances that are being sought to avoid are value-added. This time increases labor costs for the operation without any increases in profits, in fact, it would reduce the efficiencies of the operation because of the increased time spend, without increasing operational production.

Human Factors

As of 2011, between 12% and 15% of the initiating events of the total number of global aviation accidents were attributed to aviation maintenance errors (Rashid, Place & Braithwaite, 2012b). The current application of human factors includes the application of the Human Error Risk Management in Engineering Systems (HERMES) approach. This HERMES system aims to reduce the number of errors before they can occur by properly designing the system. Standardization of instrumentation and systems designed to reduce a pilot's workload during critical phases of flight have both been integrations because of the HERMES methodology.

Additionally, it is possible to implement some of these same ideas into the maintenance shift turnover system (Rahsid et al., 2012b).

By one estimate, for every hour of flight an aircraft requires approximately twelve hours of maintenance (Rahsid et al., 2012b). Often, the maintenance is carried out in less than ideal conditions. Poor lighting, inadequate shelter from the elements, time pressures and working at night or irregular shifts are all common conditions that the aviation maintenance technician faces. The study of human factors has aimed at reducing these factors, and in doing so, reduce the number of maintenance related errors that occur.

While the HERMES approach seeks to design-out the errors during the engineering process for a given aircraft model, the Aviation Maintenance Monitoring Process (AMMP) seeks to reduce the incidence of errors within a Maintenance, Repair and Overhaul (MRO) operation (Rashid, Place & Braithwaite, 2012a). The AMMP process seeks to refine the culture within an MRO to reduce the severity of a human factors' induced error. This process seeks to identify and correct errors that have been statistically known to occur before they can cause loss of life or result in damage to the aircraft through the reduction in Human Factors related factors. An AMMP system requires the creation of an organization specific system that is designed to not allow errors to go undetected in the final product delivered to the customer (Rashid et al., 2012a). Such a system, while sound in ideology, may prove to be too costly to develop and implement to be feasible within the current MRO environment.

In one notable incident, Japanese Airlines Flight 123 was lost when the aircraft flew into Mount Takamagahara in 1985 (Magnuson, Ishikawa & Reingold, 1985). Years earlier, in 1978, this aircraft suffered a tail-strike during a take-off role that caused damage to the aft portion of the fuselage that necessitated repair. The original manufacturer of the aircraft was consulted, and

a repair was developed specific to this incident. Through a misinterpretation of the repair, a small portion of the repair scheme was omitted, eventually leading to a failure of the aft pressure bulkhead (Magnuson et al., 1985). When this bulkhead failed, the aircraft's hydraulic systems suffered catastrophic damage as well as two of the primary flight control systems, resulting in loss of positive control of the aircraft and subsequent flight into terrain, resulting in the loss of the aircraft and all onboard.

In another example, China Airlines Flight 611 was lost with all individuals onboard after suffering an inflight breakup. The loss of the aircraft was attributed to several factors, including a language barrier between the manufacturer providing the repair instructions and the technicians performing the repair and the unintentional omission of several steps in the repair instructions (Aviation Safety Council, 2002). Like Japan Airlines Flight 123, China Airlines Flight 611 suffered a tail-strike during the takeoff rotation and was repaired in collaboration with the aircraft manufacturer.

This accident accrued more than 20 years of flying following the initial damage incident and subsequent repair before the structural failure occurred. As the number of aircraft worldwide continue to increase, the reduction of human factor related errors will become even more important to the industry. This accident can be used to illustrate how an error may be hidden for a long period of time before a structural failure occurs, even though systems are in place to detect the damage before the failure occurs.

In order to effectively reduce errors associated with human factors related causes, it will become necessary to reduce these errors pro-actively, rather than reactively (Rashid et al., 2012b). To correct errors through prevention before they can occur is a more effective method than waiting for an error to occur then attempting to find a solution.

Managing Risks

While there are several high-profile examples of what happens when errors are made during aircraft maintenance, these are not the common mode of failure within the industry. In 2004, American Airlines Flight 44 suffered the loss of both airspeed and altitude indications shortly after takeoff (Marais & Robichaud, 2012). The aircraft was designed to have redundant systems for the critical functions, such as described in the HERMES methodology, and the aircraft landed safely with no damage. In the case of American Airlines Flight 44, it was determined that the air data computers, which control the display of both airspeed and altitude for the pilots, were improperly secured during a recent maintenance event.

While the incidents of maintenance induced accidents have decreased since 1962, the incidents that do happen continue to result in the loss of life (Marais et al., 2012). While the analysis of aircraft accidents can result in invaluable information for the reduction of future incidents, they are unfortunately reactive and not pro-active in nature. Systems, such as HERMES and AMMP, can be utilized to mitigate these risks before they are able to result in the loss of life or an aircraft.

When the manufacturer of an aircraft writes their Aircraft Maintenance Manual (AMM), they often designate critical processes with a Required Inspection Item (RII) designation (Aviation Psychology and Applied Human Factors, 2014). These items that have been designated as critical to the safe operation of the aircraft require an inspector with specific training to inspect the task before the aircraft can be returned to service.

In one study that was focused upon a clinical setting, it was found that 70% of the observed sentinel events were directly related to a break down in communications (Vinu & Kane, 2016). It an effort to reduce these events, an electronic clinical handover system was

introduced based upon the Identify, Situation, Background, Assessment, Recommendation, Read-Back and Risk methodology, or $ISBAR_3$. The electronic format that was created was based upon the $ISBAR_3$ methodology and had to include all seven of those aspects within the turnover log to ensure that all pertinent information is passed between the involved individuals (Vinu & Kane, 2016).

It was noted that after implementation of the $ISBAR_3$ electronic shift handover system that there was an increase in the amount of information that was passed between shifts (Vinu & Kane, 2016). The standardized format for the handover process was also found to decrease the amount of time spent in the process from 31 to 27 minutes (Vinu & Kane, 2016). These 4 minutes, while they may not seem significant from the onset, represent the application of the Lean methodology in removing the waste from an existing process, thereby increasing the overall efficiency of the operation.

When an electronic format shift turnover log is implemented within an organization, there is the potential that subtle nuances may become lost in the process. The process of the shift turnover will be as unique as the operation that utilizes it. In some instances, an electronic turnover may be the best option, but in other instances the verbal form of the turnover, while supported by a standardized electronic format, will be beneficial.

A verbal based turnover was observed to be very problem focused and allowed the outgoing individual to share what they believe to be pertinent specifics, in addition to the standardized information, with the incoming individual (Randell, Wilson, & Woodward, 2011). These subtle additions allow the individuals to share their experience and observations with the incoming shifts, while still delivering the required information. It was also found that the teamwork skills of those individuals directly involved with the shift turnover process can have a

direct impact on the quality of information that is passed between shifts. Interruptions, as noted in one study in a surgical environment, occurred at a mean of 2 per handover over an observed population of 306 patient interactions (Symons et al., 2012). These interruptions, though they may not be intentional, can cause disruptions to the passage of information and cause information to be omitted or misinterpreted. A well-structured handover system would alleviate the potential for lost information due to interruptions during the process.

Process Analysis

In order to improve an existing procedure or practice in use within an organization, the current state must first be understood. The creation of an accurate current state map is a simple and effective method to visualize the process flows (Klimecka-Tatar, 2018). From the current state map, the individual steps in the process can be analyzed to determine which steps add value to the finished product or service, which steps are incidental steps that are required but do not directly add value, and which steps do not add value and are considered waste. Operations utilizing the Lean methodology focus on reducing the incidental steps in a process and eliminate the steps that are considered to be waste (Chen et al., 2010).

The steps that are in a process that do not add value to the process can often be categorized into one of seven categories: defects, overproduction, transportation, waiting, inventory, motion or processing (Shields, 2006). Defects are a waste that can be detrimental to the image of the operation if they are not caught during the process and are first noted by the customer. In process inspections can be considered incidental work because they do not add value to the product or service but are a necessary step to ensure defects do not reach the customer. Rework is an example of a defect waste that is corrected during the process because a process was incorrectly accomplished (Chen et al., 2010). Both of these examples, if eliminated

from the current process, will reduce the amount of resources that an organization must dedicate to the operation and increase the amount of time an individual can spend working on value added tasks. Once an accurate map of the current process has been analyzed, there may be steps that do not add value to the overall process. These steps that do not add value to the process, and are not necessary from an operational standpoint, can be considered waste and removed from the process with no effect on the process outcome (Fercoq et al., 2016).

Process Improvement

The lean approach is one that emphasizes continuous improvement to reduce wastes anywhere in the organization (Fercoq et al., 2016). While this would naturally be very useful during the planning phase of a new process, it can also be applied to an in-use process. The analyzation of a current process, especially one that has been established for an extended period of time, could result in the identification of waste in the process that could be eliminated (Chen et al., 2010).

One of the tools available when utilizing Lean methodology is the Plan-Do-Check-Act, PDCA, cycle. The PDCA cycle is a systematic approach to process improvement involving planning out the steps that are desired to be changed, implemented or removed from the process, and then making the planned changes during the Do phase (Matsuo & Nakahara, 2013). Once the desired changes have been implemented in the process, the Analyze phase then measures if the changes have achieved the desired outcomes. The process would then either standardize the new procedure in the Act phase, or if the outcomes were not as desired the PDCA cycle could be started anew (Matsuo & Nakahara, 2013).

While the analysis of a process is often focused upon the customer's perspective for determining the value of an individual step, when looking at an internal process employee

engagement must also be a concern. It was noted that the level of employee engagement can be an essential factor when determining an organizations level of success or competitiveness (Støle & Ekeren, 2015). By designing changes to a process that will be accepted by the individuals who utilize them, it will be more likely that the employees will embrace the changes and the benefits to the organization can be realized.

Summary

The literature review presented in this chapter identifies the need for accurate information in a shift turnover and illustrates the consequences that may happen as a result of a poor turnover. There is also a methodical approach to the analysis of the process that is currently in place in Company XYZ's service centers, and strategies to develop improvements in the process.

In a continuous operation, such as the medical field, the petroleum industry or within the Maintenance Repair and Overhaul service center, the passage of information between outgoing and incoming individuals is crucial to the success of the organization. In many instances, an ineffective passage of information can lead to the organization having to dedicate more resources to the task at hand, thereby increasing waste and costs associated with a given operation. While the loss of life or damage to customers property is a rare occurrence, it is one that should be avoided whenever possible. By designing a standardized shift turnover process that is specific to a given operation, the organization can reduce the amount of resources that have to be dedicated to the process and reduce the occurrences of shift turnover related errors.

Chapter III: Methodology

The passage of information between individual technicians is a task that happens numerous times a day. Because of the number of technicians that Company XYZ employs across several different shifts to service the customers' aircraft, there is an increased chance of missing information. As reviewed in Chapter II, an error in the process of passing the information between technicians can have very serious consequences as well as the improvements that can be made by utilizing Lean methodology. The purpose of this study was to create a proposal that would identify techniques that could be utilized to improve the current process. These improvements would reduce the amount of resources that the operation must dedicate to non-value added steps during the shift turnover process and increasing the amount of time the technician can spend servicing the customers' aircraft.

Because a shift turnover, regardless of the format, is based upon the passage of information between individuals within the same operational group, these same individuals become the key to reducing errors related to this passage of information. Clear and concise shift turnovers require both incoming and outgoing individuals to properly use the systems that are in place. Improving the current process will begin with an analysis of the current state process in order to determine where improvements can be made.

Planning

The study began with a detailed observation of the current state process. In order to better understand the current state process that is used in the organizations' day-to-day operations, several shift turnover processes were observed. The observations were made from December 2017 through February 2018 and were analyzed to create an accurate representation of the shift turnover's that take place daily within the organization.

Observations were made of the actual shift turnover process, see Figure 1 for an example of the observational data sheet. The observational data included the amount of time that was required to both write the electronic turnover log as well as the amount of time to give a verbal summation of the turnover and answer any questions that may arise from the incoming shift technicians. This time, though necessary to the daily operation, would be considered non-value added from the customers' perspective because it does not add to the services that the customer has requested be accomplished.

1) Time Allocated to Write the Shift Turnover (0-4 minutes, 5-9 min, 10-14 min, 15-19 min or 20+ min)	
2) Incoming Shift Lead Present to Receive Shift Turnover? (Yes or No)	
3) Incoming Technicians Present to Receive Shift Turnover? (Yes or No)	
4) Number of Individual Tasks on The Written Turnover? (0-4, 5-9, 10-14, 15-19 or 20+)	
5) Time Spent Giving Verbal Summation of Turnover to Incoming Shift? (0-4 minutes, 5-9 min, 10-14 min, 15-19 min or 20+ min)	
6) Feedback Provided at End of Incoming Shift? (Yes or No)	

Figure 1. Observation sheet example.

The observations were then utilized to create an understanding of how the current practice of the shift turnover functions on a daily basis. The observations may or may not concur with the written practices that are currently in place within the organization but were considered representative of the current state process.

Subject Selection and Description

The subjects were observed in their daily routine, using the currently accepted procedures. Those observed are all established in their current positions and familiar with the existing practices for the shift turnover process. It was observed that the individuals' actions

were representative of the normal interaction that would occur within the Company XYZ organization during the normal routine.

The sample observations of the population were large enough to be an accurate representation of the population as a whole. This sample size gave the observer enough data to analyze what the current state process accurately looks like. The data was collected by observing the shift turnover process as it occurred between several different individuals on both the incoming and outgoing shifts in order to obtain as diverse a sample set as possible.

Current State Analysis

The observational data was utilized to create a current state map, creating a visual depiction of the steps that are involved in the shift turnover process. Figure 2 is an example of how the current state shift turnover process can be mapped out in a visual presentation for easier understanding of the current step-by-step process.

Figure 2. Current state process map example.

These steps were then analyzed and were found to be either value added, incidental or were determined to be a wasted step in the process. Only the steps that were found to include or aid the passage of information were considered to have value to the process. Those steps that did not aid in the passage of information were considered waste, or the steps that were found to be necessary to the process even though they did not aid in the passage of information were considered incidental work.

The goal of the proposal was to identify waste or incidental steps in the process and reduce or eliminate them. By reducing the amount of resources that the organization must

dedicate to the shift turnover process, the benefit of utilizing a multiple shift operation can be increased. The current state process map that was created was utilized to see where the value was added in this process. The value in the process is the passage of information between the outgoing and incoming shifts, any steps that did not aid in this passage of information were found to be non-value added to the process. The steps in the process were evaluated to understand which steps were identified as incidental work and where the waste steps were located in the process. This allowed for the formation of recommendations to the current state in order to improve the efficiencies of the shift turnover process that is currently employed by Company XYZ.

Data Analysis

The observational data was collected and compiled in order to understand how the shift turnover process functions. A series of charts were constructed to give a visualization to the data and make interpretation easier. One of the metrics that was gathered was the amount of time that was necessary for the preparation of the shift turnover utilizing the current process. Figure 3 shows an example of how the data was organized and displayed. This gave the individual performing the analysis a visual reference to the amount of time that individuals spend directly with the shift turnover process.

The current process data was analyzed with regard to the incoming technicians who were present to receive a verbal summation of the turnover data. The current process outlines that the incoming technicians and shift lead be available at the start of their shifts to receive a verbal summation, though both groups of individuals may not be available at the same time in all instances. This verbal summation is a time for the incoming technicians to ask questions and receive clarification to anything that they do not understand.

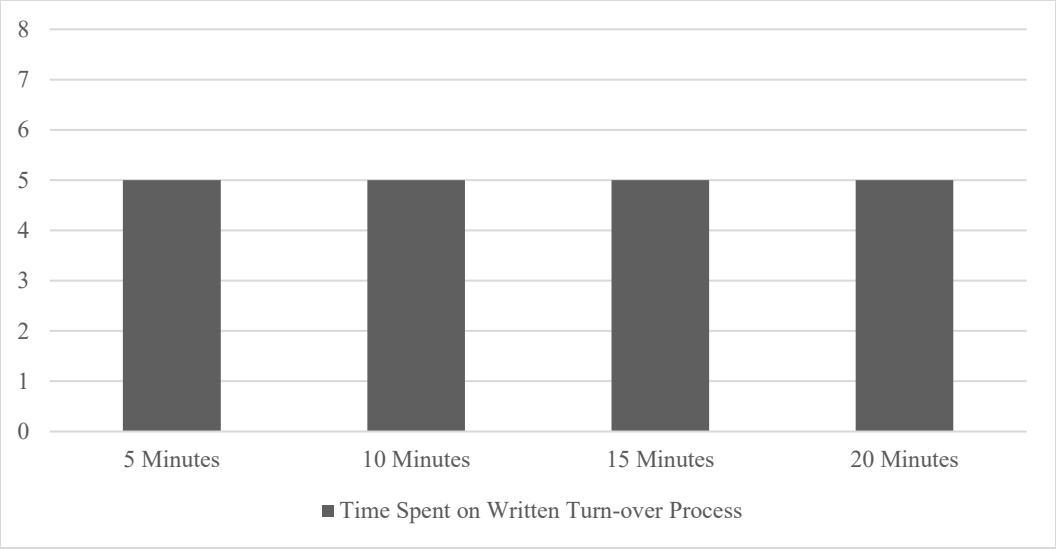

Figure 3. Example time spent chart.

This summation time is also an opportunity for the more senior technicians to share their experiences with other technicians to improve the quality of the work being performed and reduce the time required for a given task. Figure 4 shows a representation of the chart that was utilized to visualize the incoming technicians who were present for the shift turnover process.

The observational data that was collected was entered in a table with the collected metrics entered into rows. They included the amount of time that was required to prepare for the turnover, who was present for the turnover, how much time was dedicated to the verbal summation of a turnover and if feedback was left at the end of the incoming shift. For the purposes of this proposal, feedback was defined as the status of the tasks that were assigned, including which tasks were not completed or required additional attention at the end of the incoming shift. By entering the amount time allocated for each item into columns, a table was created that clearly defined the amount of time spent for the turnover process. This time, because it does not add value to the services Company XYZ offers but is necessary for the passage of information between shifts, is considered incidental work.

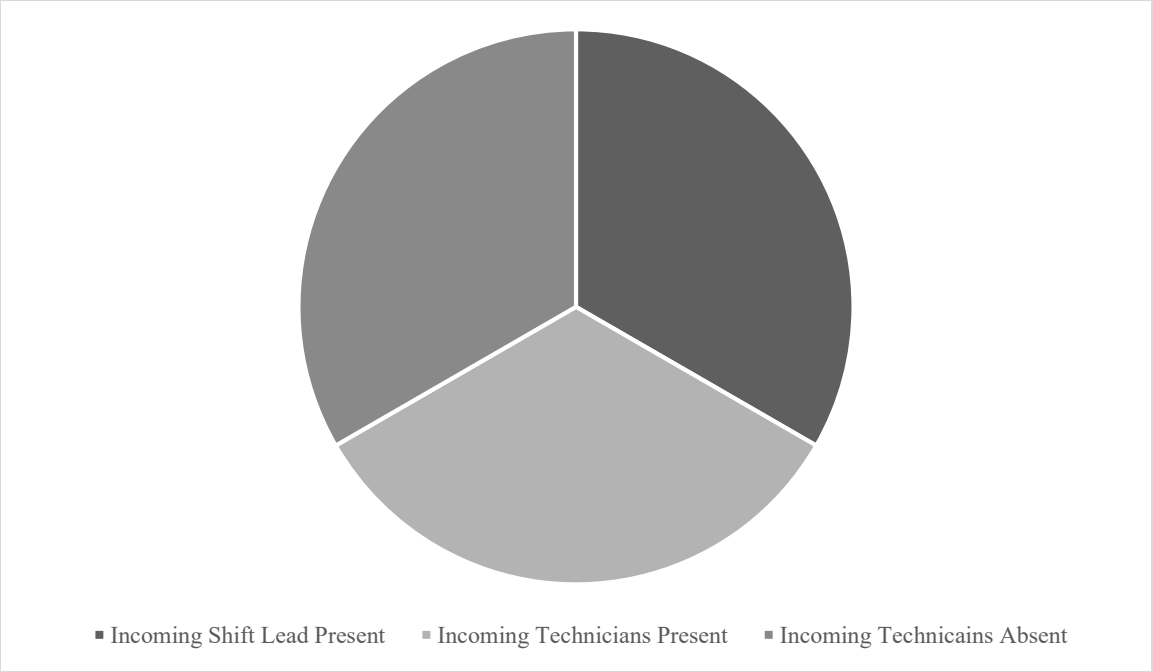

Figure 4. Individuals receiving shift turnover data example.

At this point, the amount of time that was dedicated to a verbal summation was compared to the instances of feedback left. The frequency of the amount of time that was spent on the verbal summation during the turnover process was compared to the frequency of feedback being left at the end of the incoming shift. It was determined that a relationship existed between the two. See figure 5 for an example chart of the data that was analyzed to compare the amount of time spent on the verbal shift turnover and the instances of feedback left by the incoming shift.

In the same manner that clear and concise information passing between the outgoing and incoming shifts is important to the process, so is the information that is then passed from the incoming shift back to the outgoing shift for the next day's activities. By understanding both the individuals present during the shift turnover, and the incidental and wasted steps in the existing process, an in-depth analysis can be conducted. By analyzing the current process, the steps that directly aid in the passage of information between shifts can be identified, and in the proposal these steps can be given emphasis to their importance to the process. This analysis can also

identify the steps in the process that do not add value to the shift turnover process order to reduce the amount of time spent on the process and increase the time available to the technicians to accomplish their assigned tasks.

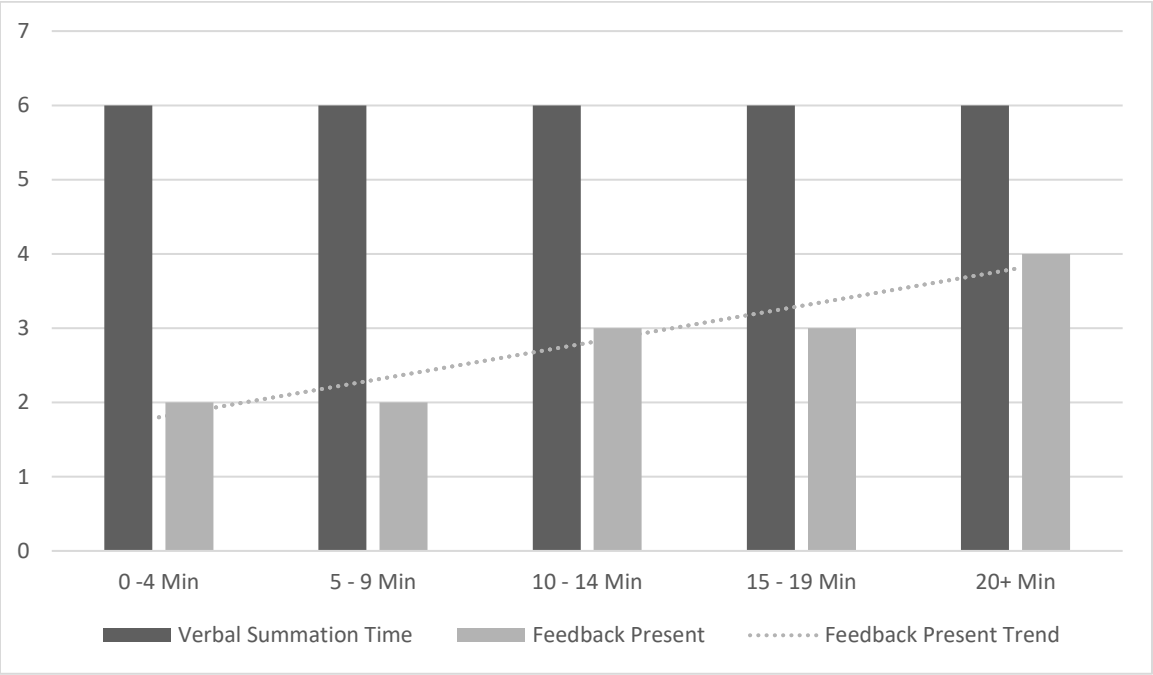

Figure 5. Comparison of verbal summation time to feedback example.

The steps in the current state process map that add time, but do not aid in the passage of information, are not considered to be value added, and will be identified as steps that can be reduced or eliminated without negatively affecting the shift turnover process. Any time that can be eliminated from the process that does not affect the information that is passed between the outgoing and incoming shift technicians, will reduce the costs associated with a given project within Company XYZ's service center.

Summary

This chapter reviewed the methodology that was employed to create the proposal for improvements to the current shift turnover procedures that are in place in Company XYZ's service center. The process began with observations of the current shift turnover process as they

occurred within the service center. These observations were compared to the written documentation for the shift turnover process and a current state map was created.

The generated current state map was further analyzed in an effort to determine which steps added value to the process, which steps were incidental work steps necessary to the process and which steps were waste and could be eliminated. Once the value in the current process is understood, recommendations can be made to improve the process and make the service center more efficient.

Chapter IV: Analysis

In Company XYZ's service center, there was a procedure in place the was used to facilitate the passage of information between the incoming and outgoing shifts. Any time this passage of information is disrupted, there was an increased chance for an error to be made or a step in the process omitted unintentionally.

This turnover procedure, when analyzed utilizing the Lean methodology, was shown to have room for improvement by reducing the non-value added steps in the process. The goal of this study was to create a proposal that could be presented to the leadership team within Company XYZ to improve the process.

The Lean methodology approach was utilized in other similar circumstances with positive results, as shown during the literature review. These circumstances were considered during the analysis of the current process that is in use at Company XYZ's service center.

Planning

Before the observational data was collected, the current shift turnover procedure was reviewed. Company XYZ's current process has the individual project lead utilize an electronic form located on the companies' internal computer network. It was designed internally to replace the previous system of handwriting the data on paper forms.

The electronic system was designed to be easier to use than the previous paper forms, while providing an electronic format that is available to any interested employee who has access to the internal network. The electronic turnover form was created to be used by several different departments, there are features and portions of the form that may not be utilized during every turnover. The form contains separate fields for the individual project work order, tasks to be accomplished, tasks that are completed during the incoming shift and tasks that have not been

completed. The incoming shift lead utilizes the electronic turnover log as a means to prioritize work that has to be accomplished on their assigned shift.

The shift turnover process focuses upon the passage of information that was prepared and presented by the project lead, and the observations focused upon the interaction between the project lead and the incoming shift. It was noted how much time had to be dedicated to the written shift turnover record, how much time was dedicated to the verbal summation with the incoming shift and who was present for the verbal summation.

Subject Selection and Description

The primary focus of the observations was the day shift project lead, who prepares the written turnover data and then gives a verbal summation of that data to the incoming shift whether they be working the second or weekend shifts. Those observed were all familiar with the expectations of the current system and were observed to be following the currently accepted procedures.

The working conditions during this time period were observed to be normal in that there were no major procedure or policy changes during the time period that would have affected the practices that were used in the workplace. The individuals were also noted to be working their normally assigned shifts and not working an atypical schedule or in another area of the organization.

Current State Analysis

A review of the shift turnover practices and observations were utilized to create a current state map of the process. Figure 6 is a graphic representation of the steps in the shift turnover process. The steps in the process were analyzed to determine which steps have value with regard to the turnover process. The passage of information between the incoming and outgoing shift is

necessary because of the multiple shifts that Company XYZ has chosen to use in their operation. The time that the project lead dedicates to the preparation and writing of the turnover data adds value to the process because there is a direct passage of information between the outgoing and incoming shifts.

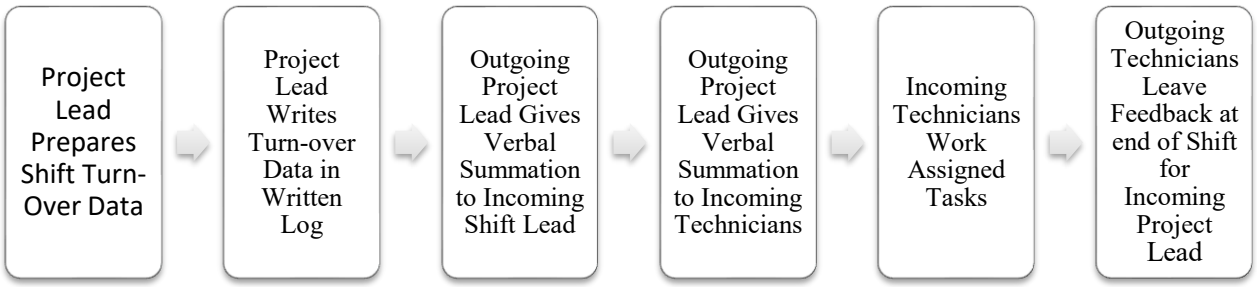

Figure 6. Current state process map.

The incoming shift lead who received a verbal summation of the turnover data did not add value to the process of passing information from the outgoing shift project lead to the incoming shift technicians. Because the incoming shift lead was not actively performing the tasks on the shift turnover log, spending time on a verbal summation did not add value to the process. The incoming shift lead was available to the technicians on the incoming shift to answer questions that may have arisen during their shift.

The verbal summation that occurred between the incoming and outgoing shifts gave the technicians a chance to review the written turnover and ask questions to ensure that there was a clear understanding of the data. This is the time when the project lead can share experiences with the less experienced technicians who are unfamiliar with a given task. This time, while not directly adding value to the process the service center used, can reduce the amount of time that the incoming technicians must spend accomplishing the assigned tasks.

The incoming technicians working their assigned tasks is where the value gets added by the organization. From the customers' perspective, the accomplishment of these tasks is the

service that they find value in. By maximizing the amount of time that the technicians are able to work on the assigned tasks, the operation can become more efficient.

At the end of the incoming shift, an expectation exists that feedback will be left for the project lead. In instances where the project lead leaves incorrect or inaccurate information for the incoming shift, the incoming shift technicians must spend more time determining what must yet be accomplished. In much the same way, if the incoming shift does not leave feedback for the project lead, then additional time must be spent to understand the current state of the project.

The steps that were found in the current state process were the project leads written turnover, the verbal summation of the turnover given to the incoming technicians and the feedback that is left by the incoming technicians for the project lead. While the actual work that gets accomplished by the incoming technicians is value added for the operation, it does not add value to the shift turnover process. These three steps that were considered to add value to the turnover process were what made the passage of information most effective. Placing an emphasis upon these steps would increase the effectiveness of the shift turnover process without increasing the amount of resources that the organization must dedicate to the process.

Data Analysis

The data analysis was based upon the observational data that was collected. Once the data was compiled, an analysis was performed to understand the turnover process. One of the metrics that was analyzed was the amount of time that the project lead dedicated to the preparation of the written turnover. Figure 7 shows that the amount of time dedicated had a normal distribution with a median time required of 10 to 14 minutes over the sample population. This data was important to the proposal because subsequent process should not increase this time due to process changes.

Any changes to the current process will have to be evaluated to determine their effectiveness in the process through repeating the observational analysis. If the changes result in an increased amount of time that the project lead has to dedicate to the preparation of the turnover data, then the effectiveness of the changes would have to be analyzed again. The repeated observations should follow the same general format to ensure the changes made to the process are properly evaluated.

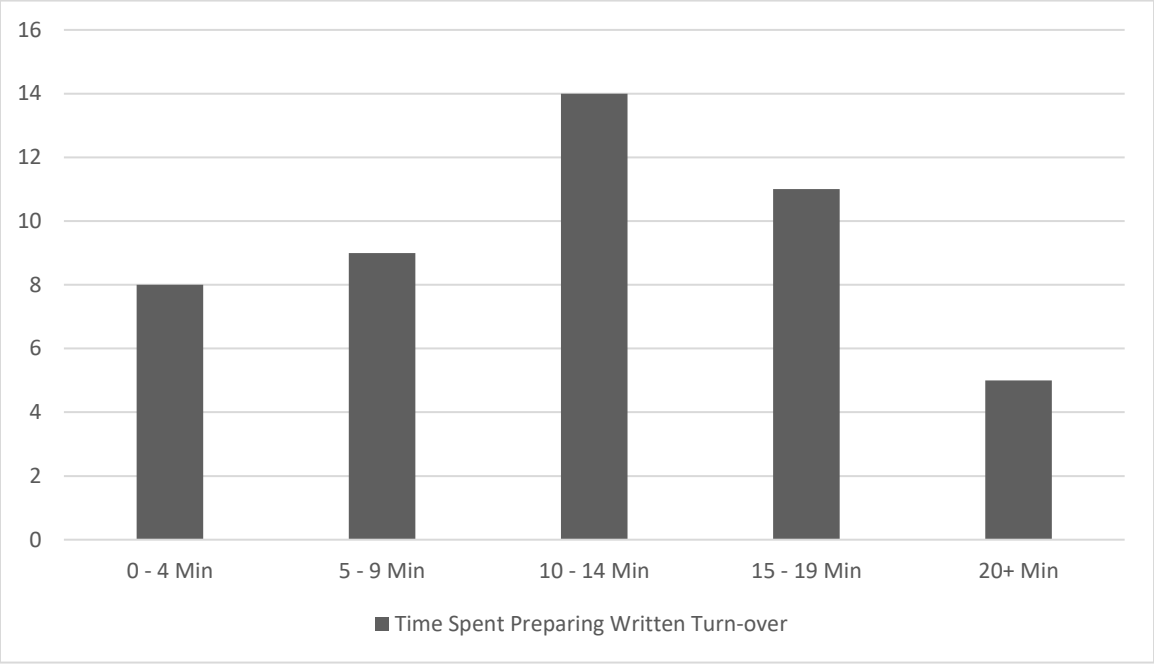

Figure 7. Time project lead spent preparing turnover.

From the observational data, it was determined that the incoming shift lead was not present during many of the turnover observations, see Figure 8. The shift lead, who was responsible for all the technicians and projects that are in process during a given shift, does not directly add value to the turnover process because they are performing project management functions.

The incoming shift lead is able to provide assistance with other company practices, such as the procurement of parts of the location of specialized tooling for a given task. They are,

however, available to assist the technicians during their shift, adding value to other processes in use by Company XYZ.

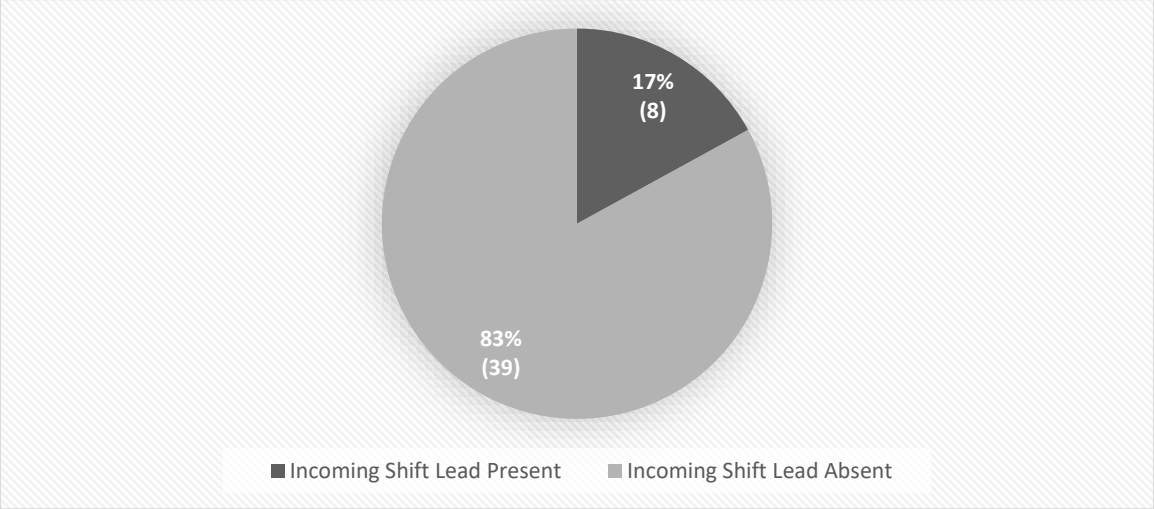

Figure 8. Frequency of incoming shift lead present for turnover summation.

The analysis of the observational data included the frequency of the incoming technicians present for the verbal summation of the turnover data. Figure 9 depicts that the incoming technicians were present for 85% of the 47 observations.

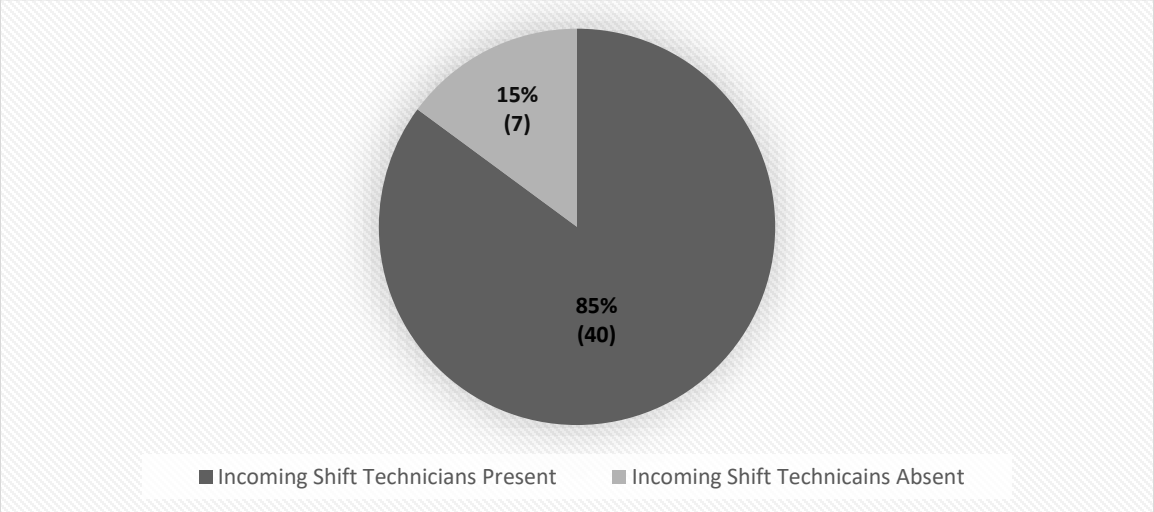

Figure 9. Incoming technicians' presence during turnover summation.

Because this was the time for the project lead to ensure that the incoming technicians have a complete understanding of the summation of the turnover data, the presence of the incoming technicians is a valuable step in the process. This summation time allows for the incoming technicians to ask questions regarding the tasks that are assigned during the shift turnover process

Analysis of the observations shows a correlation between the amount of time that was dedicated to the verbal summation of the shift turnover and the occurrence of feedback that was left by the incoming shift. Figure 10 illustrates the number of feedback events and the amount of time that was dedicated by the project lead to the summation of the turnover data during the current process. While a verbal summation that lasted longer that fifteen minutes only occurred in approximately thirty percent of observations, they accounted for 11 of the 22 feedback events. This feedback from the incoming shift becomes important to the project lead so that an accurate status of the project can quickly be ascertained.

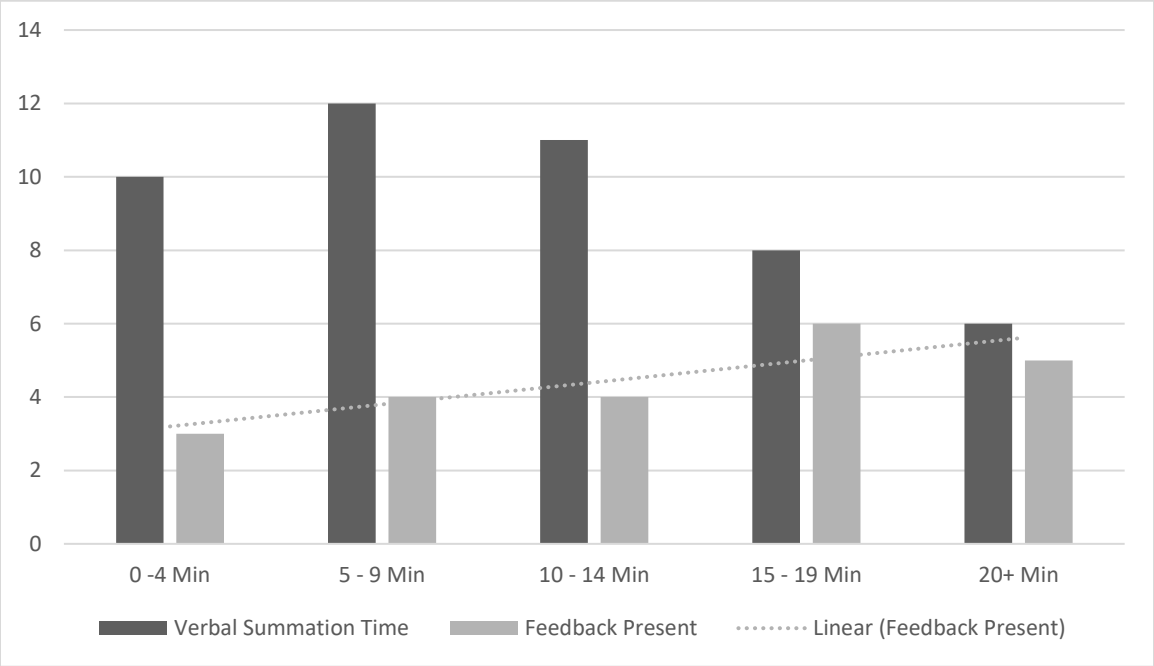

Figure 10. Relationship of summation time and instances of feedback.

As the amount of time that was dedicated to the verbal summation of the turnover increased, so did the instances of feedback being left at the end of the shift. When there was between 0 and 4 minutes dedicated to the summation, there was feedback left during 30% of the observations. When there was between 15 and 19 minutes dedicated to process the frequency of feedback rose to 75%, and when 20 or more minutes were dedicated the frequency of feedback during the observations rose to 83%.

Proposal

From the analysis of the observational data and the current state process, a proposal was created. While the observed process was effective in the transmission of data from the outgoing to the incoming shift, there were potential improvements that were identified. The separate step of the project lead giving a verbal summation to the incoming shift lead was found not to add value to the shift turnover process and was not a necessary step for the operation. If the shift lead was available, it may be advantageous to join the incoming technicians during the verbal summation that they receive. Figure 11 shows the proposed future state process map. By eliminating the specific step for giving the incoming shift lead a verbal summation, the time dedicated to the shift turnover process can be reduced, saving resources for value added tasks elsewhere in the operation.

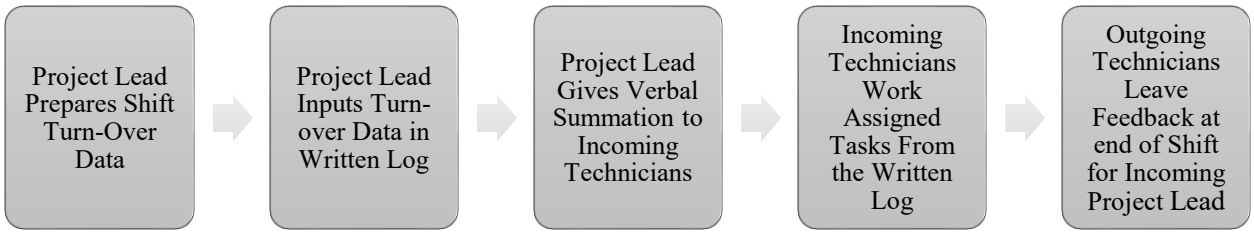

Figure 11. Proposal future state map.

In the proposed future state process, the project lead will prepare and input the shift turnover data in the existing written turnover log. This data will be available electronically for the incoming shift lead to read to gain an understanding of what work is available on each individual project for them to effectively manage the operation. But, the incoming shift lead will not receive an individual verbal summation of the turnover data from each project lead, as had happened in the previous process. The outgoing project lead will then give a detailed verbal summation to the incoming technicians, this time in the process will give the incoming technicians time to ask questions to ensure their understanding of the assigned tasks on the written turnover log. The technicians will then work the assigned tasks from the written turnover log, supplemented by the verbal summation given by the outgoing project lead.

Under the proposed future state process, the incoming technicians will be expected to leave feedback at the end of their shift for the project lead. This feedback will contain information such as tasks that were completed, tasks that were not completed and any issues or concerns that may have arisen during the shift. The feedback can be left on the currently available electronic shift turnover log. By utilizing a standardized process that is similar to the previous system, there should be less anxiety felt by the individual employees and less resistance to the change in the process. Training for the future state process can be accomplished easily by explaining the changes to the current employees and built into the training that is available for the individuals new to the organization.

It was found during the analysis of the shift turnover observational data that the longer the outgoing project lead was able to spend with the incoming technicians, the greater the frequency of the technicians leaving feedback for the project lead. This feedback adds value to the process because it allowed the project lead to quickly determine the current status of the

project, without having to spend time determining what was done during the previous shift. This feedback from the incoming shift, while it may not appear to be as valuable as the verbal summation, has just as much value in the process as the summation itself. The recommendation was generated to place an emphasis on the verbal summation time the outgoing project lead spent with the incoming technicians. As the project lead dedicates more time to the verbal summation, the frequency of feedback that is left by the incoming technicians should increase. As the feedback occurrences increase, it should become a part of the culture of the organization and begin to increase regardless of how much time is spent during the verbal summation by the project lead.

Summary

The collected observational data was utilized to create a current state map of the shift turnover process that was in use by Company XYZ in their service center. The analysis focused upon the steps that are currently in the process that do not add value to the turnover, including giving the incoming shift lead a verbal summation of the written turnover data. By eliminating these steps, costs can be reduced for the organization without affecting the outcome of the process. The observational data also included the amount of time that was spent preparing the turnover data, which becomes important for a comparative analysis after changes are made to the prior turnover procedures.

The steps in the current process that were found to be effective in the passage of information between the shifts were the creation of the written turnover log, the verbal summation to the incoming technicians and the feedback that was left by the incoming technicians. By focusing the recommendations on these three steps in the process, improvements can be made that will make the shift turnover process more effective.

The next chapter will include a discussion of the recommendations, limitations and conclusions as a result of this study.

Chapter V: Discussion

Operational practices within Company XYZ's service center necessitated the need to have multiple shifts of individuals working together to accomplish the tasks that the customer had requested. The multiple shift schedule created a need for individuals to pass information from one shift to another in order to maintain continuity of the work that was being accomplished. While there was a procedure in place as to how the passage of information in a shift turnover was to take place, there was room for improvement in this process to reduce errors that may occur and reduce the costs associated with the operation by reducing the time spent in the turnover process. The impact to the organization because of errors related to the turnover process could have been as subtle as the financial loss due to work that was accomplished multiple times, or as severe as the loss of an aircraft and those onboard in an accident. The goal of this research project was to create a proposal that could be presented to the leadership team at Company XYZ to improve the shift turnover process.

Chapter I discussed the problem that faced Company XYZ and the scope and limitations of this study. Because the organization has chosen to utilize multiple shifts in their operation, there is the potential for an error to occur as a result of the passage of information between the shifts. The division of labor was one aspect of the operation that could not be altered because that affected much of the organizational structure.

In addition to the division of labor, the structure regarding the management of individual projects was not considered when developing recommendations for the proposal. Definitions were provided for terms that may not have been familiar to the reader. The methodology of suggesting improvements to the previous shift turnover process was based upon observational data collected during turnover events.

Chapter II reviewed the topics of why an effective shift turnover process was necessary for an operation to follow, as well as the potential consequences for not following, the proper procedures during the shift turnover process. Literature regarding the implementation of the Lean approach was also reviewed showing the positive applications that could come from this approach. The concept of Human Factors was reviewed as a way to help design a standard work process that would reduce the instances of errors from occurring as a direct result of the procedures that an organization had in place. While not all the literature was focused upon the aviation or MRO industry, all of the industries reviewed had the necessity for an accurate shift turnover process.

Chapter III discussed how the research was conducted. The recommendations of the proposal were based upon a thorough review of the procedures and the observational data that was collected. The collected data was used to form an accurate current state map as it applied to the turnover process. The steps in the current state process were evaluated to determine which steps added value to the shift turnover process, which steps did not add value but were necessary to the operation and which steps did not add value and were not needed from an operational standpoint. This analysis of the current state map was the basis of the analysis of the collected data and subsequent proposed recommendations.

Chapter IV included an analysis of the data that was collected for the proposal. The metrics collected included the amount of time that was spent preparing the turnover data by the project lead. This data could be used following implementation of the recommendations to ensure that the process is not taking more time than the previous process. The current state map that was created based upon the observational data was analyzed in order to determine which steps in the turnover process added value to the passage of information, and which did not. The

analysis focused upon removing the steps that did not directly add value to the process and emphasizing the steps that did add value. This analysis was utilized to create a future state process map, that would implement the recommendations of this study.

The collected data also showed that the more time that the outgoing shift lead spent with the incoming technicians during the verbal summation, there was an increased frequency of feedback left at the end of the incoming shift. By emphasizing the summation time with the incoming technicians more information could be passed than what was written down in the electronic log. This information could include experiences that the more senior technicians could pass to the technicians who were not as familiar with the assigned tasks, improving the performance of the less experienced technicians.

Limitations

One method to reduce the errors and inefficiencies that occurred during the shift turnover process was to eliminate the multiple shift operations in favor of all individuals working the same schedule as the project managers. While this would reduce waste in one portion of the operation, it would have eliminated a major organizational feature. Because the organization has committed to the multiple shift structure, the study purpose was to find other recommendations to improve the passage of information during the turnover process. The observational data that was collected from December 2017 through February 2018 and was representative of the working environment during that time period.

Conclusion

The shift turnover process that was in place inside Company XYZ was found to be an effective method for the passage of information between shifts, but there was room for improvement. By making minor alterations to the current process, the passage of information

became more effective, and required less time which reduced costs for the organization. Examination of the current state process revealed that the individual summation of the turnover data provided directly to the incoming shift lead did not add value to the process because the shift lead was not directly performing the tasks on the turnover. The incoming shift lead had access to the written turnover log that was created by the outgoing project lead and could utilize these logs to determine the status of all the projects that were to be worked during a given shift. The recommendation was further made to determine if there was another mechanism in use by the organization that could be utilized to get the data to the incoming shift lead.

The recommendation was also made to emphasize the time that the outgoing project lead spent during the verbal summation directly with the incoming technicians. This summation allowed the incoming technicians to ask questions to ensure that they understood the tasks that were contained within the written shift turnover log. The verbal summation allows for the passage of nonverbal cues between the outgoing shift and the incoming technicians. The opportunity also existed for the senior technicians to pass their experiences onto the lesser experienced technicians and improve their understanding of the tasks and reduced the chances of inadvertently causing an error in the process.

Recommendations

The purpose of the study was to create recommendations to improve the current procedures in order to reduce the amount of time required for the turnover and reduce the number of errors that may occur as a result of improving the passage of information. One way to reduce the amount of time that the project lead had to dedicate to the turnover process was to de-prioritize the incoming shift lead receiving an individual turnover summation. While it was important that the incoming shift lead have access to the information, there were other

mechanisms in the operation that could be utilized to get the shift lead the high-level view of what is in the shift turnover. It was recommended that an examination take place to ascertain which other procedures within the operation could be used to give the incoming shift lead a high-level overview of what should happen on each individual project on a given shift. The time that was dedicated to providing the incoming shift lead with a dedicated verbal summation was then utilized during the summation with the incoming technicians without increasing the amount of time and resources dedicated to the process as a whole.

It was also noted, based upon the observational data, that the more time the outgoing project lead spent with the incoming shift in a verbal summation resulted in a greater instance of feedback left at the end of the incoming shift. The information that was returned to the project lead was found to be as important to the process as the information that was passed on during the shift turnover process to the incoming shift. While utilizing the existing written turnover electronic document is important, focusing upon the verbal summation allowed the incoming shift technicians more time to ask questions to ensure understanding of the expectations as well as the opportunity for more experienced technicians to share their experiences with other technicians.

It was noted during the observations that the outgoing project lead was utilizing the written turnover log to convey information to the incoming shift technicians, while the incoming shift was not always leaving feedback for the project lead utilizing the written turnover log. To coincide with the implementation of the recommendations of this study, training was created to ensure the proper use of shift turnover log. The process was similar to the previous system and was familiar to the existing technicians and was implemented into the training program that is utilized for technicians that were hired into the organization.

Once the recommendations were implemented, the observations should be repeated to ensure that the amount of time spent on the process has not increased. By not causing an increase in the time spent dedicated to the turnover process, the amount of resources that must be dedicated to the shift turnover process will not increase for the operation. Another indicator of the recommendations improvement to the current process is an increased instance of feedback that is left by the incoming shift for the project lead. If the observed correlation between the amount of time the outgoing project lead spends with the incoming technicians in the verbal summation is correct, the frequency of feedback should increase in relation. By increasing the feedback, the project leads must spend less time determining the status of a given project, increasing the time that the project lead may spend actively managing the current project.

The emphasis on inter personal interactions during the shift turnover process is a technique that could be implemented by any organization, regardless of industry, as a way to improve the passage of information between shifts. This personal approach allows for the individuals involved to convey subtle communication through non-verbal cues and the sharing of prior experiences. By increasing the amount of time that the project lead is able to spend directly with the incoming shift technicians, the recommendations will result in fewer errors related directly to the shift turnover process.

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