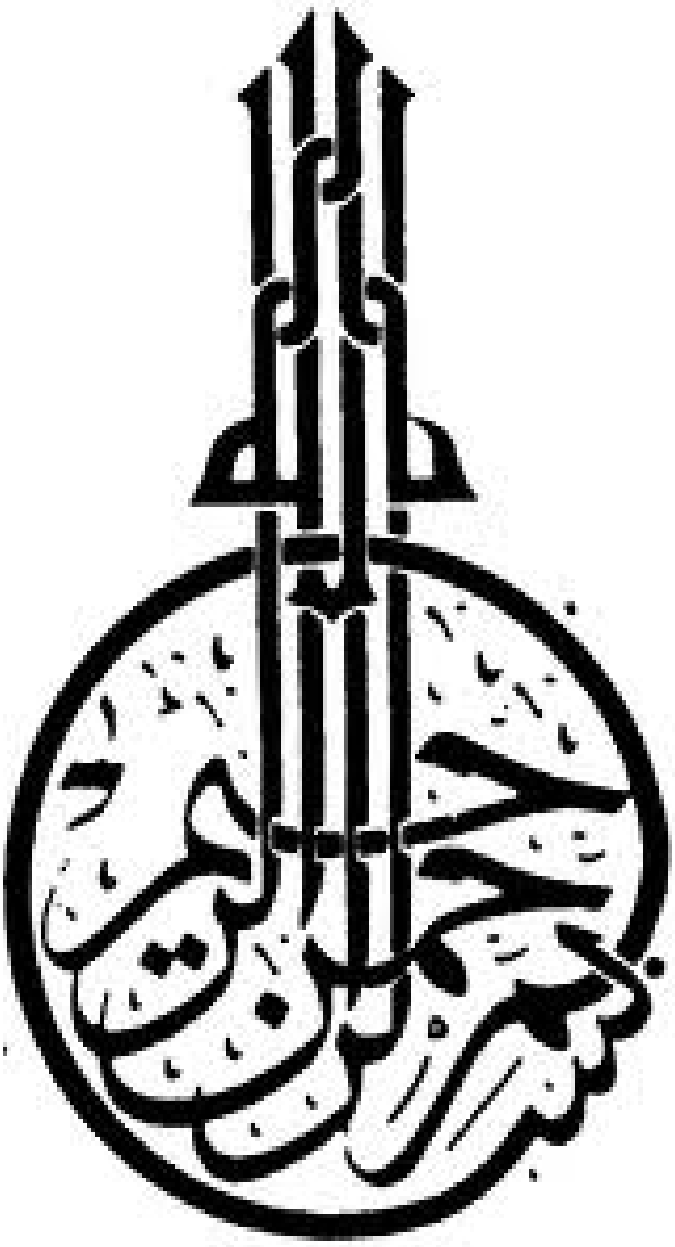
بسم الله الرحمن الرحيم

A Study of Boeing 747 "C" Check Maintenance Processes Using Simulation

By

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BSBA, King AbdulAziz University, 2009

A thesis submitted for the requirements of the degree of Master of Science [Industrial Engineering]

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This thesis has been approved and accepted in partial fulfillment of the requirements for the degree of Master of Science [Industrial Engineering]

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Dedicated to

I dedicate this thesis primarily to my parents for providing motivation and support throughout my graduate school, I will always respect and appreciate you.

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A Study of Boeing 747 "C" Check Maintenance Processes Using Simulation

Anas A. Shargawi

Abstract

Saudi Arabian's aerospace and aviation sector is a dynamic industry due to the country's expanding population and increasing religious tourism. Growth in demand gives rise to flow in responsibility for a safe journey with appropriate maintenance to aircraft.

In the airline industry, the role of maintenance is to provide safe, airworthy, on-time aircraft, around the clock. Aircraft maintenance must be planned and performed according to prescribed procedures and standards. An airline generally has a diverse fleet of aircraft. Each fleet type has a predetermined maintenance program established by the manufacturer.

Saudi airlines have always been a government sector. Due to globalization, increase demand, and economic strategy the maintenance sector of airlines has been nominated for privatization. Saudia Aerospace Engineering Industries (SAEI) became the privatized division of Saudi Arabian Airlines holding company. This business unit is to peruse the strategic goal of the Saudi airlines to ensure a continuation of flight safety with a focus on profitability. SAEI invested to offer maintenance services to other airlines like American, Iraqi, British, etc. Standardized maintenance time has become the key factor to achieving the customers' attraction among competitors in which to reduce maintenance direct and indirect costs. Therefore, resources allocation may be one crucial factor in the optimization and decision-making process.

Five simulation models were developed using Arena® to evaluate maintenance tasks and processes of the Boeing 747-400 "C" check. Four departments (i.e., airframe, powerplant, avionics, and cabin) were modeled and then combined in one complete model that represented the entire maintenance check. The complete model results indicated that an aircraft was on the ground for an average of 34 days total time to complete the maintenance "C" check. Other results (e.g., manpower utilization, scheduling, non-routine tasks, etc.) were collected and reviewed to provide insight and understanding of aircraft heavy maintenance systems.

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Chapter I

Introduction

1.1 Introduction

Aviation provides the only worldwide transportation network, which makes it essential for global business and tourism. It plays a vital role in facilitating economic growth, particularly in developing countries. It transports close to 2 billion passengers annually and 40% of interregional exports of goods (by value). 40% of international tourists now travel by air [1].

Aviation's global economic impact (direct, indirect, induced, and catalytic) is estimated at US$ 2,960 billion, equivalent to 8% of the world's Gross Domestic Product (GDP). The world's 900 airlines have a total fleet of nearly 22,000 aircraft. 25% of all companies' sales are dependent on air transport. 70% of businesses report that serving a bigger market is a key benefit of using air services [2].

In the early days of aviation, owners and engineers were often concerned with in-flight failures and component reliability developed Maintenance Schedules to help prevent costly occurrences. As aviation grew and scheduled air transport arrived, safety, reliability, and economics became important to attract passengers. Aviation maintenance has been identified by the FAA (Federal Aviation Authority) as an area where better efficiency is needed to cope with ever-increasing workloads. It became apparent that to achieve a controlled balance between safety and economics,

Regulatory authorities needed to ensure minimum standards were maintained and a level playing field existed for fair competition between operators. What to maintain, when to maintain, and how to maintain, are the keys to the content of the Maintenance Schedules and a system was developed for Operators, Manufacturers, and Regulators to share experience and knowledge on these very issues for new aircraft being developed. The frequency of maintenance tasks is affected by the way the aircraft is to be operated. The maintenance scheduling policy plays a vital role to ensure that the aircraft remains within an effective operational condition for stipulated calendar days. Saudi Arabian's aerospace and aviation sector is a dynamic industry due to the country's expanding population and increasing religious tourism. The Saudi Government is working to sophisticate and streamline the industry through infrastructure development, privatization initiatives, and market liberalization.

With the increasing worldwide population with lightning-fast speed, the demand for air transport has been boomed. Growth in demand gives rise to flow in responsibility for a safe journey with appropriate maintenance to aircraft.

In the airline industry, the role of maintenance is to provide safe, airworthy, on-time aircraft, every day. Aircraft maintenance must be planned and performed according to prescribed procedures and standards. An airline generally has a diverse fleet of aircraft. Each fleet type has a predetermined maintenance program established by the manufacturer. Based on an airline's experience and mode of operation, an original program is adapted to meet FAA approval. Maintenance task standards (norms) specify when each task is scheduled and how much time is spent on each task [3, 4].

Commercial aviation and industry expansion through privatization initiatives and Market liberalization has been facilitating the airline industry to be competitive in the global market. The privatization will mark another milestone in the process of

liberalization in the Saudi aviation industry. With the partial privatization of its airports and the end of Saudi's transport monopoly, the national aviation market is slowly beginning to be opened up to competition and private enterprise. National carrier Saudi Arabian Airlines (SV) and low-cost carrier NAS air serve the domestic market of over 27 million passengers.

SV's fleet expansion to 125 aircraft includes 50 Airbus 320s, 321s, and 330s, Boeing 777s, and Boeing 787s (2011-2015) [4, 11]. SV's privatization program includes five units [11]:

- Cargo Division,
- Catering Division,
- Ground support services,
- Maintenance Division,
- Aviation training academy.

The Kingdom of Saudi Arabia is opening its market to foreign carriers to operate domestic and international flights, promoting significant growth in the commercial division.

Airline maintenance accounts for approximately 11% of an airline's employees and 10 – 15% of its operating expenses [6]. A large portion of the direct and indirect maintenance costs in the whole life cycle stems from the consequences of decisions made during the initial maintenance program development. The cost of airline maintenance has steadily increased in recent years. Since the decision was made to develop the maintenance initial scheduling program, this may strongly affects the aircraft safety, availability performance, and lifecycle cost, it is essential to select the most effective maintenance options that ensure system effectiveness.

Regular maintenance and inspections ensure that aircraft are airworthy and prevent component and system failures during operation. There is always tension within airlines between the need to maximize the availability of aircraft for operations and having sufficient downtime for maintenance. While commercial departments want to maximize aircraft utilization, maintenance departments need to have the aircraft available in the right locations for reasonable periods of time. Unexpected failures of components or a shortage of parts or mechanics with particular skills and qualifications add to the complexity and stress of planning maintenance.

Many inputs need to be manipulated by maintenance planners to produce a workable solution: the flight schedule; the aircraft's technical status; material availability; hangar space; mechanics' availability; and the scheduled tasks themselves. The cost savings derived from efficient maintenance planning, however, can be substantial. Out of a fleet of 20 or 30 aircraft, there will always be three or four aircraft in maintenance and out of revenue service [8]. If maintenance planning can be optimized, and hangar time reduced, it might be possible to release one of those aircraft into service and reduce the direct and/or indirect maintenance cost. When maintenance planning is efficient, it produces a 'free' aircraft to generate additional capacity and revenue and meet the fleet demands. The scope for this level of efficiency is naturally higher with larger fleets. At a micro-level, there are still substantial savings to be realized, for example, task yield: the actual interval ove

r which the task is accomplished compared to its theoretical allowable interval expressed as a percentage. Another way to express this is the utilization of the interval for a maintenance task.

Aviation is the field of maintaining airplanes; making them Airworthy to fly as well as flying them within the international authority standard and safety. Aircraft (ACFT)

must have scheduled maintenance programs that keep track of the time of each plane and once a maintenance check is due, it is good to be taken Out Of Service (O.O.S). Sometimes, a due maintenance check is extended under Engineering Restrictions (ER) which is rarely practiced. Once ACFT is taken O.O.S, different specialties are responsible to accomplish the specified check with a commitment to bring the ACFT Back In Service (B.I.S) on a specific date and time [11, 9].

Thus, effort on making good utilization and excellent planning must be considered to make sure communication and coordination are applied. The airframe section is one of the biggest departments that cover many ATA chapters and systems such as fuel, hydraulics, landing gears, flight controls, water and waste, cargo compartment, ice and rain, fire systems as well as empennage, fuselage, and wings. There is also a powerplant, avionics, inspection, and cabin department. All these specialties have the initiative to start maintenance routines and processes as soon as the ACFT arrived at the hangar for any scheduled maintenance in which to achieve the pre-specified committed date and time. Numerous human factors challenges associated with aircraft maintenance exist. Maintenance and quality inspection are essential to ensure continuing airworthiness of an aging fleet. New advanced technology procedures for aircraft further complicate the aviation maintenance system. The human is a critical component of the maintenance system. Therefore, research and development must address a variety of issues affecting operators to perform ACFT maintenance.

In order to plan well and have an actual picture of the system shortcomings and high-performance areas within the system, simulation modeling techniques were conducted to interpret each system. Simulation modeling is a tool that allows management to investigate any process, and analyze its data via a program such as the Arena® software package which is one of the most popular and powerful computer programs.

Maintenance checks/phases are divided into Categories – 'line'/'transit', 'A', 'B', and 'C' (from lightest to heaviest) – enabling aircraft operators to plan regular inspections. Although the required maintenance tasks and the number of engineers assigned may vary between aircraft type and model. Maintenance, Repair, and Overhaul (MRO) typical check types are summarized in section 1.3. The periodic maintenance checks must be performed after a certain amount of time or usage. The most common checks are [10, 11]:

- "A" Check – due every month or each 500 flight hours; done overnight at the airport gate;
- "B" Check – due every 3 months; also done overnight at the gate;
- "C" Check – due every 18 months or each 9000 flight hours; performed at a maintenance base or a hangar and takes about 3 days - 1 week.

1.2 Hangar Maintenance Brief [11, 7]

Hangar maintenance is one section of many departments at Saudia Aerospace Engineering Industries (SAEI). It comprises five major departments (Figure 1.1).

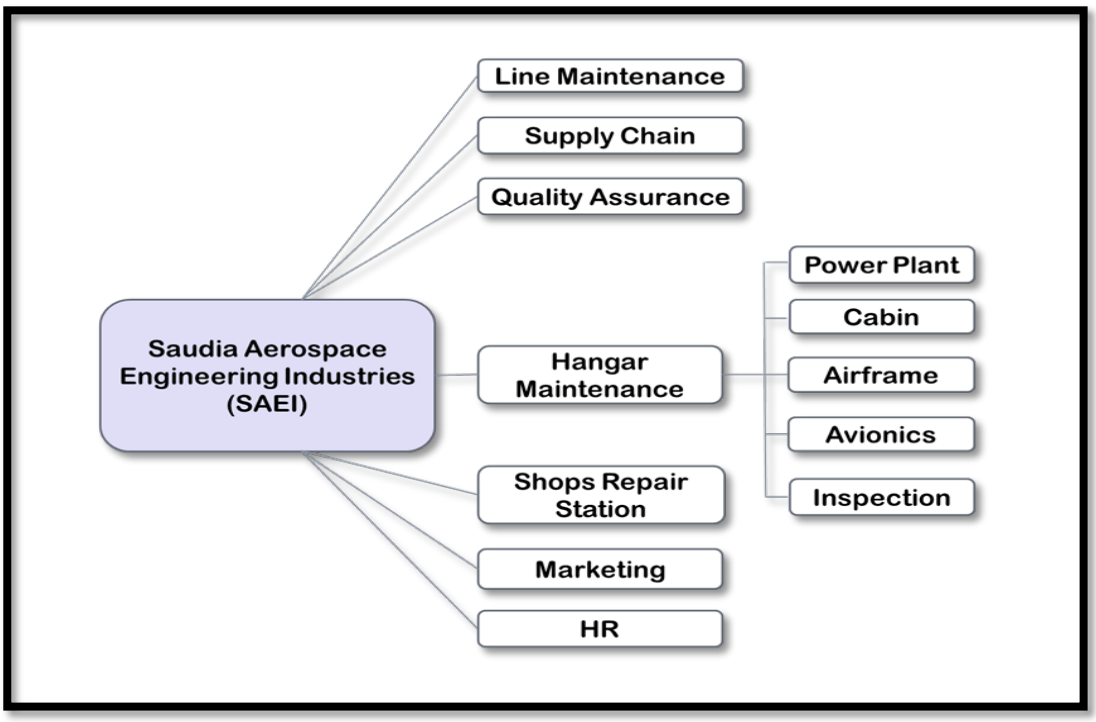

Figure 1.1 SAEI Departments and Hangar Major Sections.

Since there are many specialties and different schedules of maintenance check types as well as many different ACFT types and models, the simulation process may become complex, and thus, mimicking only one ACFT type, 747- 400, one type of maintenance check, "C" check, for the four major departments including inspections, may simplify the representation of the simulation model and advance the identification of any bottlenecks within the system.

1.3 Types of Maintenance Check [5, 8]

Check	Location	Description	Duration
Line/ Transit	At Gate	Daily (before first flight or at each stop when in transit). Visual inspection; fluid levels; tires and brakes; emergency Equipment.	≈ 1 hour
"A"	At Gate	Routine light maintenance; engine inspection.	≈ 10 hours (whole shift) / overnight
"B"	At Gate	If carried out, similar to 'A' check but with different tasks (may occur between consecutive 'A' checks)	≈ 10 hours to 1 Day
"C"	At Hangar	Major structural inspection of airframe after paint removal; engines, landing gear, and flaps removed; instruments, electronic and electrical equipment removed; interior fittings (seats and panels) removed; hydraulic and pneumatic components removed	≈ 3 Day to one week

1.4 Literature Review

In 1997, a simulation model was developed by the Economic Development Institute, Georgia Institute of Technology, U S A, for Delta Airlines shop processes and engine removal capacity in which to provide a better understanding of the capacity of the engine maintenance facility versus the current realized capacity and also to capture the availability of the assigned manpower. The model demonstrated that the loading of engines into the repair cycle has a great effect on the capacity of the facility. If the engines are loaded incorrectly, the amount of engines produced lessens and the turn time increases as well as the variability [10].

The simulation modeling showed to be a valuable tool because it accurately depicted the interactions between different parts and the resources required. In the future, the model could also be expanded to include insourcing. The model will provide insight into the timing and amount of insourcing available based on the current engines in repair [22].

Also, in 2013, in Stuttgart, Germany, a simulation study of engine processes to prioritize a process that maximized productivity. The aim was to develop a tool, which helps to react to some variables within the process and highlight the challenges. This study showed the optimal priority rule that the maintenance operations may find most suitable [32].

In 2013, a major shift in support and maintenance logistics for complex engineering systems over the past few years has been observed in the defense and aerospace industry. Availability contracting, a novel approach in this area and a special type of performance-based contract, is replacing traditional service and also procurement practices. The service provider is measured against an equipment availability target set by the customer and rewarded on savings achieved. The performance of such contracts depends on the proper utilization of the right mix of labor resources. Contemporary literature on resource modeling has not attempted at modeling the entire aircraft maintenance line along with the labor resources. Therefore, this research aimed to improve resource utilization in availability type contracts by simulating human resources and processes in an aircraft maintenance line, simultaneously.

1.5 Study Definition

The Boeing 747 “C” Check maintenance duration at the SAEI hangar has become lengthy over time. This study was conducted to investigate the routine maintenance

time to understand the reasons behind the frequent delays of the “C” check maintenance executions.

The goal of this study is to build a complete simulation model to simulate the Boeing 747-400 “C” check maintenance processes.

The objectives of this study are:

1- To understand each task performed by each department during the routine maintenance check, manpower utilization, and cost.

2- To have a validated model for short future optimization scenarios and alternatives to provide visibility and support management decisions.

3- To identify maintenance tasks' total ground time for the entire check and to estimate projected lost revenue.

1.6 Methodology

The methods are listed step by step as follows:

- Conducted a thorough intensive literature review on ACFT maintenance in general and the Boeing 747- 400 in particular;
- Studied and analyzed the Boeing 747- 400 maintenance check procedure in SAEI departments and other hangar major maintenance sections;
- Developed the schematic diagrams of the different processes involved in the “C” check maintenance of the Boeing 747- 400. Identified the activities in every process, their priorities, needed resources, and the time required to complete each activity;
- Collected all needed data for each activity in every process;

- Developed the logic of the simulation model based on the actual execution of the maintenance processes, their priorities, and the sequence of activities identified within every process.
- Constructed the simulation model using Arena® simulation software package,
- Performed model verification and validation procedure to ensure proper representation of the actual "C" check maintenance system,
- replicated the simulation experimentation to accomplish the objectives of the study and achieve its goal,
- Analyzed the collected results, documented all findings of the study, and stated a relevant conclusion and necessary recommendations.

1.7 Data Collection

Data was collected from SAEI production and maintenance planning. Information on aircraft maintenance processes and policies was obtained by interviewing the mechanics, supervisors, managers, engineering support team, and planners. For each shift, data was collected on the current schedule, current workforce size, manpower requirement, and average overtime hours per month. Other relevant statistics were also collected from the engine manufacturer. In addition to interviews, sources of data included:

- Weekly flight schedules,
- Weekly maintenance planning schedules,
- Weekend work schedules,
- Yearly maintenance projections,
- Employee timesheets,
- Maintenance work logbooks,

- Work schedules company manual (Saudi Arabian Airlines, 2010).

The most important step in data collection was determining the daily labor demands for each shift daily for the entire week. In addition, the actual workload was extracted from the logbook. The reliability maintenance personnel helped to collect some very useful information about the schedule times of ACFT arrivals that are based on tracking systems from ACFT purchase time until the phase-out time. The hangar maintenance planning team was asked to estimate the number of operators that would be needed to satisfy the load requirements for both the flight schedule and actual work recorded in the logbook. O.O.S and B.I.S five years history of 747 - 400 “C3” checks were obtained as represented in section 2.7 of Chapter II.

Moreover, flight standard operating cost per hour was collected from the flight operations center to estimate the flight standard revenue per hour in which to capture the ground time impact as in lost revenue.

Chapter II

Saudi Arabian Airlines and Saudia Aerospace Engineering Industries

2.1 Overview

Saudi Arabian Airlines is the national passenger airliner serving the kingdom and is the second-largest air carrier in the Middle East region, called "The Jewel of the Middle East." Saudi Arabian Airlines is a member of the Arab Air Carriers Organization, which promotes cooperation and safety standards among Arab airlines [12].

Saudi Arabian Airlines started in 1945 with a single twin-engine DC-3 (Dakota) HZ-AAX which was offered to King Abdul Aziz as a gift by U.S. President Franklin D. Roosevelt. This was followed by the purchase of two more DC-3s, and these formed the center of what in a few years later became one of the world's largest airlines [18].

Today Saudi Arabian Airlines has some one hundred and thirty-nine (139) aircraft, including the latest and most advanced wide-bodied jets presently available: B747-400s, B747-300s, B747-100s, B777-200s, Airbus A300-600s, MD-11s, and MD90s [13, 14].

Saudi Arabian Airlines operating as Saudia (Arabic: السعودية as-Saudiyyah) is the flag carrier airline of Saudi Arabia, based in Jeddah. The airline reverted to its abbreviated English brand name Saudia (used from 1972 to 1996) from Saudi Arabian Airlines

(historic name in use until 1971 and reintroduced in 1997) on 29 May 2012, the name was changed to celebrate the company's entry into the Sky Team airline alliance on that day, and it was a part of a larger rebranding initiative. It operates domestic and international scheduled flights to over 90 destinations in the Middle East, Africa, Asia, Europe, and North America. Domestic and international charter flights are operated, mostly during Ramadan and the Hajj season [14].

The airline's main operational major base is at Jeddah-King Abdul-Aziz International Airport (JED). Other major hubs are Riyadh-King Khalid International Airport (RUH), and Dammam-King Fahd International Airport (DMM). The new Dammam airport was opened for commercial use on 28 November 1999. Dhahran International Airport was in use until it has been converted to being used as a military base [13, 14].

The airline used to be the largest carrier in the region, but because of the growth of other airports and airlines has become the third-largest, behind Emirates and Qatar Airways.

2.2 Operational Highlights

Throughout the years, Saudi Airlines has strived to maintain high-performance standards in all aspects of its operation. Major industry criteria that airlines compete to increase, is the on-time performance index.

The chart below displays Saudi Airlines' on-time performance during the last decade (From 1993 to 2002). During this period, a total of 809,626 flights have been successfully operated with an average on-time departure of 90% [23].

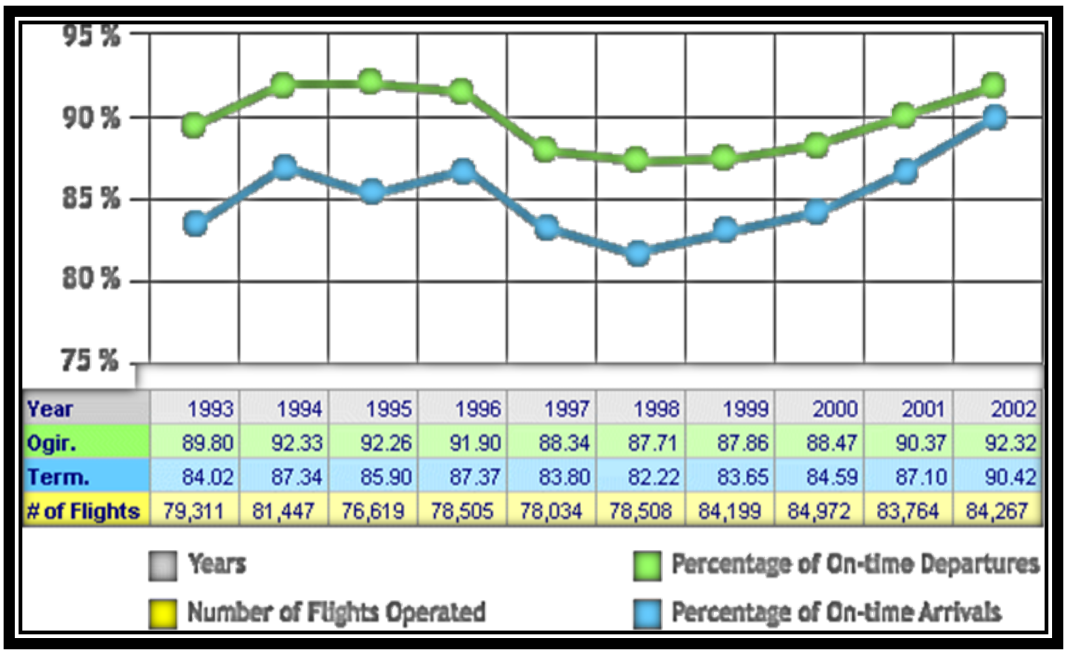

Figure 2.1 Saudi Airlines on Time Departure/Arrival Ten Years Statistics.

2.3 Modern Fleet

Saudi Arabian Airlines recently augmented its fleet with the acquisition of 61 state-of-the-art Boeing 747-400s, 777-200s, MD-11s, and MD-90s. These 61 aircraft have already been received and introduced into service thus making the Airline's fleet among the youngest in the world.

2.3.1 Types of Fleet

Nearly 150 aircraft are utilized by Saudi Arabian Airlines today. The fleet of wide-bodied passenger aircraft comprises such models as the Boeing 747, one of the first wide-bodied jets ever produced; the Boeing 777, the world's largest twin-jet commercial aircraft; and the Airbus A300, used for short- and medium-range flights. Saudi Arabian Airlines also uses a fleet of cargo jets to move materials for commercial and business customers. Saudi Arabian Airlines launches international and domestic

flight schedules to more than 70 points across the Middle East, North America, Asia, Africa, and Europe.

2.4 The Hierarchy of Saudi Arabian Airlines Holding Company [13, 14]

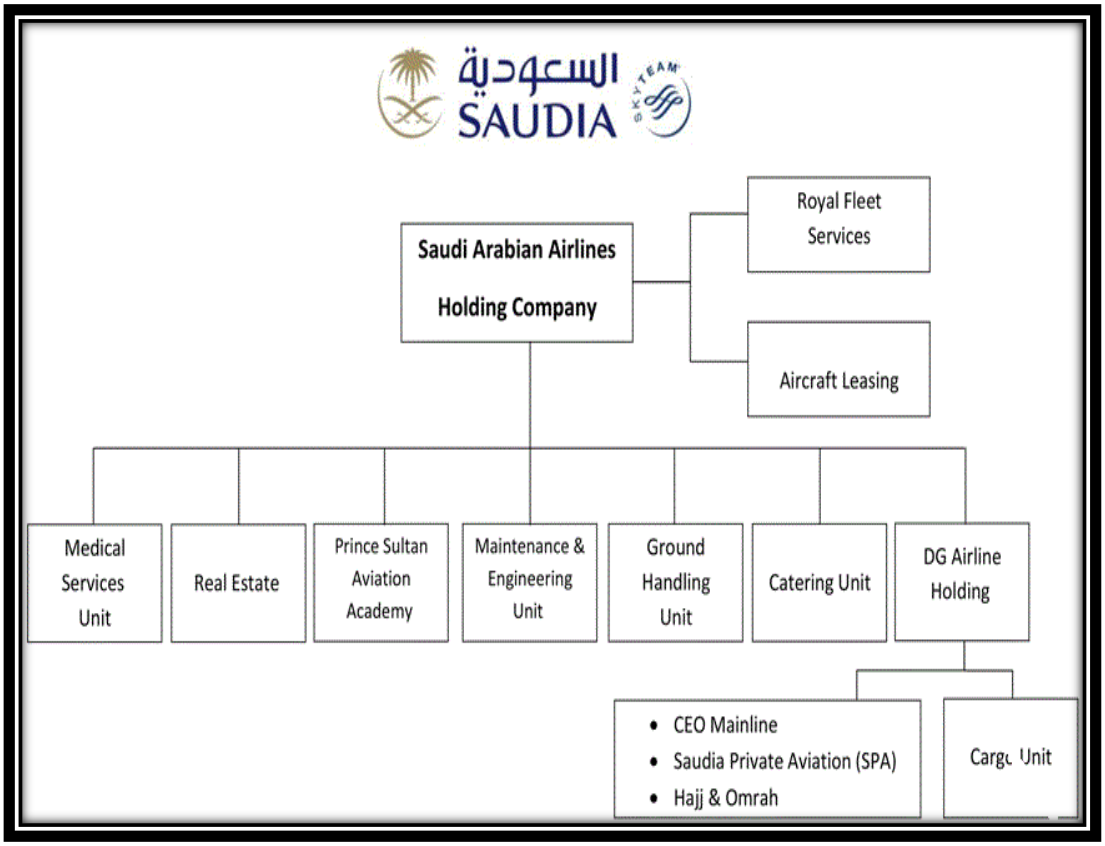

Figure 2.2 Hierarchy of Saudi Arabian Airlines Holding Company.

2.5 Saudia Aerospace Engineering Industries (SAEI)

"SAEI's long-standing experience and capability to perform maintenance on a wide variety of aircraft, aircraft components, and engines coupled with various repair station approvals are now being focused on supporting third party business in Saudi Arabia and the region."

SAEI has more than 55 years of experience in aircraft maintenance, engineering, planning, and fleet management. Currently, it maintains the fleet of Saudi Arabian Airlines and extends its services to many other customers in Saudi Arabia and around

the world. SAEI's current capability includes the A320 family, A330, A340, B737, B747, and B777 series, MD11F, MD90 & ERJ170. The B787 series will soon be added to the fleet. Also, SAEI is currently providing its engineering and maintenance services to Saudia private jets and other local, regional, and International customers such as NAS, British Airways, Air India, PIA, Air Arabia, Emirates, Qatar Airways, Delta, and Jet Aviation [21, 23].

Additionally, SAEI handles several business jets such as GII, GIII, GIV, Hawker 400XP, Falcon 900, and Falcon 7X. SAEI has a standalone engines repair and test center that handles various types of engines such as the RB211, PT6A, PW2037, PW2040, PW4462, CF6-80C2, and CF34& V2500. CFM56 engines will be added to their capability in the first quarter of 2012 [21].

SAEI maintenance services cover all 26 Saudi Arabian domestic airports and many international stations with total staff strength of over 5000 qualified personnel of which more than 85% are Saudi nationals. Troubleshooting capabilities are provided to all stations 24/7 through the SAEI Maintenance Control Center (MCC). SAEI holds Federal Aviation Administration (FAA), European Aviation Safety Agency (EASA), and General Authority of Civil Aviation (GACA) certification to repair and overhaul a large variety of aircraft components, aircraft engines, and Auxilary Power Units (APUs). The Facilities are equipped with both ATCE 5000 and 6000 test computers.

Saudi Aerospace Engineering Industries is headquartered in Jeddah and has responsibility for the maintenance of Saudia’s entire fleet. With more than 5,000 employees as of year-end 2010, it currently operates as a strategic business unit of Saudia. Saudia has entered into a long-term agreement with SAEI according to which SAEI is granted exclusive rights to provide maintenance and related services to Saudia [21].

SAEI Plays a key role by providing comprehensive services including heavy/light aircraft maintenance, technical training, engineering support, line maintenance services, inventory management, component support, engine overhaul, and engine condition monitoring to keep the fleet flying. It is proud to offer customers the same technical expertise, quality, and service that enable Saudi Arabian Airlines to enjoy industry-leading aircraft and engine reliability at low operating costs.

The capabilities include technical support, aircraft recovery, repair design, modification, fabrication, fleet management, including the development of aircraft maintenance programs and aircraft purchase.

SAEI places great emphasis on quality; regular audits are conducted to ensure that policies and procedures are adhered to and that the quality of work performed conforms strictly to standards prescribed by manufacturers and regulatory authorities including FAA, GACA, and EASA.

Aviation Link Corporation selected SAEI to provide line maintenance support services to their growing fleet due to their extensive knowledge, experience, and capabilities. Aviation Link Corporation. provides total airplane management services for VIP customers in the Middle East including aircraft purchase, interior design, and completion, as well as operational and maintenance management [24].

SAEI MRO is the largest facility in the region. It is designed to meet the MRO business requirements over the next 20 years of operations.

SAEI is one of the largest engineering departments in the region with the following specialties.

1. Airframe Maintenance,
2. Supply Chain Management,
3. Engine Maintenance,

4. Human Resource,
5. Component Maintenance,
6. Quality,
7. Engineering & Planning,
8. Finance.

2.5.1 The Hierarchy of Saudia Aerospace Engineering Industries [21]

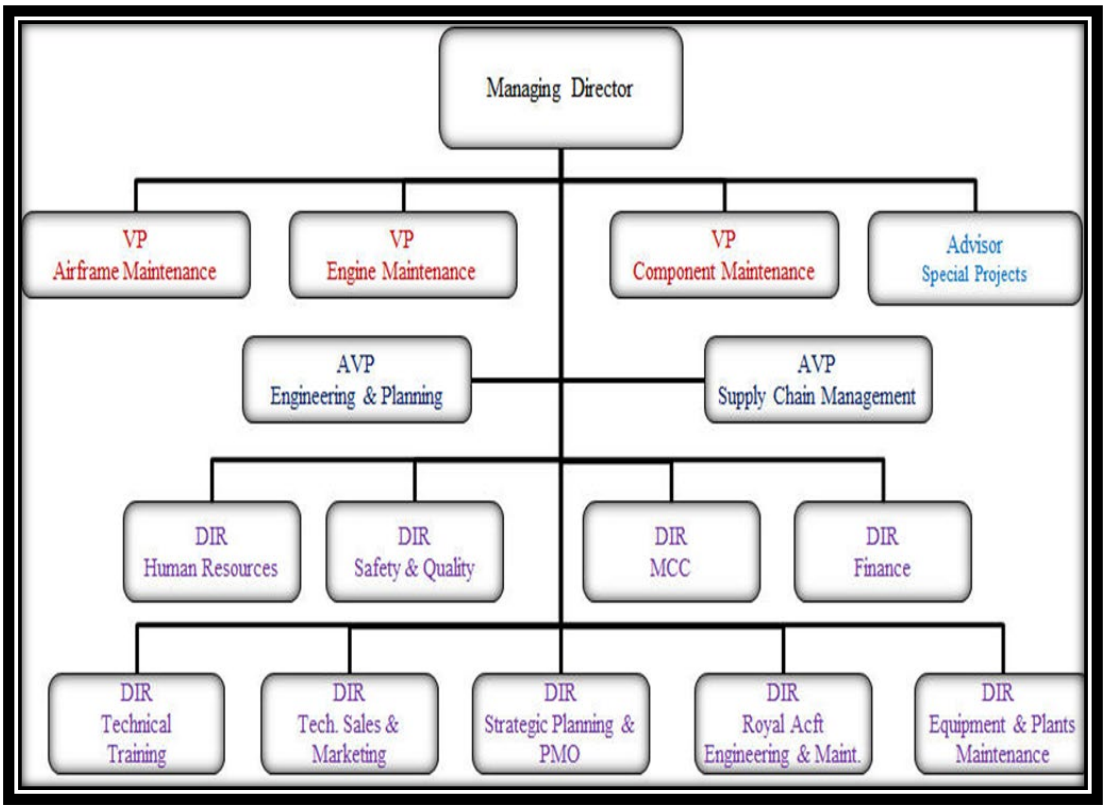

Figure 2.3 Hierarchy of Saudia Aerospace Engineering Industries.

2.5.2 Fleet Management

Fleet Management is a function that allows transportation companies to minimize the risks associated with vehicle investment, improve efficiency, and productivity and reduce their overall transportation and staff costs, provide 100% compliance with government legislation, and many more.

It develops and plans schedules and it controls the maintenance activities inside SAEI to ensure that the business lines meet the commitments made to the customers. It ensures the availability of conforming aircraft parts, serviceable engines, and spares at established objective levels to avoid delays and interruptions to maintenance operations. Also, conduct an initial evaluation of the customer's bill of work to be performed by SAEI and coordinate and track maintenance activities data records.

2.5.3 Supply Chain Management

SCM offers SAEI integrated and automated tools, parts, and inventory management system that reduces the costs associated with the MRO while driving increased maintenance and operations productivity. The team, with a decade of experience in materials management, manages every aspect of SAEI operations, including purchase management, Inventory Control, material and supplier issues, and logistics. Its cost-effective inventory management system delivers capabilities and values that the client needs to win in today's competitive market.

SCM offers the following Services:

- Provides all required aircraft parts and materials to various SAEI repair shops and hangar and line maintenance,
- Provides efficient warehouse, material, support, and handling of company material through its various storage locations,
- Maintains proper warehouse environment according to aviation standards,
- Develops, negotiates, and administers technical contracts for the procurement of equipment and services from external vendors.

2.5.4 Quality Assurance

SAEI quality assurance department controls the accuracy and quality of work performed on aircraft and components to ensure safety standards adhere to FAA, GACA, and EASA rules and regulations to maintain aircraft airworthiness and safety of operators.

Quality Assurance at SAIE includes the following:

- Declares aircraft/Components serviceability before an aircraft flight release,
- Performs receiving inspections on all incoming parts to ensure conformity,
- Repairs and calibrates testing equipment per international measurement standards,
- Performs Non-Destructive Testing (NDT) inspections to detect cracks and defects in aircraft structures using various methods.

Dedication to the highest standards of services can be seen throughout SAEI's highly trained and experienced technicians who perform inspections to guarantee the safety of passengers and the reliability of aircraft.

Quality Assurance Department highlights:

- Ensures all technical functions within the MRO comply with SAEI standards and applicable regulations,
- Conducts regular internal audits and facilitates AS9100, FAA, EASA, and GACA annual audits,
- Review the history of defects and perform root cause and corrective actions, present to senior leadership the highlighted major findings and solutions,
- Communicates with external supplier quality teams to ensure compliance.

2.5.5 Technical Training

The training system includes system rating, airframe and powerplant licensing program, hands-on laboratory, and visual management.

2.6 Advanced New Facility in SAEI

International and domestic aircraft Maintenance and repair increasing demand has extended the work area with new facilities and amenities around the world.

SAEI has selected a joint venture of the United Arab Emirates base Habtoor Leighton Group, Turkey's TAV, and Al Rajhi, for an SR 2.87 billion contract to design and build a new MRO in Saudi Arabia. The JV's scope of work includes the design and construction of 11 aircraft maintenance hangars with clear spans up to 160 meters, ancillary buildings, and workshops comprising 343,000 m^2 for the built-up area, all electro-mechanical and special equipment required for an automated modern MRO facility, corresponding aprons, taxiways, and airfield infrastructure works [19, 21, 23].

SAEI is developing a new state of art aircraft maintenance, component maintenance, and jet propulsion center aimed to handle the future challenges imposed by the forecasted market expansion in air transportation and consequently the associated maintenance demands. SAEI is planning this facility as a catalyst to enhance its production flexibility and efficiency for many types of aircraft, engines, and repair and overhaul equipment. The New facility would be established over an area of one million m^2, at the east-north side of King Abdul-Aziz International Airport in Jeddah (JED).

2.7 Hangar Maintenance

SAEI hangars comfortably accommodate multiple narrow and wide-body aircraft, Boeing B747s, B787s, Airbus A330s, and an Airbus A380 as well as smaller business jets of every type. SAEI boasts an overall hangar floor footprint of 21,200 m^2 and

workshop space totaling 5,300 m^2. Tactical interlinking of the hangars and workshops ensures superior time management and manpower allocation for in-house projects [29-31].

With an anticipated contract value of $800 million, Phase I Works will be completed by the end of 2023. SAEI hangars will be one of the largest MRO facilities in the region. It is designed to meet the MRO business needs for the next 20 years of operation. The design of the facility will allow phased construction to accommodate future capacity expansion requirements [32].

These facilities will consist of 11 hangars including heavy maintenance and line maintenance, wash and paint, component and support shops, supply chain center, administrative offices, miscellaneous support buildings, multi-level and surface car park, and aircraft parking aprons.

All hangar departments will be equipped with automated material handling systems such as an automated guided vehicle system, automated storage, and retrieval system, pneumatic tube system, vertical reciprocating conveyors, power roller conveyors, gravity conveyors, and various cranes systems, and multi-use wide-body and narrow-body dock systems.

Phase “C” is performed every 12-18 months and/or a specific number of flight hours determined by the manufacturer maintenance program. This check requires the aircraft to come off the line and be inspected in a hangar environment. “C” check maintenance consumes approximately four weeks undergoing routine tasks which are performed according to the task cards with a sequence, & Non-routine tasks are unplanned tasks that were captured during inspections [29, 31]. The history of ground time to perform 747- 400 phase “C” was estimated (Table 2.1).

Table 2.1 "C" Check Average Time per Speciality.

Specialty (Department)	Range	Average Days
Airframe	28-36	32
Cabin	27-34	30
Avionics	28-31	29.5
PowerPlant (Engines)	26-31	28.5
Aircraft 5 years history*	28-36*	32*

Mean	Standard Error	Mode	SD	Count	CI 95%
31.75	0.56	33	2.5	20 ACFT	1.2

*Descriptive Statistics of O.O.S & B.I.S data.

As shown in Tables 2.2 and 2.3, aircraft ground time cost per hour may be considered as lost revenue for an airline. The maintenance total time continues to increase due to many factors (e.g., aging fleet, poor time management, etc.).

Table 2.2 Saudi Arabian Airlines Operational Revenue.

Statistics for B-744	SR Per Flight leg (SR)	SR Per Flight hour (SR)	SR Per Day hour (SR)
Standard AVG Operating Revenue	800,000	47,904	31,951
Standard AVG Operating Cost	550,000	32,934	21,972
Standard AVG Net Revenue	250,000	14,970	9,984

Table 2.3 Aircraft 2012 Average Utilization Hours

Month	Monthly Utilization Average Hours	Daily Utilization Average Hours
November	498	16.6
December	501	16.7
January	492	16.4
February	504	16.8
March	501	16.7

2.8 Cabin

An aircraft cabin is the section of an aircraft in which passengers travel. At cruising altitudes of modern commercial aircraft, the surrounding atmosphere is too thin for passengers and crew to breathe without an oxygen mask, so the cabin compartment is pressurized anytime the cabin pressure is less than ambient pressure.

In commercial air travel, particularly in airliners, cabins may be divided into several parts. These can include travel class sections in medium and large aircraft, areas for flight attendants, galleys, and storage for in-flight service. Seats are mostly arranged in rows and alleys. The higher the travel class, the more space is provided. Cabins of the different travel classes are often divided by curtains, sometimes called class dividers though some airlines will not utilize a curtain between Business and First class. Passengers are not usually allowed to visit higher travel class cabins on commercial flights.

Some aircraft cabins contain passenger entertainment systems. Short-haul cabins tend to have no or shared screens whereas long-haul flights often contain personal screens which allow passengers to choose what to watch on their screen.

The Pre hangar check in the CABIN is listed below [32]:

- Galley filter replacement,
- Entry doors indication operational check,
- Upper deck slide doors Indication check,
- Lavatory, cleaning, and Indication Check,
- Lavatory smoke detection Check,
- Lavatory fire extinguisher expiration check,
- All seat and seat belt checks,
- Galley elevator check,
- Slide raft check,
- All doors power actuation system expiration check,
- Storable berth Operational Check.

When the aircraft is towed into the hangar, the following operational checks are performed:

- All floor panels check,
- Recirculating system and filters check,
- Left main entry doors mode selector functional check,
- Cabin attendant seats upholstery replacement,
- Left and right upper deck arm/disarm lever operational check,
- Right main entry doors mode selector functional check,
- Left and Right upper deck doors latch/lift mechanism operational check,
- Left and Right upper deck flight lock actuator operational check,
- Power actuation system gauge check,
- Lavatory doors operational check,
- Passenger compartment air outlets and seat operational check,
- Stabilizer trim and rudder ratio control module existing faults check F/C and J/C seat leg rest slides and rollers lubrication,
- Lavatories heater and bidet system operational check,
- Power megaphones and emergency flashlight operational check,
- Gallery faucets and valves operational check,
- Doors overhead crew rest drapery and bunk cover replacements,
- Main cabin Entry door escape slide functional check,
- Galley compartment doors, drawers, and torque check aisle stand C.

2.8.1 Fleet Services [32]

Fleet service employees are responsible for loading and unloading cargo, as well as transporting cargo to and from the aircraft. Fleet service employees also clean and service cabin interiors, lavatories, overhead storage bins, and buffets.

The following are the tasks that are to be accomplished in fleet service assignments:

- Passenger service units and closure panel cleaning,
- Flight compartment cleaning,
- Passenger compartment sidewall panels cleaning,
- Passenger service closure and panels cleaning,
- Passengers' seat cleaning,
- Passenger compartment ceiling panels cleaning,
- Galley craft lift cleaning,
- Trash compactor cleaning,
- Cappuccino maker deep cleaning,
- Passenger compartment curtain rail assemblies cleaning,
- Steam and convection ovens deep cleaning,
- Lavatory compartment deep clean,
- Passengers compartment carpets and floor mats installation,
- Stair enclosure cleaning,
- Portable oxygen stowage boxes cleaning.

2.9 Avionics

Avionics (aviation and electronics) is a term that describes all of the communication, navigational, and flight management equipment used in aircraft to make flight safer and more efficient. The term avionics is also used to describe weapon guidance and delivery systems in military aircraft as well as electronic systems used in satellite and space delivery systems.

Avionic technicians are trained to remove, troubleshoot, repair, and install aircraft electronic systems, including the associated wiring and structural mounting of the systems. After repairing avionic systems, technicians are also responsible for

performing operational checks of the system to ensure the system works as designed. Technicians can perform flight line work on the aircraft or shop work where they bench test and repair various systems. Avionics technicians typically find work at major airlines, FAA repair stations, and even aircraft manufacturers.

Avionics maintenance covers a wide range of the aviation and aerospace sectors – which together work to keep aircraft safe, serviced, and airworthy.

The following checks are performed before the aircraft is towed inside the hangar [33]

- Navigation Check,
- Ground Resistance Check,
- Stall Warming Check,
- Flap Time Delay Check,
- Cockpit Window heater Check,
- Fuel Quantity Indication Check,
- Engine Indicator Check,
- Fuel Installation Resistance Check,
- Under Water Locator Check,
- All Seat digital Indication Checks,
- All Flight deck Effect and Now Flight deck Message check /corrections.

When the aircraft is towed inside the hangar, the following tasks are checked:

- Fuel Pump Resistance check,
- Video – Audio Projector Adjusting,
- Megaphones batters replacement,
- Integrated display unit and air inlet screen filters cleaning,
- Control display unit and cooling air inlet screen cleaning,
- Selector module operational check,

- Voice record operational check,
- Primary Ice detection operational check,
- Hydraulic Air Driven Pump Pressure Switch Warning Lights operational check,
- Video-Audio Projectors check,
- Yaw damper module operational check.

Some operations are performed in parallel with other departments, such as:

- Ground and flight mode operational check with airframe and powerplant,
- Engine overheat sensors check.

After the accomplishment of the cross-functional tasks, the avionics department will perform preplanned routine cards.

After finishing the routine cards, non-routine tasks will be performed, which are not listed in the preplanned cards; then the tracking schedule will be adjusted as needed.

2.10 Airframe

The airframe of an aircraft is its mechanical structure. It is typically considered to include fuselage, wings, and landing gears excluding the propulsion system. Airframe design is a field of aerospace engineering that combines aerodynamics, materials technology, and manufacturing methods to achieve balances of performance, reliability, and reduced fuel consumption. Airframe mechanics are authorized to work on any part of the aircraft except the instruments, powerplants, and propellers. All the tasks should be performed under the rules and regulations approved by the local authority GACA.

The airframe department consumes the majority of maintenance time and tasks assigned to be performed during the “C” check.

The pre-hangar includes the following checks before the aircraft is towed inside [29, 31]:

- Equipment cooling test,
- Landing gear alternative extension check,
- Fuel boost pump check,
- Cockpit/window washer check,
- Radar hangar free play,
- Elevator flushes check,
- Stabilizers operational check,
- Flap alternate & primary operational check,
- Fuel sample and hydraulic sample for microbiological test,
- Fire extinguisher bottle squid test,
- Waste tank pressure switch functional check,
- Smoke detector, tube heater system operational check,
- Waste tank fillers check,
- Cargo doors actuator quick rig check,
- Oxygen control functional check,
- Nose gear pressure switch check.

The checks that are performed before the aircraft is towed inside the hangar:

- Pneumatic Heat Guard check,
    - Check all pneumatic connections for leaks in the left and right wings of the airplane, air-conditioning, and cross-over bays.
- Break and Tire Checks:
    - Break accumulator pressure check,
    - Break surge accumulation check,

    - Break hydraulic pressure check,
    - Tire pressure check.
- Cargo loading operational check:
    - Aft and forward loading system.

After completing all routine tasks, some of the non-routine tasks are to be completed and communication with other departments is initiated. The airframe crew accomplishes maximum tasks in the pre hangar process to identify as many defects as possible whereas it may be difficult to do so once the aircraft is inside the hangar with no power available.

Certain routine tasks are in series with inspection items after opening up panels to gain access and some of these tasks are performed simultaneously.

When the aircraft is towed inside the hangar the subsequent check and open up routine tasks start accordingly.

- De-fueling the aircraft,
- Inspection of the upper and lower wings,
- Empennage open up,
- Radars, Stabilizers, Fairing, Jack and Shroud inspection,
- Hydraulic component check,
- Fuel dry bays open up,
- Air-conditioning access open up.

2.11 Inspection

The process of systematically examining, checking, and testing aircraft structural members, components, and systems, to detect actual or potential unserviceable conditions.

The quality assurance system is the last line of defense, it is affected by a variety of geographically dispersed entities ranging from large international carriers, repair and maintenance facilities, through regional and commuter airlines, to the fixed-based operators associated with general aviation. Inspection, like maintenance, is regulated by the FAA, while the adherence to inspection procedures and protocols are closely monitored, monitoring the efficacy of these procedures is much more difficult [28, 33]. Just as effective inspection is seen as a necessary prerequisite to maintenance safety, inspector reliability is fundamental to effective inspection. Since 90% of all inspection in aircraft maintenance tends to be visual inspections, this must be performed effectively, efficiently, and consistently in a predetermined schedule. These schedules are then taken by the carrier and modified so that they suit individual carrier requirements and meet legal approval. Thus, within the carriers' schedule there will be checks at various intervals, often designated as flight line checks, overnight checks, A, B, C, and D phases.

The objective of these phases is to conduct both routine and non-routine maintenance of an aircraft. The maintenance includes scheduling the repair of known issues, replacing items after certain flight hours, cycle time, or calendar time, repairing defects discovered previously (e.g., reports logged by pilot and crew, line inspection, items deferred from previous maintenance), and performing scheduled repairs. If a defect is discovered by the inspection system, it often leads to repair/maintenance. In the context of an aging fleet, inspection takes a more vital role. Scheduled repairs account for only 30% of all maintenance compared to 60-80% in the earlier fleet which can be attributed to an increase in the number of age-related defects. In such an environment the importance of inspection cannot be overemphasized.

Once the maintenance and inspections are scheduled on an aircraft, the schedule is translated into a set of job cards or work cards (instructions for inspection and maintenance tasks) as the aircraft arrives at any maintenance site. Initially, the aircraft is cleaned and several accesses are opened so that inspectors can view the different areas. This activity is followed by a heavy inspection check. As stated earlier, most of this inspection is visual. Since such a large part of the maintenance, the workload is dependent on the discovery of defects during an inspection, it is imperative that the incoming inspection is completed as soon as possible after the aircraft arrives at the inspection maintenance site [34, 39].

Furthermore, there is pressure on the inspector to discover critical defects that necessitate long follow-up maintenance times, early on in the inspection process. Thus, there is a heavy inspection workload at the beginning of each check. It is only after the discovery of defects that the planning group can estimate the expected maintenance workload, order replacement parts, and schedule maintenance time. Frequently, maintenance facilities resort to overtime, increasing the total number of inspection hours. This often leads to prolonged work hours. Also, much of the inspection is carried out during the night shift, including routine inspections on the flight line, which are scheduled to occur between the last flight of the day and the first flight on the next day.

During the inspection, each defect is written up in Non-Routine Cards (NRCs) as a finding. This is translated into a set of work cards to rectify each defect. The defect is rectified by maintenance technicians from a different department depending on the finding type. Once the defect is rectified, it may also generate additional inspection buyouts to ensure that the work meets necessary standards. These subsequent inspections are typically referred to as buyback inspections. Thus, it is seen that

initially, the workload on an inspector is very high upon the arrival of an aircraft. As the service on the aircraft progresses, the inspection workload decreases as the maintenance crew works on the repairs. The inspection load again increases towards the end of service. However, the rhythm of the work changes towards the end of service as there is much frequent interruption as technicians call in inspectors to conduct buyouts of completed work [36, 38].

Task analysis of aircraft inspection has revealed inspection to be a complex task where the inspector has to visually search for defects occurring at varying severity levels and locations. In performing the inspection task the inspector has to be sensitive to efficiency (speed measure) and effectiveness (accuracy measure). The inspector needs to be sensitive to these factors if he or she is to optimize his or her performance.

The inspection task is further complicated by the wide variety of defects that are being reported in older aircraft. Consequently, a more intensive inspection program is required for aging aircraft. The introduction of newer aircraft does not strictly reduce the inspection workload, as new airframe composites create an additional set of inspection variables. Nevertheless, the widespread use of aging aircraft is expected to continue in the future. Thus, the Office of Aviation Medicine and the FAA Technical Center have recently concentrated their efforts in these areas [38]:

- Flight compartment placards inspection,
- Crew compartment overhead hatch drain inspection,
- Doors warning system operational check,
- Crew cabin interior inspection,
- Passenger address system functional check,
- Flight compartment seats and crew rest inspection,
- Control display units and cooling air inlet screens cleaning,

- Central warning system modules operational check,
- Integrated display unit and Air inlet screen filters cleaning.

The Inspection process is a vital role in maintaining aircraft safety with proper checks to be airworthy. In pre hangar process, visual inspections are a common method of quality control, data acquisition, and data analysis. Visual inspection is used in the maintenance of facilities, inspection of equipment and structures using either or all of raw human senses such as vision, hearing, touch, and smell, and/or any non-specialized inspection equipment.

The inspection process is divided into two categories:

- General Visual Inspection:
- Detail Visual Inspection:

The following inspections of an element of aircraft are engine components, flight control actuators, hydraulic connection, corrosion, loose rivets, fairing, flight coordination check, landing gear, structure, brake system, wheel and tires, and oxygen system.

In maintenance activities inspection involves the measurements, tests, and gauges applied to certain characteristics regarding an object or activity. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets. Inspections are usually non-destructive.

Completion of all routine and non-routine tasks require a final inspection per area as well as a final workaround that includes a check of leaks, missing screw, damage, cleanliness, and abnormal conditions which then leads to releasing the aircraft for a flight.

2.12 PowerPlant

Established in 1983, SAEI's Jet Propulsion center extends over a 61000 m^2 area in Jeddah and employs over 500 highly skilled engineering and technical staff. The center has the capability to repair and overhaul jet engines, auxiliary power units, thrust reverses, and various engine parts with excellent turnaround times.

The Jet Propulsion center also has a twin-engine test call capable of handling up to 90000 lbs of thrust. SAEI is planning the construction of a state-of-the-art Jet Engine Maintenance facility by 2014 which will have an engine test cell capable of handling up to 150000 lbs of thrust.

The engine and propeller often referred to as the powerplant, work in combination to produce thrust. The powerplant propels the airplane and drives the various systems that support the operation of an airplane.

The following maintenance checks were performed proceeding with the aircraft hangaring [39, 37]:

- Open up of engine panels,
- Pylon access panels open up,
- Integrative Drive Generator (IDG) check,
- Thrust repair operational check,
- Change all filters, engines, oil coolers, IDG,
- Statics aerodynamics smoothness inspection,
- Replace fuel filters, pneumatics seals, and component filters.

Data were collected in time units for actual 16 "C" checks performed by Saudi Arabian Airlines (SV) maintenance division SAEI on 747 – 400. Another set of data was collected from AB MRO facilities on the same aircraft type, model, and check. Finally, General Electric provided average hours for each task of CF6-80 engine maintenance,

which was convenient to validate the engine simulation model as demonstrated in chapter 3. Simulation comparison will be tested to see how the simulation model executed the data for all airlines and this will be discussed in terms of manufacturer or benchmarking time (Table 2.2).

Additionally, work-study consideration of waste measurements was demonstrated and the data were normalized to rank SAEI (SV) and AB MROs (Table 2.3).

Times were given in hours which were simulated for two working technicians for all sequenced processes and three inspection processes were accomplished by only one inspector (Table 2.4).

Table 2.4 PowerPlant Department, Engine Maintenance Processes Average Hours Collected for Three Different Companies.

Processes per Engine	*GE 1R	**GE 2R	SV MRO	AB MRO
1- Open up Access Panels	11.5	6.9	12	16
2- Stow Reverse plus Routine MTCE	4.8	2.9	8	4
3- Inspection	2.0	1.2	4	2
4- IDG Oil Change plus Routine MTCE	15.7	9.4	12	12
5- Engine Oil Change	2.0	1.2	2	2
6- Filters Change and Ignition System Check	11.8	7.1	16	14
7- Engine Baroscopic	5.6	3.4	4	8
8- Inspection	2.0	1.2	2	2
9- Plugs Close Up	3.9	2.3	4	3
10- Fan Blades & Shafts Lubrication	7.8	4.7	16	10
11- VIGV Rig & Routine check	10.5	6.3	8	12
12- Non-Routine Cards	31.4	18.8	30	35
13- Operational Check	20.7	12.4	32	18
14- Final Inspection	4.2	2.5	6	4
15- Pylon Corrosion Inhibiter Application	4.2	2.5	4	3
16- General Close up	11.8	7.1	24	12
Total processes Average hours	149.9	89.9	184	157

*Standard hours provided by GE representative for CF6-80 engine maintenance (one technician).
**Standard hours were adjusted for CF6-80 engine maintenance (two technicians) to match SV and AB.

SV MRO is consuming more hours compared to AB MRO in terms of total time (Figure 2.4). Some processes SV performed more efficiently than AB and vice versa in terms of ratio and proportion (Figure 2.5).

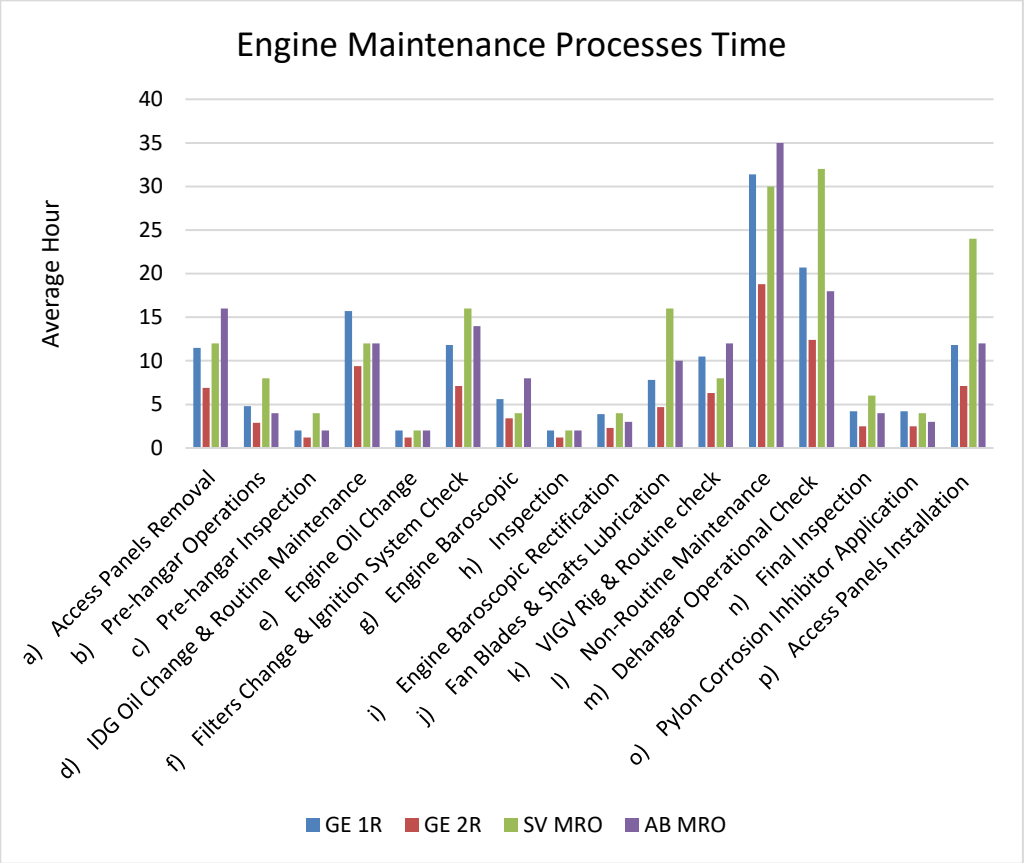

Figure 2.4 Processes Average Hours Comparison.

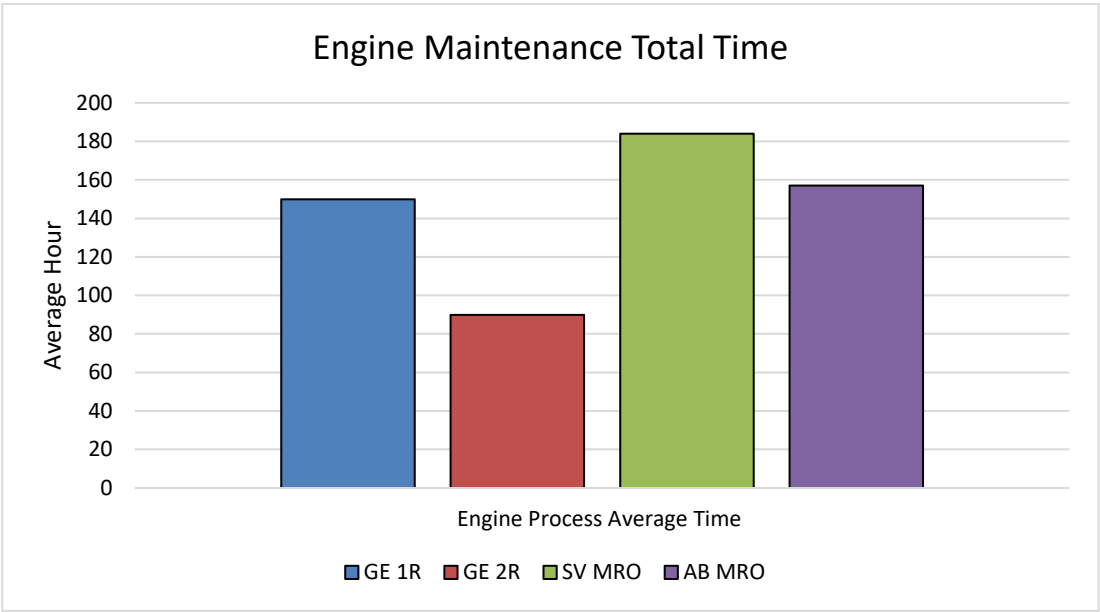

Figure 2.5 Total Average hours Comparison.

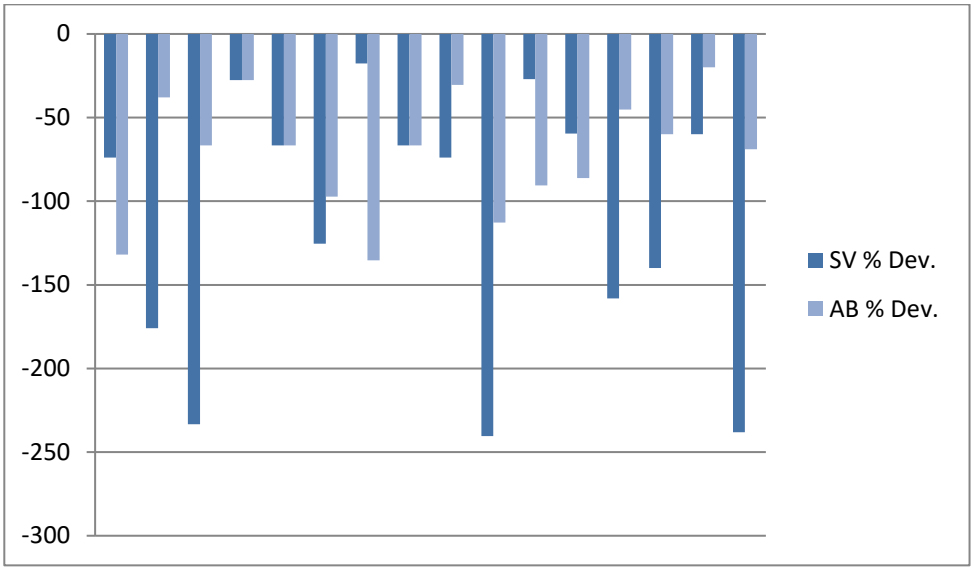

Figure 2.6 Percentage Deviations from Bench Mark.

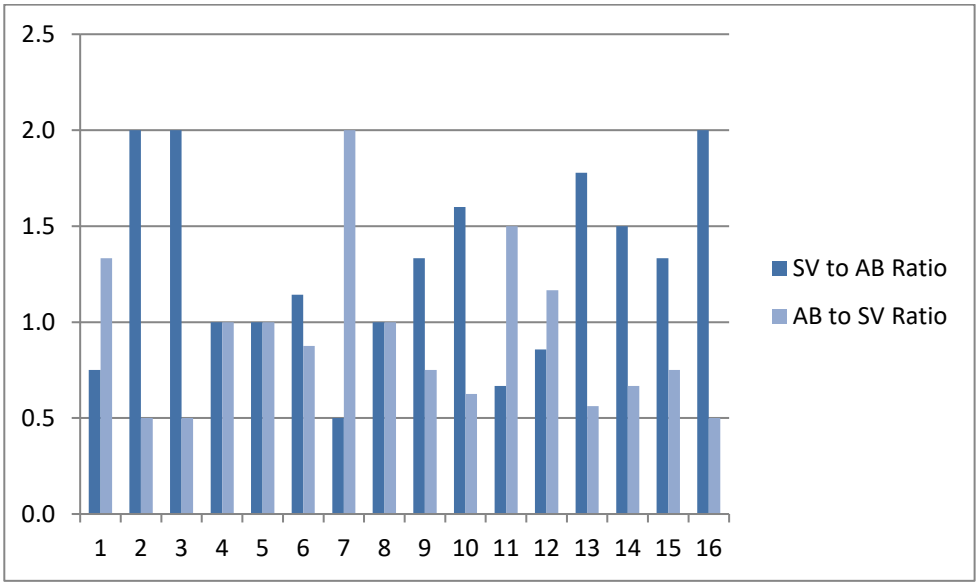

Figure 2.7 Ratio Comparisons between SV and AB.

Figure 2.6 indicated the ratio between SV and AB and Figure 2.7 and Table 2.5 showed SV and AB percentage deviation from the manufacturer benchmark.

Table 2.5 Comparison Summary from Table 2.2.

SV% Dev.	AB% Dev.	SV to AB Ratio	AB to SV Ratio
-74	-132	0.8	1.3
-178	-39	2.0	0.5
-233	-67	2.0	0.5
-27	-27	1.0	1.0
-67	-67	1.0	1.0
-126	-98	1.1	0.9
-19	-138	0.5	2.0
-67	-67	1.0	1.0
-71	-28	1.3	0.8
-242	-114	1.6	0.6
-27	-90	0.7	1.5
-59	-86	0.9	1.2
-158	-45	1.8	0.6
-138	-59	1.5	0.7
-59	-19	1.3	0.8
-239	-69	2.0	0.5
-105	-75	1.2	0.9

SV was utilizing 74% excess time to perform the first task and 104% excess time from the benchmark GE 1R total average hours. Presumably, SV is consuming almost double the average time to complete engine maintenance. Furthermore, SV was completing the maintenance by utilizing an excess average time of 17% compared to AB.

Difference between SV actual average hour and GE standard hours = 184 – 89.9 = 94.1 hours and difference percentage deviation = 94.1 / 89.9 = **104%**. This is more than the Difference between SV and AB = 184 – 157 = 27, thus the excess time utilized by SV compared to AB = 27 / 157 = **17%**.

2.13 Sheet Metal

SAEI is equipped with a full range sheet metal fabrication shop including disassembling, modifying, repairing and reassembling complex aircraft sheet metal systems including bulkheads, airframe spars, wing scoops, flaps, fuselages, skins, ribs, gussets, and internal and external fuel tanks structure [41, 31].

- Assesses maintenance and repair requirements for sheet metal components and assemblies using standard repair and technical manuals, service bulletins, and other approved data from ATA chapters,
- Provides technical information to engineers for the development of repairs outside of approved data scope when required,
- Performs approved repair operations to structures including sheet metal and other structures,
- Overhauls mechanical assemblies including repairs and part replacements,
- Documents maintenance/repair actions per company and FAA requirements,
- Maintains a safe and clean working environment,
- Read and interpret technical drawings,
- Perform layout patterns templates,
- Perform cutting of material to size,
- Form sheet metal with hand/machine tools,
- Perform cold-working of fastener holes,
- Perform sawing and routing of sheet metal,
- Perform stop drilling of small cracks in sheet metal,
- Perform fastening of sheet metal with rivets,
- Perform fastening of sheet metal using the bonding process,
- Perform punch and drilling of sheet metal,
- Perform dimpling and countersinking of sheet metal.

Chapter III

Boeing 747 – 400 "C" Check Maintenance Processes Simulation Models

3.1 Simulation Model Design

A simulation model was designed, developed, verified, and validated using Arena® simulation software to evaluate all the maintenance processes and tasks involved in the "C3" check that is performed on B747- 400 to search for possibilities of reducing the maintenance total time. Four models were built each of which mimicked one of the four departments (i.e., powerplant, airframe, cabin, and avionics). Once each model was completed, verified, and validated, a complete model was built to interconnect all four models.

3.2 Model Brief

- Aircraft arrives for a "C3" check and Engineering Orders (EO),
- Aircraft is scheduled for the check,
- Aircraft will be seized for different processes by different specialties to perform maintenance tasks.
- Once all the processes are completed, the aircraft will be airworthy and the simulation will stop.

A discrete event simulation using Arena® was used to model the various maintenance approaches. The simulation systems allowed insightful looking into hangar

maintenance activities in terms of how it takes to accomplish a task, cross-functional activities and priority, total time, waiting time, manpower scheduling and utilization statistics, and other relevant results like cost and revenue were involved.

Assumptions:

- Maintenance technicians adhere to the Technical Policies and Procedures (TP&P) of SAEI,
- Required tools and equipment for performing maintenance tasks are available.
- Aircraft parts are available (the maintenance will not stop due to shortages).
- Maintenance technicians are available (operations will not stop due to absenteeism).

3.3 PowerPlant Department

The powerplant department has three working crews (resources) that maintain propulsion systems in the ACFT. Each crew has 14 employees some of which are a day off, on training, and some are assigned to different ACFT other than 747. Only two technicians from each crew are assigned to the 747 - 400 “C3” check. Two on engines 1 and 2, two on engines 3 and 4, and two technicians on Auxilary Power Unit (APU) and EOs. This department will be simulated in two different models, the engine model, and the APU model.

3.3.1 Engine System Description

The 747 – 400 aircraft is equipped with four identical General Electric CF-60 Turbine Engines two of which are located on each wing. The powerplant department has three crews working consecutively and two of which crews are responsible for the maintenance tasks of the four engines; two engines per crew, (each crew has two

technicians), morning and afternoon shifts respectively (Figure 3.1). Shift change is due every two weeks from morning to night, from afternoon to morning, and from night to the afternoon shift.

In the "C3" check, most of the processes are routine maintenance. The "C3" maintenance package is distributed for each crew, tasks to be accomplished. Tasks rarely change; also major non-routine jobs are similar from one check to another.

The following checks and tests are performed during the pre hangar [39, 37]:

- Open up of engine access panels,
- Pylon access panels open up,
- Integrative Drive Generator (IDG) check,
- Thrust reverse operational check,
- Engine run,
- Aerodynamics smoothness inspection.

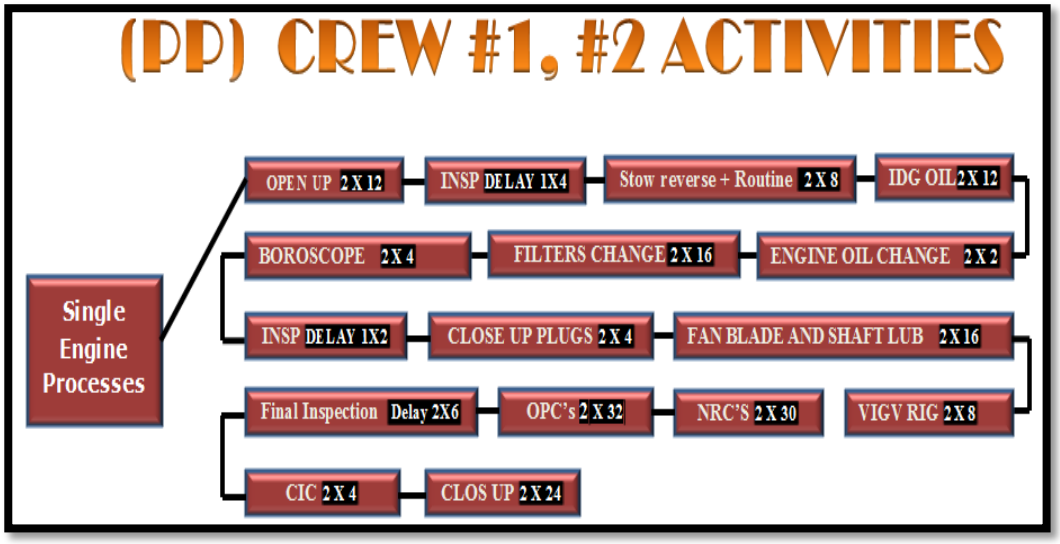

Figure 3.1 Engine Processes Schematic Diagram.

Two technicians (2 Resources) hours were adjusted for all tasks to match SV and AB MROs. The 2R is estimated by only 60% of the 1R standard hours' process estimate. A brief description of each task per one engine is listed and explained:

Process	GE 1R	GE 2R	SV MRO	AB MRO
1- Engine Open up Access Panels	11.5	6.9	12	16

Access panels open up is the main and first step of all sequenced processes. Sub-processes are as follows: cowl accesses, core panels, and pylon access panels. SV MRO recorded 12 hours, AB airlines estimated 16 hours while the standard time that was collected from GE representative showed 11.5 per one technician.

Process	GE 1R	GE 2R	SV MRO	AB MRO
2-Stow thrust Reverse, and begin routine maintenance precedence	4.8	2.9	8	4

Stowing the thrust reverse takes 2.9 (benchmark average hours) and 8 hours on average for SV, as well as half the time, is estimated for AB MRO.

Process	GE 1R	GE 2R	SV MRO	AB MRO
3- Inspection starts once all panels are opened	2.0	1.2	4	2

This step is accomplished by a single inspector to look for defects, loose bolts and cracks, damages, and for up normal conditions observed even in hidden cavities to satisfy the detailed visual inspection requirements. Findings are written in Non-Routine Cards (NRCs) and will be presented to technicians to repair per maintenance manuals procedure.

Process	GE 1R	GE 2R	SV MRO	AB MRO
4- IDG maintenance and oil change, after baroscopic	15.7	9.4	12	12

This step is accomplished in partial and then reinstalled after the internal inspection of the engine is satisfactory.

Process	GE 1R	GE 2R	SV MRO	AB MRO
5- Engine Oil Change after engine internal inspection	2.0	1.2	2	2

This process is the same as the previous IDG in terms of handling and servicing to be after the internal inspection is satisfied with other sub-processes and then the baroscopic inspection will start as the IDG oil drainage is completed and sold. Once this is completed, the rectification of baroscope access plugs is due.

Process	GE 1R	GE 2R	SV MRO	AB MRO
6- Filters Change and Ignition System Routine check	11.8	7.1	16	14

Ignition cable, starter air filter, exciter boxes check and all other hydraulic, fuel, and oil filters are due for replacement and/or cleaning. These sub-processes are completed consecutively and SV consumes 16 hours on average around two full shifts by two technicians to complete the task.

Process	GE 1R	GE 2R	SV MRO	AB MRO
7- Engine Baroscopic (Internal accessing) all locations	5.6	3.4	4	8
8- Inspection of the internal sides by the inspector also	2.0	1.2	2	2
9- Plugs Close Up immediately and secure all locations	3.9	2.3	4	3

A major part and critical decision will be made if possible damage is observed inside the engine shafts, blades, and seals or rings as well as all internal components during the baroscopic inspection. Once this inspection is satisfactory, plugs close up immediately initiated, IDG, Engine oil, and rectifications are due after filters accomplishment.

Process	GE 1R	GE 2R	SV MRO	AB MRO
10- Fan Blades & Shafts, rings, and bearings Lubrication	7.8	4.7	16	10

Lubrication is a no-callback item, AB MRO and GE do not require inspection. However, SV recorded excess time in this process due to their inspection requirement of lubrication and cleaning of excess lubrication if the inspector rejected the task. This is why SV consumes a significant amount of time performing lubrications.

Process	GE 1R	GE 2R	SV MRO	AB MRO
11- VIGV Rig and routine cards, installation and rig	10.5	6.3	8	12

Variable inlet guide vanes are to be disconnected for access. Adjustment is required at reinstalling stage and that must be rectified at the end.

Process	GE 1R	GE 2R	SV MRO	AB MRO
12- Non-Routine Cards from first inspection step	31.4	18.8	30	35

This is a pre-evaluated process to document all the inspection findings by the inspection team. These findings will be evaluated to decide what action is to be taken from material requirements to internal and external engineering team involvement.

Process	GE 1R	GE 2R	SV MRO	AB MRO
13- Operational and functional check	20.7	12.4	32	18

This is a critical step, a decision to be made while operating engines, its output parameters and indications are vital and need to be within the maintenance manual limits and tolerances.

Process	GE 1R	GE 2R	SV MRO	AB MRO
14- Final Inspection by inspection when package is signed	4.2	2.5	6	4
15- Pylon Corrosion Inhibiter Application (preventative)	4.2	2.5	4	3
16- General Close up of all accesses or/and components	11.8	7.1	24	12

Finally, the “C” check package is audited for completion and appropriate buyouts for each task. Planners ensure that there are no open items before engines start for safety purposes and final detail visual inspections are performed to confirm close up after the 14^{th} and 15^{th} steps were satisfactorily accomplished. Also, inspection after close-up is practiced to ensure the panels' final security is properly performed.

3.3.2 Engine “C” Check Simulation Model

The manpower is assigned from day one to start opening up the access panels for the inspection team, crew #1 supervisor, for example, will send two technicians to work on engine #1 (i.e., open up), and after that, they become idle for the delay created for the inspection time that is accomplished by an inspector. The inspection utilization results are not discussed in the study and their delay time was included as “other time” in the simulation report). However, the two engine technicians were waiting to perform the next process, which will be delayed until after the inspector releases the entity (engine #1) for these technicians to begin their second process. The nature of these patterns creates “waiting time” through the complete “ C” check and will be accumulated in the ACFT total time.

Two technicians per engine (a senior and a junior technician) for an 8-hour shift, in other words, two resources are working simultaneously. Two engines are seized by their resources on the morning shift and the other two engines on the afternoon shift. Seize / delay/release function was selected serially, however, the four entities (i.e., engines) are performed in parallel, and each resource is taken from the resource pool

and grouped from a “resource set”. To model that, two sets were created and each of which model has four resources (first set: Senior 1, Senior 2, Senior 3, and Senior 4; Second set: Junior 1, Junior 2, Junior 3, and Junior 4). Senior 1 and Junior 1 are assigned to engine #1 on the morning shift and Senior 2 and Junior 2 on the morning shift are assigned to engine #2 (6:00 AM – 2:00 PM). Shift change will occur every two weeks and the night shift resources will move to the morning shift. Likewise, engine #3 is seized by Senior 3 and Junior 3 and engine #4 by Senior 4 and Junior 4 but on the afternoon shift (2:00 PM – 10:00 PM) and be changing shift to morning shift after two weeks as well. Engines #1 and #2 processes are identical, however, the resources scheduled break time is different. Excessive break time in the afternoon shift schedule is modeled and simulated (employees perform Asur, Magreb, and Isha prayers). Therefore, the “pre-empt rule” for the resources break schedule was selected. The following process blocks were created to simulate the “C” check and each will be explained in detail:

Create module: Engines arrival was formulated by a constant value of 4 arriving at time zero with a maximum arrival of 1.

Assign module: A variable was defined “= Index + 1” where engine #1 will take a value of 0 and the second engine will take a value of 1 and so on until entity four will be represented in the model as a value of 3. This was performed to assign “Entity Types” and “Entity Pictures” attributes for each entity respectively (e.g., engine #1 Type and Picture were unique and carried the value 0). Furthermore, the resources (i.e., technicians) were gathered respectively, in the same manner, to specify them in the process resource window: “Senior Technician Set” and “Junior Technician Set” were added to the process resource window and were selected in the type as a “***specific member”*** in which to attach the entity attribute (i.e., engine type and picture) for the

"Set Index" called "***Entity Type***". This will ensure that each resource will be assigned to its respective entity in which to avoid dependency and overlapping.

Table 3.1 Important Factors Considered During Modeling.

Operational factor	Scheduling Assignment factor	Resource Allocation
Average 0.25 hours late*	Two Resources per engine*	Morning, Afternoon*

(*) represents the actual current configuration of the system

Replication length was established by a "**terminating condition"** at the run/set /up window in which to stop the simulation run at the time that the entity index variable counts 4th entity (value of 3) is out of the close-up process block and moving to the disposal block [expression:(Engine Close Up.NumberOut == 4)] (Figures 3.2 – 3.12).

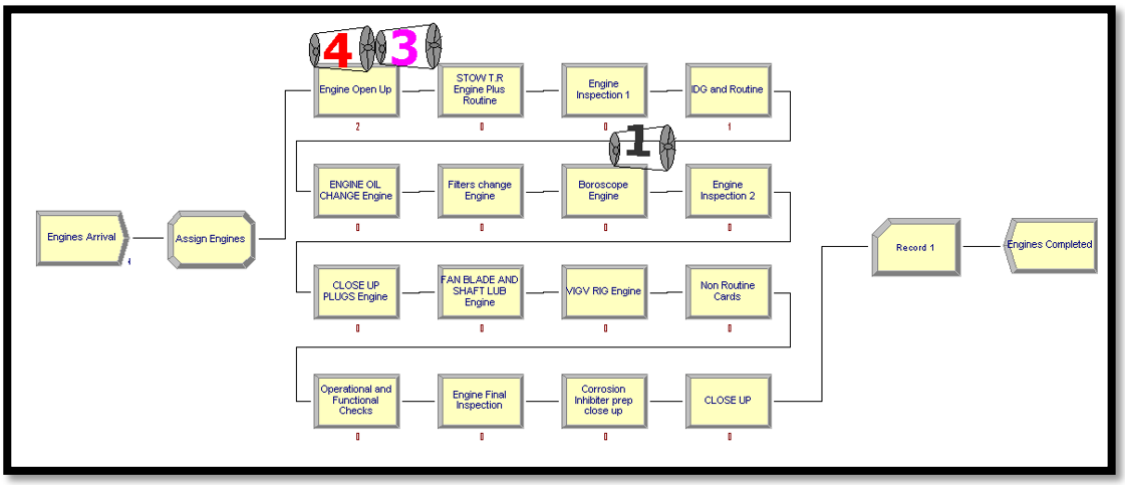

Figure 3.2 Engine Model.

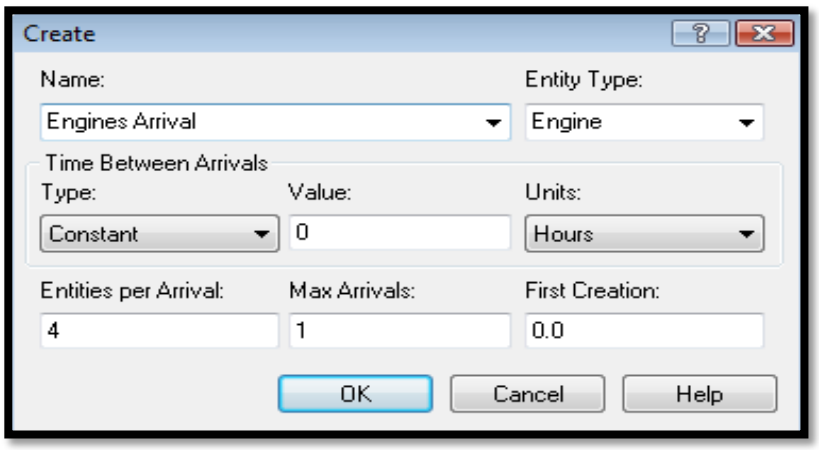

Figure 3.3 Engine Model Create Module.

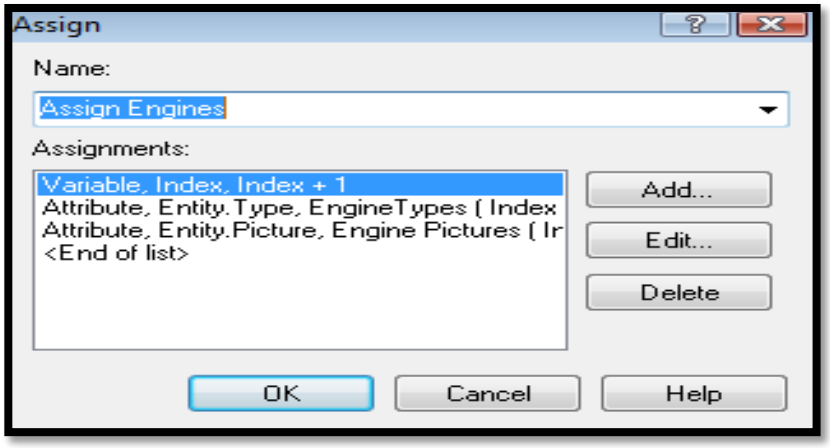

Figure 3.4 Engine Model Assign Module.

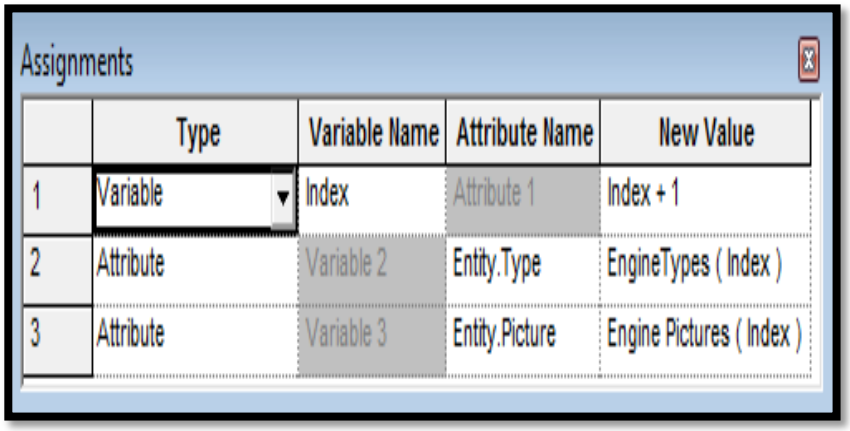

Figure 3.5 Engine Model Assignments Logic.

Set - Basic Process

	Name	Type	Members
1	EngineTypes	Entity Type	4 rows
2	Engine Pictures	Entity Picture	4 rows
3	Senior Technicians	Resource	4 rows
4	Jonior Technicians	Resource	4 rows
5	Inspectors	Resource	4 rows

Members

	Entity Type
1	Engine 1
2	Engine 2
3	Engine 3
4	Engine 4

Figure 3.6 Engine Model Entity Type Set.

Resource - Basic Process

	Name	Type	Schedule Name	Schedule Rule	Busy / Hour	Idle / Hour
1	Senior 1	Based on Schedule	Morning Shift	Preempt	125	125
2	Senior 2	Based on Schedule	Morning Shift	Preempt	125	125
3	Senior 3	Based on Schedule	Afternoon Shift	Preempt	125	125
4	Senior 4	Based on Schedule	Afternoon Shift	Preempt	125	125
5	Jonior 1	Based on Schedule	Morning Shift	Preempt	80	80
6	Jonior 2	Based on Schedule	Morning Shift	Preempt	80	80
7	Jonior 3	Based on Schedule	Afternoon Shift	Preempt	80	80
8	Jonior 4	Based on Schedule	Afternoon Shift	Preempt	80	80
9	Inspector 1	Based on Schedule	Morning Shift	Preempt	135	0.0
10	Inspector 2	Based on Schedule	Morning Shift	Preempt	135	0.0
11	Inspector 3	Based on Schedule	Afternoon Shift	Preempt	135	0.0
12	Inspector 4	Based on Schedule	Afternoon Shift	Preempt	135	0.0

Figure 3.7 Engine Model Resources Pool.

Schedule - Basic Process

	Name	Type	Time Units	Scale Factor	Durations
1	Morning Night Shift	Capacity	Quarterhours	1.0	248 rows
2	Afternoon Morning Shift	Capacity	Quarterhours	1.0	240 rows

Figure 3.8 Engine Model Arrival and Resources Schedule.

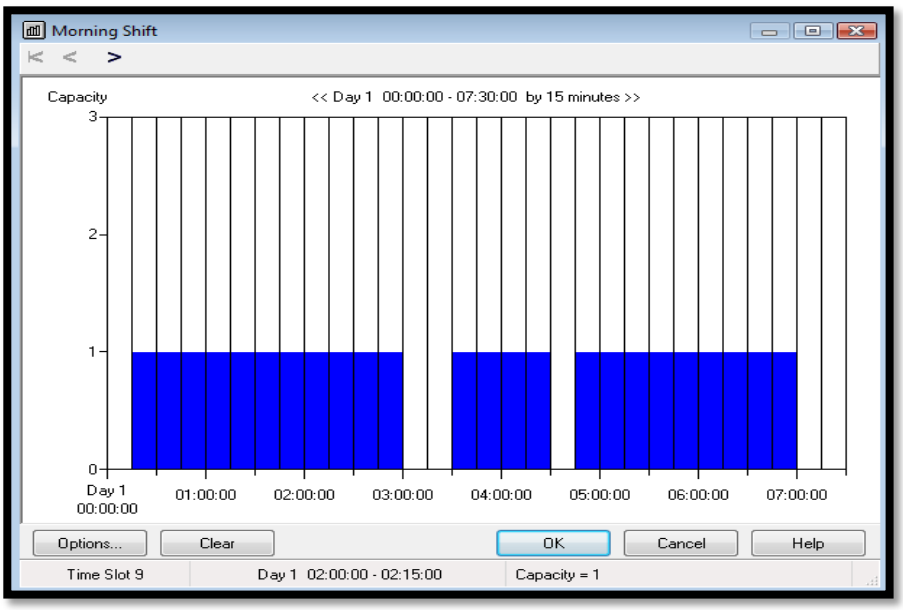

Figure 3.9 Engine Model Resources Morning Shift Schedule.

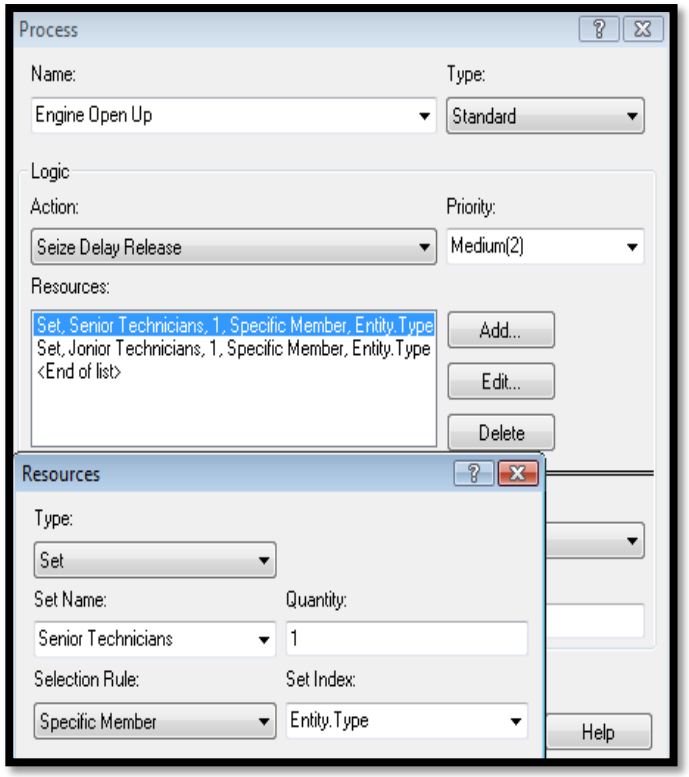

Figure 3.10 Engine Model Resource Selection Rule for a Process.

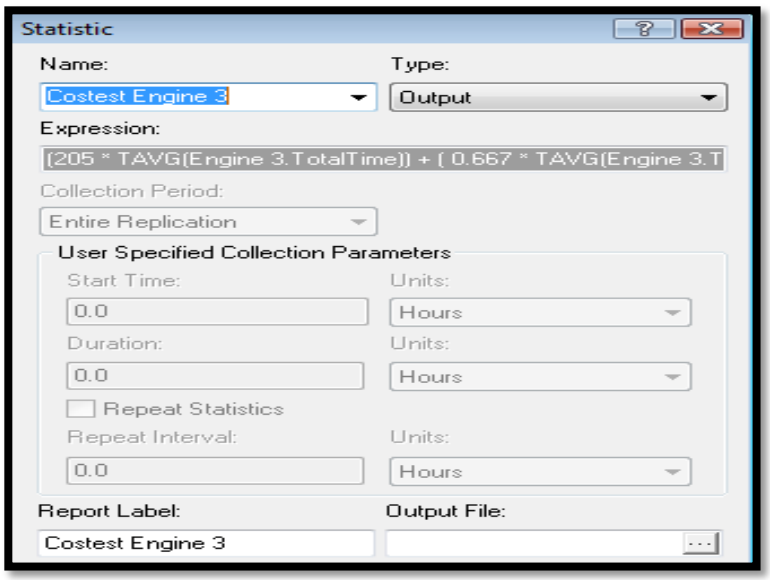

Figure 3.11 Engine Model (Resources and Lost Revenue) Costs Formula.

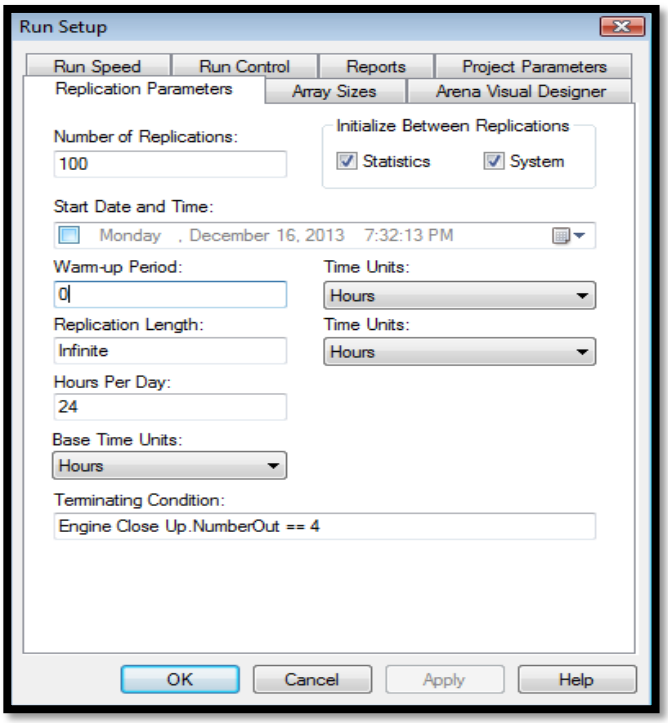

Figure 3.12 Engine Model Run / Set / Up Window.

3.3.3 Engine Model Verification and Validation

This model has been tested for undefined cells, bugs, errors, and warnings to simulate the engine maintenance process. The four engines were simulated at the same time to ensure that each engine process logic was mimicked independently. Each engine model produced the same results when tested individually and when tested within the four engines combined model.

Moreover, the previously collected data to compare manufacturer data and other MOR facilities to SV MRO facilities were simulated and the results indicated that the model was valid and ready to run. Uniform distribution was utilized for the engine simulation model with + or – 20% of the processing time due to the variability that was captured in the average processing time from the 5 years of actual data that was collected for SV MRO. Demonstration of the simulation results of the two other facilities AB and GE with their different average hours for each process was beneficial for comparison purposes.

Again, the difference between actual and simulated results was not significant and was a result of natural variability. Also, the difference was reduced when uniform distribution was used with less than + or - 20% of the average time of an engine process. This showed the excessive time that SV MRO consumed to maintain an engine. Simulation results and actual data indicated model stability when compared between outputs. The total processes time of an engine when maintained by the manufacturer was shorter than SV MRO's total time by approximately 100% (91.93 hours – 186.38 hours) (Table 3.2).

Table 3.2 Engine Model Validation, Simulated vs. Actual Metrics from Data Collected on Table 2.2.

	GE			SV MRO		
Processes per Engine	Actual Time	***Simulated***	**Diff.**	Actual Time	***Simulated***	**Diff.**
1- Open up Access Panels (hours)	6.9	6.02	0.88	12	11.11	0.89
2- Stow Reverse plus Routine	2.9	2.76	0.14	8	8.92	-0.92
3- Pre Inspection	1.2	2.01	-0.81	4	4.81	-0.81
4- IDG Oil Change plus Routine	9.4	9.6	-0.20	12	12.71	-0.71
5- Engine Oil Change	1.2	2.01	-0.81	2	2.49	-0.49
6- Filters Change & Ignition Check	7.1	7.02	0.08	16	15.71	0.29
7- Engine Baroscopic	3.4	4	-0.60	4	4.92	-0.92
8- Inspection	1.2	1.99	-0.79	2	2.15	-0.15
9- Plugs Close Up	2.3	2.5	-0.20	4	4.24	-0.24
10-Fan Blades & Shafts Lubrication	4.7	5.04	-0.34	16	15.11	0.89
11- VIGV Rig & Routine Check	6.3	6.49	-0.19	8	8.26	-0.26
12- Non-Routine Cards	18.8	19.06	-0.26	30	29.82	0.18
13- Operational Check	12.4	11.96	0.44	32	30.91	1.09
14- Final Inspection	2.5	1.47	1.03	6	6.73	-0.73
15- Pylon Corrosion Inhibiter	2.5	2.51	-0.01	4	4.99	-0.99
16- General Close up	7.1	7.49	-0.39	24	23.5	0.5
Total processes Average hours	**89.9**	**91.93**	-2.03	**184**	**186.38**	-2.38

Wait time statistics from the simulation output report were affected by the 24-hours base time selection (Figure 3.13). However, 8-hours per day and 16-hours per day were more adequate for modeling actual system representation, especially for the cost, entity wait time, and resources utilization (night shift crew does not maintain engines, only APU).

After testing, resources utilization was captured by the frequency statistics rather than the scheduled utilization thaw is shown in Table 3.4 below. Therefore, instantaneous utilization indicated accurate results representation (Figure 3.13).

Senior 1 State	Number Obs	Average Time	Standard Percent
BUSY	47	9.6359	59.92
IDLE	25	1.3945	4.61
INACTIVE	66	4.0626	35.47
Senior 2 State	**Number Obs**	**Average Time**	**Standard Percent**
BUSY	42	11.2651	62.59
IDLE	23	1.4290	4.35
INACTIVE	59	4.2353	33.06

Figure 3.13 Engine Model Frequencies Statistics for Different Resources States.

Busy: when the technician is performing engine maintenance.

Idle: when the technician is not performing engine maintenance while being scheduled (queue waiting time). Break time is scheduled and will show as an Idle time.

Inactive: when the technician is not performing engine maintenance and is not scheduled (technicians are not at work). This is the hours of wait time until the entity will have a scheduled resource

The simulation model will calculate the cost only when the resource is busy and/or idle. A resource inactive state represents almost 2/3 of the total time percentage and should be associated with the cost because SV MRO technicians' based pay is daily and not hourly (only overtime is calculated hourly). Therefore, the daily-based pay was converted to hourly-based pay for easier representation of the total cost.

The difference between based hour selection showed that only wait time and utilization are affected because of the inactive time of technicians and besides that, value-added times were very similar, which also indicated the validity of the model (Table 3.3).

Table 3.3 Engine Model Actual System Results for Different "Based Hours per Day" Comparison between Processes Time and Cost Statistics.

8-hr per Day	Maint. VA Time	Maint. Cost (SR)	Insp. VA Time	Insp. Cost (SR)	Time Total	Total Cost (SR)
Engine 1	169.42	34731	11.07	1495	222.08	40599
Engine 2	168.96	34636	11.44	1544	221.97	39952
Engine 3	168.87	34617	11.23	1516	240.13	41564
Engine 4	168.87	34618	11.22	1515	240.10	42305
16-hr per Day						
Engine 1	169.23	34693	11.27	1521	440.51	60467
Engine 2	170.03	34855	11.35	1532	442.38	61138
Engine 3	169.58	34763	11.24	1517	485.72	66198
Engine 4	170.32	34916	11.30	1525	488.31	66224
24-hr per Day						
Engine 1	169.23	34693	11.27	1521	658.91	83016
Engine 2	170.03	34855	11.35	1532	661.58	82037
Engine 3	169.58	34763	11.24	1517	722.38	87914
Engine 4	170.32	34916	11.30	1525	726.41	88501
						341468

Table 3.4 Engine Model Results in Actual System Different "Based Hours per Day" Comparison between Resources Utilization Statistics.

8-hr Model

Resources	Instan.Utiliz.	NO. Busy	NO. Sched.	Shed. Utiliz.	Busy Cost	Idle Cost*
Junior 1	0.73	0.73	0.81	0.89	13009	2251
Junior 2	0.79	0.79	0.81	0.97	14142	2288
Junior 3	0.83	0.83	0.75	1.11	14919	1074
Junior 4	0.76	0.76	0.75	1.02	13739	1074
Senior 1	0.81	0.81	0.81	0.99	22511	3517
Senior 2	0.74	0.74	0.81	0.91	20612	3575
Senior 3	0.78	0.78	0.75	1.04	21906	1678
Senior 4	0.85	0.85	0.75	1.13	23748	1677

16-hr Model

Junior 1	0.59	0.59	0.41	1.46	22532	2599
Junior 2	0.60	0.60	0.41	1.49	22905	2535
Junior 3	0.57	0.57	0.38	1.53	22004	1115
Junior 4	0.58	0.58	0.38	1.55	22353	1056
Senior 1	0.57	0.57	0.41	1.40	33718	4060
Senior 2	0.57	0.57	0.41	1.40	33578	3961
Senior 3	0.70	0.70	0.38	1.86	41307	1742
Senior 4	0.69	0.69	0.38	1.84	40897	1649

24-hr Model

Junior 1	0.48	0.48	0.27	1.76	28402	2599
Junior 2	0.55	0.55	0.27	2.01	31434	2535
Junior 3	0.58	0.58	0.25	2.32	33194	1115
Junior 4	0.57	0.57	0.25	2.28	32345	1056
Senior 1	0.58	0.58	0.27	2.12	51661	4060
Senior 2	0.52	0.52	0.27	1.89	47582	3961
Senior 3	0.58	0.58	0.25	2.34	51833	1742
Senior 4	0.59	0.59	0.25	2.37	53182	1649

*All cost is in Saudi Riyals (SR).

3.3.4 Engine Model Sample Size Estimation

An adequate number of replications was selected with a 95% confidence interval for calculated cost and at the same time to avoid skewed total time. A 100 replications were the optimum number that would produce the total cost range and reduce it from 3159.7 (SR) half widths to 1000 (SR) with 95% confidence interval half widths (Table 3.5). An educated guess of 10 replications was initially selected. Then, the 10 different output results of the total cost (minimum, maximum, and half widths) were analyzed for their descriptive statistics (actual cost matched the 10 replication output).

Moreover, two formulas were applied to develop (h): the desired half-width with a 95% confidence interval and depending on the (h node): the actual half width from the ten replications, (n): number of replications = 10 replications * ((standard deviation^2) / (h^2)) as follow: 10*((4417.07^2) / (1000^2)) = 74.9 or 75 replications as a first approximation. The first approximation may allow for a higher value of (n) because the student ***t*** distribution value was used rather than the ***z*** value.

Finally, a second approximation was performed to estimate (n) utilizing (h node) value as follow:

(n): number of replications = 10 replications * ((ho^2) / (h^2)) as follow:

10*((3159.783^2) / (1000^2)) = 99.8 replications. Therefore, 100 replications were performed to achieve the desired goal of 1000 (SR) total cost half-width (the initial half-width cost with one replication (h)) with a confidence interval of a 95%.

Table 3.5 Engine Model Ten Replications Single Resource Total Cost.

NO. of Replication	Total Cost (SR)
1	89,591.19
2	79,108.25
3	77,486.39
4	77,644.57
5	78,303.19
6	83,228.88
7	84,957.19
8	86,581.18
9	82,751.61
10	76,903.27

Engine Model Ten Replications Descriptive Statistics of Cost (SR)	
Sample Mean	81,655.572
Sample Standard Deviation	4,417.073319
95% Confidence Interval Half Width	3,159.783903
Minimum Summary Output Value	76,903.27
Maximum Summary Output Value	89,591.19

3.3.5 Auxiliary Power Unit (APU) and Engineering Orders (EOs) System Description

An **auxiliary power unit** (**APU**) is a device on a vehicle that provides energy for functions other than propulsion. They are commonly found on large aircraft, naval ships, as well as some large land vehicles. Aircraft APU generally produces 115V at 400 Hz, rather than 50/60 Hz in main supply, to run the electrical systems of an aircraft; others can produce 28V DC. An APU can provide power through single or three-phase systems.

APU is the fifth turbine engine installed in an aircraft located at the aft fuselage section to supply electricity and pneumatic air during ground times and flight time when needed. Also, it is the main source used for starting one or all of the turbine engines before a flight, usually, APU is turned off when ACFT is in flight, however, it can be turned on during flight for an emergency to generate electric power and/or pneumatic air. APU is an assembly that is equipped with two generators both are used simultaneously when APU is running, one is feeding the ACFT and the other is a backup (stand by) when a power drop occurs. This unit is removed and reinstalled as an assembly and also can be overhauled at a specialized shop. During “C” check maintenance the APU routine cards and non-routine findings are held until the ACFT is inside the hangar to start performing the job needed. Usually, the manpower assigned for the APU and EOs is four technicians throughout the entire “C” check process. Moreover, a schematic diagram was constructed to represent the APU and EOs processes and the estimated time to perform each task (Figure 3.14).

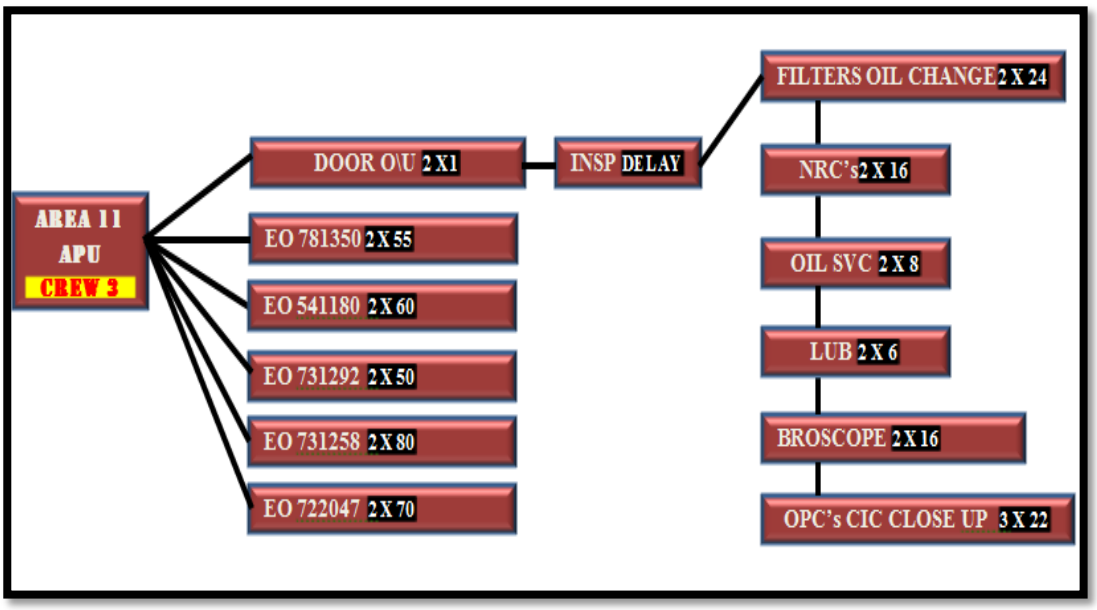

Figure 3.14 APU and EOs Process Schematic Diagram.

Door Open up: It is the APU door open up; two technicians will accomplish the open up including the preparation (platform, tools, etc.) in one-hour constant time.

Inspection delay: Inspector is the person who is responsible for evaluating the area after the technicians have opened up the door and also is responsible for raising non-routine cards.

NRCs: Non-Routine Cards: Findings are written in Cards based on inspection or/and technicians.

LUB: Lubrication of all required areas per the maintenance manual and task card.

Filter change: Cleaning or replacement of the old filters based on the condition mentioned in the routine card.

Oil service: The maintenance manual instructs the technician to make sure the correct oil type is used and the appropriate level is measured.

Operational check: (OPC's) check is the functional check of the APU after accomplishing all tasks including the **CIC**, which is the corrosion inhibitor compound,

that is applied in the external areas of APU and the internal compartment of the APU. Finally, a close-up of the door is required after making sure all the tasks have been completed and bought off including the ok to close door stamp by an inspector.

EOs: Engineering orders are tasks that are originally raised from the manufacturer for modifications and/or inspection to provide data on the system condition, some other EOs are accomplished based on historical findings. Some of these EOs are labeled as Airworthiness Directives (Ads) and be performed during these types of maintenance phases.

On the other hand, the main processes are often routine tasks such as the oil change, filters cleaning, fuel valves inspection, leakage check, and operational performance testing.

3.3.6 APU and EOs "C" Check Maintenance Model

First, the entity (APU and EOs) will enter the system through the **create module** and be assigned with "Entity Type" named *APU* and a picture of a *blue engine* in the "**Assign Module**.**"** These entities will go through processing and passes a "**Duplicate"** block to generate a duplicate of the APU for the EO's segment. One entity passes to the upper processes segment and the other one to the lower processes segment (parallel processing) where two technicians were assigned to be seized in each processing segment (Figure 2).

Finally, the original entity and the two duplicated entities will be released through the "**Group"** block, which may leave the system without batching. The simulation termination rule was used during the last process via the Run/set/up window expressed as follows: if (Entity Number.Out = = 3) at both close-up and the last EO simulation stops.

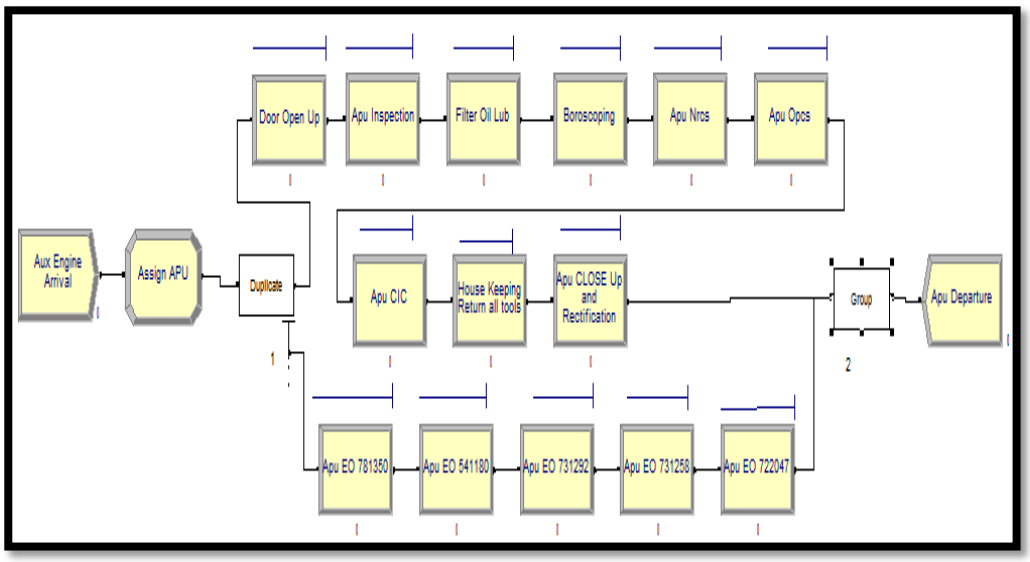

Figure 3.15 APU and EO's Model.

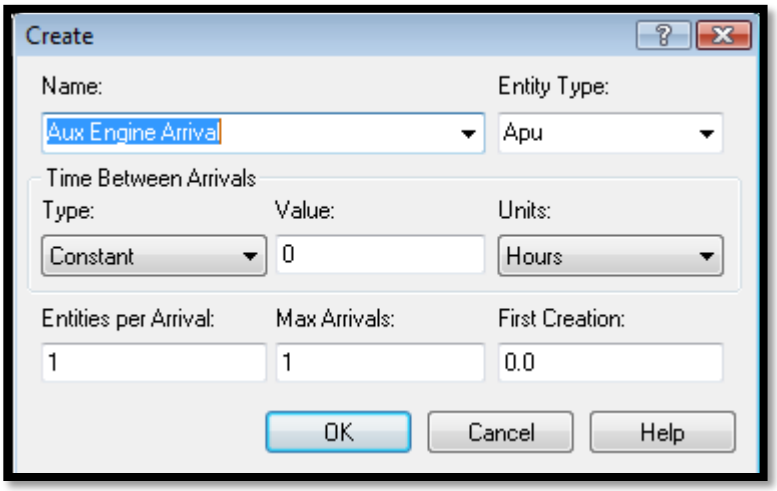

Figure 3.16 APU and EO's Model Create Module.

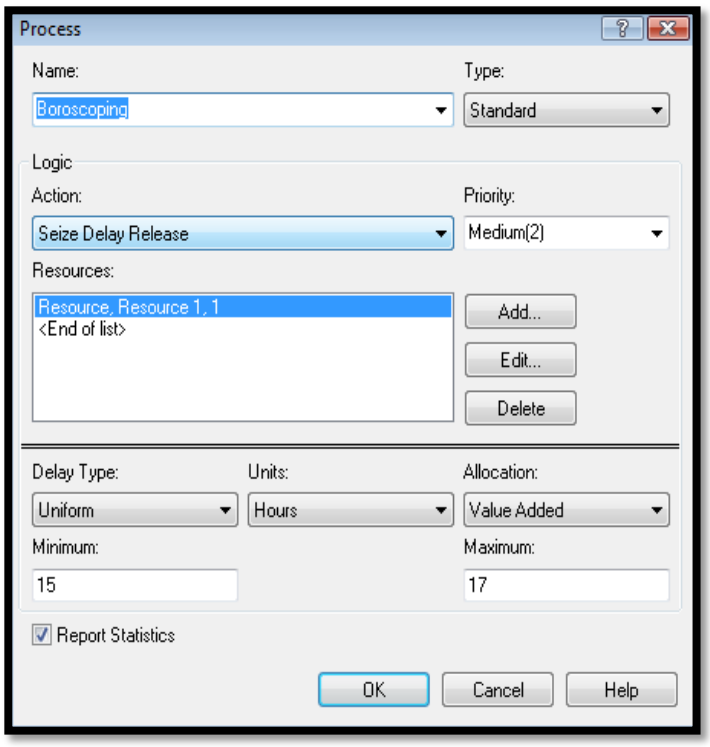

Figure 3.17 APU Baroscopic Process.

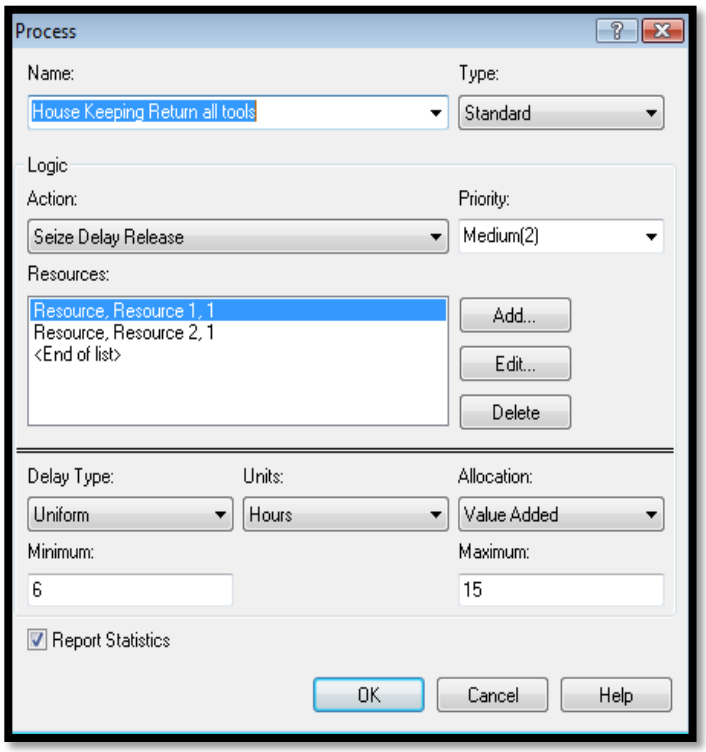

Figure 3.18 APU and EO's Model Housekeeping & returns all tools Process.

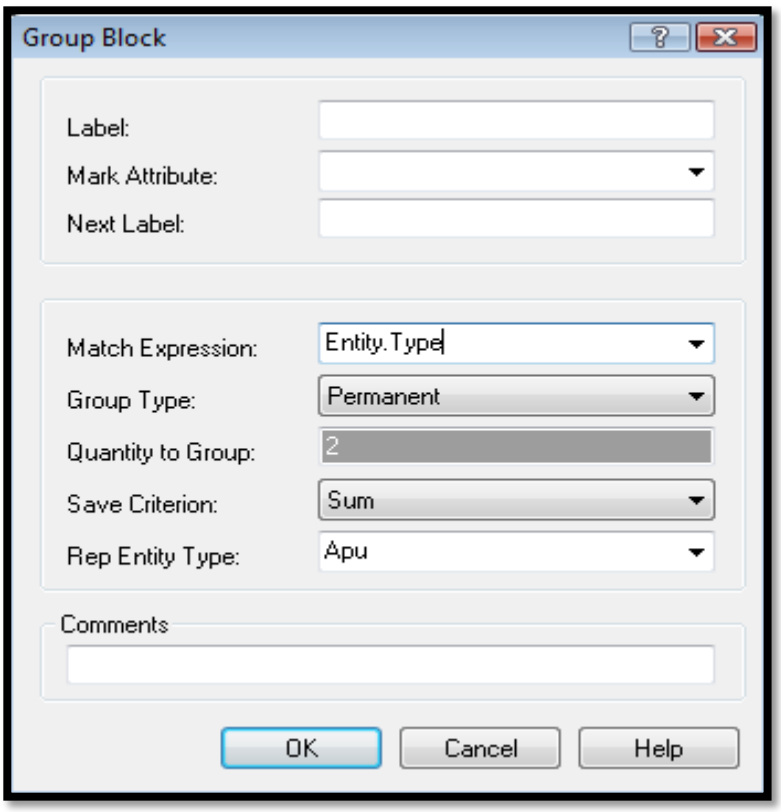

Figure 3.19 APU and EO's Model Group Block.

3.3.7 APU and EOs Model Verification and Validation

Model validation is the lengthiest step of modeling [3], and as a user of the system for more than ten years. It is found that the outputs (dynamic statistics) were representing the actual system with an average total time and waiting time which may vary depending on delays and some other uncontrollable factors. However, the variability was accounted for in this modeling where the uniform distribution was utilized to estimate all potential times between the minimum and maximum values with- of 20% of the actual process time.

3.3.8 APU and EOs Model Sample Size Estimation

A 100 replication was the optimum number to test the cost calculation range from 50,000 (SR) half widths to 35,000 (SR) with 95% Confidence. First, 10 replications

were performed. Then, the 10 different output results of the total cost (minimum, maximum, and half widths) were analyzed for their descriptive statistics (actual cost matched the 10 replication output).

Moreover, two formulas were applied to develop (h): the desired half-width with a 95% confidence interval and depending on the (h node): the actual half width from the ten replications, (n): number of replications = 10 replications * ((standard deviation^2) / (h^2)) as follow: 10*((107,435.28^2) / (35000^2)) = 94 replications as a first approximation. The first approximation may allow for a higher value of (n) because the student ***t*** distribution value was used rather than the ***z*** value.

Table 3.6 APU and EOs Model Ten Replications Single Resource Total Cost.

NO. of Replication	Total Cost (SR)
1	4,904,628.70
2	4,594,046.60
3	4.570,884.62
4	4.728,692.72
5	4,761,198.44
6	4,769,166.65
7	4,752,619.29
8	4,899,377.26
9	4,758,056.80
10	4,765,387.41

APU Model Ten Replications Descriptive Statistics of Cost (SR)	
Sample Mean	4,750,405.85
Sample Standard Deviation	107,435.28
95% Confidence Interval Half Width	76,854.57
Minimum Summary Output Value	4,570,884.62
Maximum Summary Output Value	4,904,628.70

Finally, a second approximation was performed to estimate (n) utilizing (h node) value as follow:

(n): number of replications = 10 replications * ((ho^2) / (h^2)) as follow:

10*((76,854.57^2) / (35000^2)) = 50 replications. Therefore, 50 replications were performed to achieve the desired goal of 35,000 (SR) total cost half-width (the initial half-width cost with one replication (h)) with a confidence interval of a 95% (Table 3.6).

3.4 747-400 Cabin Features

The 747-400's glass cockpit features CRT displays that show flight instrumentation along with engine indication and crew alerting system (EICAS) diagnostics. The flight engineer station on the previous 747 classic models was eliminated, and the new displays and simplified layout resulted in a 75% reduction of switches, lights, and gauges. Other new systems include an advanced Honeywell Flight Management Computer (FMC) which assists pilots in calculating optimal altitudes and routes along with a Rockwell-Collins Central Maintenance Computer (CMC) that automates troubleshooting tasks.

The redesigned 747-400 interior features new cabin sidewalls, heat-resistant phenolic glass, carbon composite paneling, and larger storage bins. An enhanced in-flight entertainment framework, called the Advanced Cabin Entertainment Service System (ACESS), integrates 18-channel audio capability, four-passenger intercom announcement zones, inter-cabin telephones, and passenger lighting into a central system. Eight-bunk overhead crew rest is installed above the aft cabin, while a second crew rest area is located on the upper deck behind the cockpit for flight crew use.

3.4.1 Cabin Department System Description

Cabin department processes are somewhat identical and performed in series. Three processes are not identical between the three-cabin crews which are galley

maintenance for crew 1, canted pressure deck area for crew 2, and the crew rest area for crew 3. Each process has its time needed and the allocated manpower. The cockpit compartment is also part of the cabin department; however, the cockpit is handled by a single technician who works only the morning shift and does all the routine tasks (Figure 3.20).

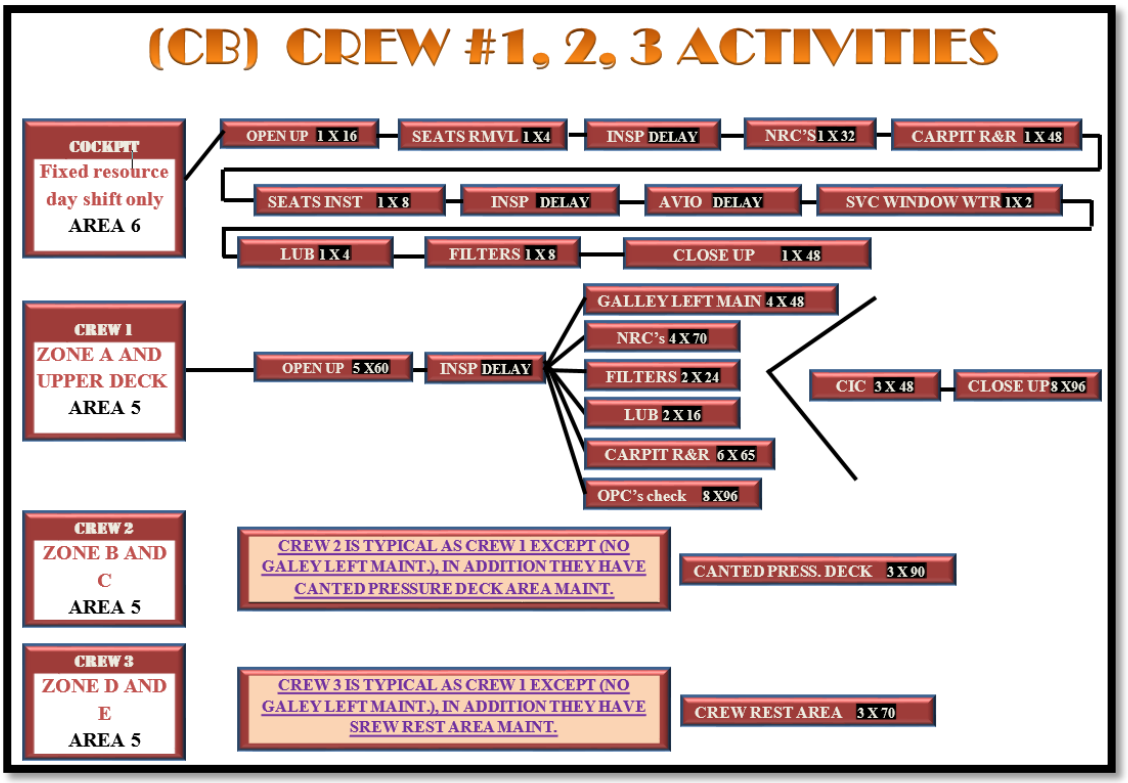

Figure 3.20 Cabin Department System Schematic Diagram.

3.4.2 Cabin Department "C" Check Maintenance Model

The ACFT cabin is divided into Zones, A through F. A and B zones are combined into "Zone 1" which is maintained by crew 1. Zone 2 (Zone C and D) is maintained by crew 2 and Zone 3 (Zone E and F) is maintained by crew 3.

As shown in Figure 3.23, Zone 1 is the interior from the front side of the aircraft until the second entry doors of the first and business classes including the upper deck and

excluding the cockpit compartment. Zone 2 starts at the end of Zone 1 until the middle area of the aircraft cabin, Zone 3 starts at the end of Zone 2 until the backside of the aircraft called the aft pressure bulkhead. All zones will be combined into one model with the assignment of entities as follows: Zones 1, 2, and 3 are identical; however, in the cabin model some processes are not identical and will differ from one Zone to another. Therefore, a "**Sub-Model"** (Figures 3.26 and 3.27) was created to differentiate between these processes with their time, and their assigned technicians were selected accordingly. Also, a "**Branch"** module (Figures 3.24 and 3.25) was added to decide where a specified zone process will be seized next to its correct process module. For example, the task of opening up each zone will consume a different time, so once the entity "zone 1" arrives at the "**Branch"** module, it will direct the resources to open up Zone 1 by the decision expression (IF (Entity. Type == Zone 1)) condition, which facilitated easier validation for the system during modeling.

This entity will then be processed for open up and after that will be sent to a seized-delay-release "**Process"** module for an inspection phase, afterwards, it enters another **"Branch"** module which is not like the previous branch module but to branch the entities (zones) by matching expression of the assignment module earlier with entity variable **"Index + 1"**, so once the entity is in the branching module, the entities will be branched into three sets of series of processes until it arrives at the close-up **"Process"** module where it is synchronized to it after it is combined by a **"Combine"** module. Nine technicians were assigned to Zones 1, 2, and 3 and were utilized inside the system only for their specific Zone by the propriety of the **Set element** that allowed selecting a "***specific member"*** rule in which to assign each of the nine technicians to their proper set of Zone. The model was **validated** by looking at the technicians' numbers seized throughout the complete check. Additionally, the technicians were

located in a pool (resources and members of a resource set); whenever all zones were required the same process, the selection was through a specific member from the **resources set**, and whenever the process is different for an intended zone, the selection will be from the **resources element**. Moreover, for the three different processes that are in a sub-model (nonidentical tasks each of which is related to a different zone), the technicians were assigned to seize that process once they were available each of which is in their respective zone and shift.

This model simulated the cabin department and represented its real system with the following technicians' preferences:

1- C1T1, C2T1, and C3T1, example: (Crew 1 Team 1, handling filters change and sub-model different processes),
2- C1T2, C2T2, and C3T2, example: (Crew 1 Team 2, handling non-routine cards and carpets replacement),
3- C1T3, C2T3, and C3T3, example: (Crew 1 Team 3, handling the remaining processes such as lubrication and operational check A, B, and C. These examples (Figure 3.28) are also applicable for crew 2 and crew 3 (identical processes, different zones, different resources).

The "**assign**" module was added to allocate resources when two resources are performing two different assignments they will not wait for each other. For example, if C1T1 resource 1 is performing an open up, then C1T1 resource 2 is opening up or performing another open task.

Terminating Rule was set by an expression at the run/ set/up window to stop the simulation when all processes were accomplished and no entities (zones) were seized in the simulation system (*Entity Number.Out (close up.process) == 3 zones).*

Cost of resources was associated in the model when being busy or idle. SV MRO technicians' wages were around 125 (SR) per busy or idle hour. Other outsourced contracted technicians' wages were around 30 (SR) per busy or idle hour. Those contracted technicians represented the majority of approximately 75% of the SV MRO cabin department.

Finally, the cockpit model was modeled to include the cockpit compartment The model contained a series of processes from the time an entity (cockpit) enters the system until disposal after the final inspection stage by an inspector (Figures 3.21 and 3.22).

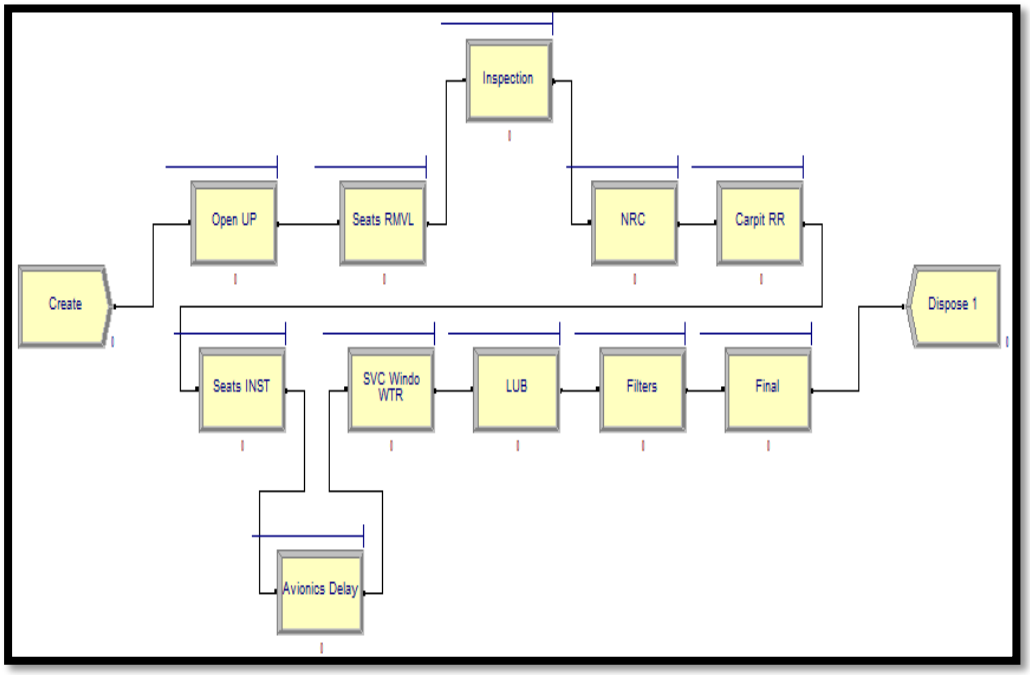

Figure 3.21 Cabin Department Cockpit Model.

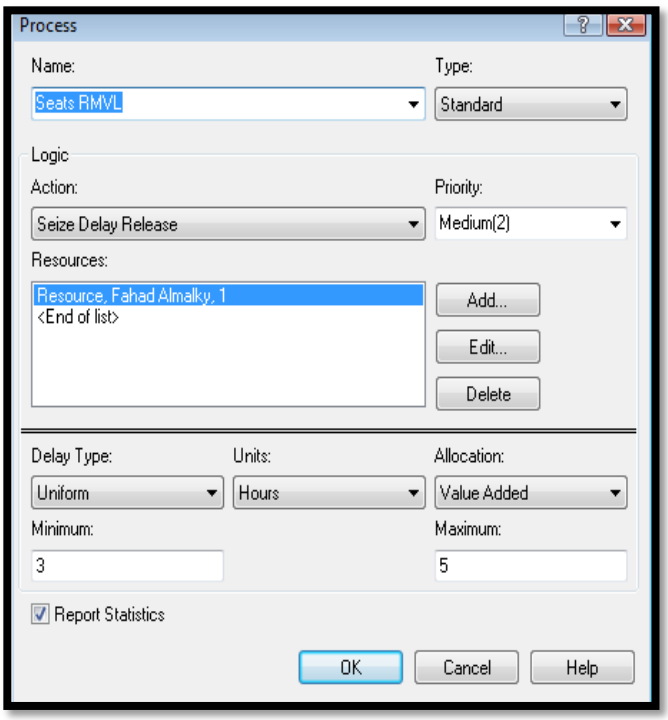

Figure 3.22 Cockpit Process.

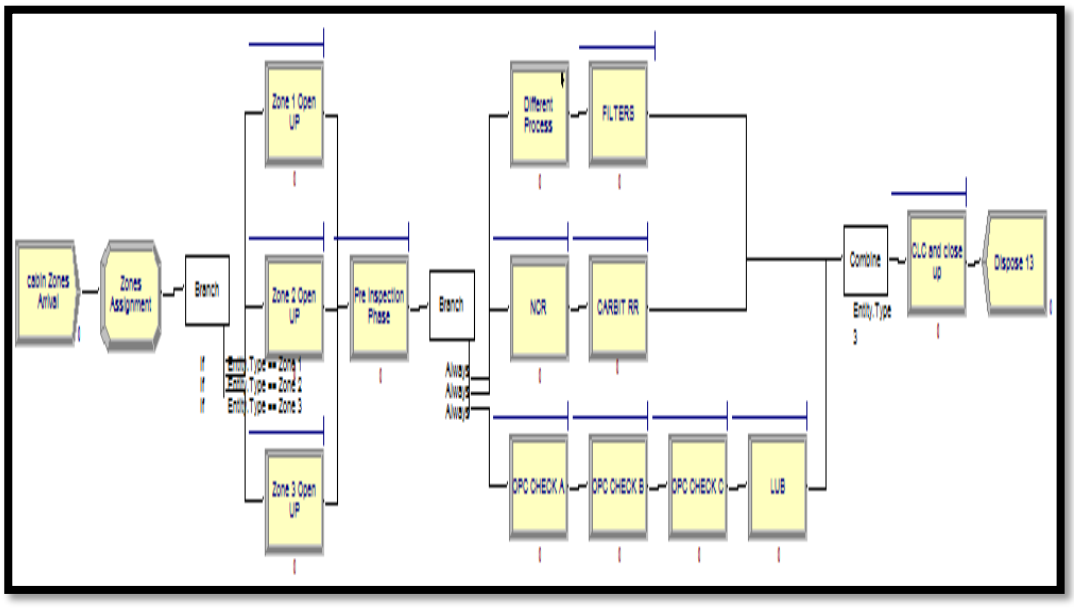

Figure 3.23 Cabin Department (Zones) Model.

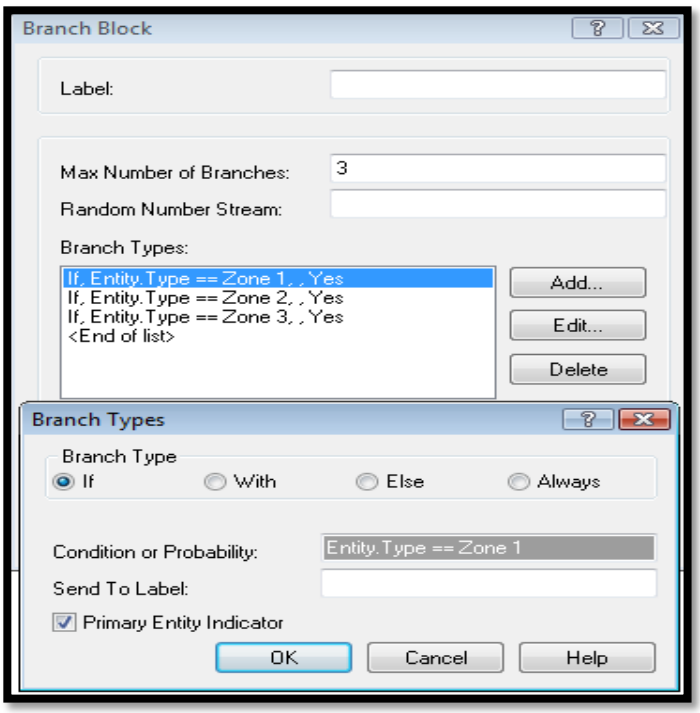

Figure 3.24 Cabin Model (Zones) Branch Block.

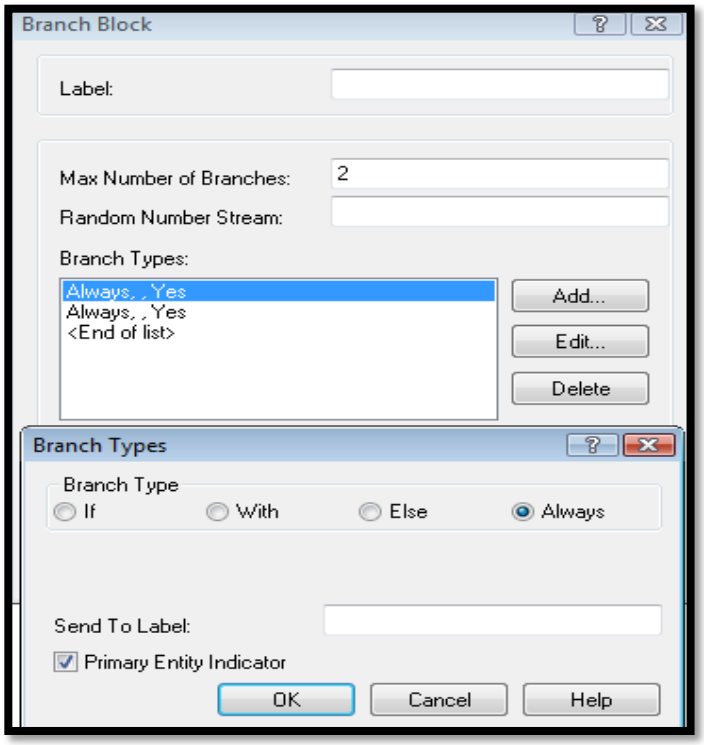

Figure 3.25 Cabin Model (Zones) Branch Types.

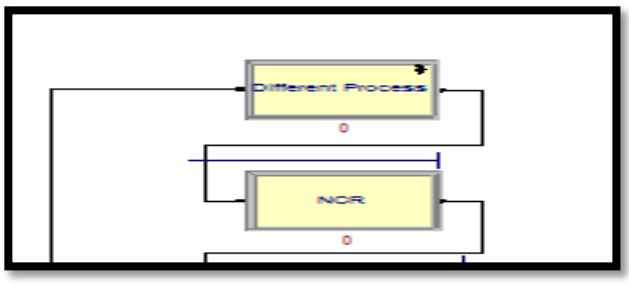

Figure 3.26 Cabin Model (Zones) Sub-Model for Different Processes.

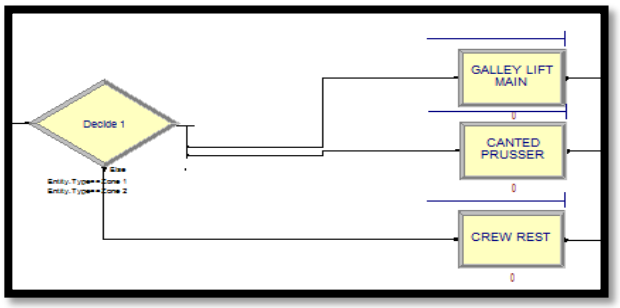

Figure 3.27 Cabin Model (Zones) Sub-Model Insider.

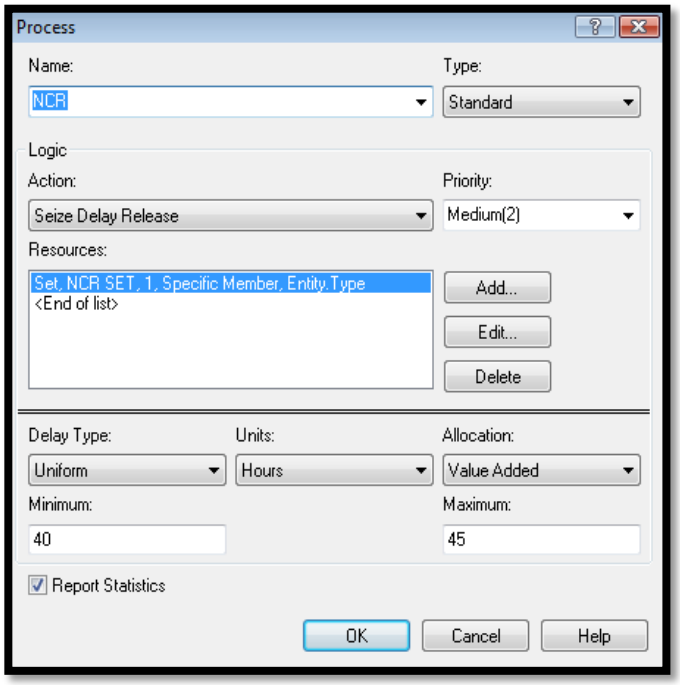

Figure 3.28 Cabin Model (Zones) Non-Routine Cards Process.

3.4.3 Cabin Model Verification and Validation

Model validation is the lengthiest step of modeling [3], and as a user of the system for more than ten years. It is found that the outputs (dynamic statistics) were representing the actual system with an average total time and waiting time which may vary depending on delays and some other uncontrollable factors. However, the variability was accounted for in this modeling where the uniform distribution was utilized to estimate all potential times between the minimum and maximum values with- of 20% of the actual process time.

This model was tested for bugs and undefined cells which indicated that the model was ready to simulate the maintenance processes of aircraft zones and routine tasks. First, the model was run with only one replicate for each zone independently to make sure that each zone was independent of its logic. The simulation results were indicative of the actual inputs and outputs of the real-world processes.

3.4.4 Cabin Model Sample Size Estimation

An adequate number of replications was selected with a 95% confidence interval for calculated cost and at the same time to avoid skewed total time. A 100 replications were the optimum number that would produce the total cost range and reduce it from 6461.27 (SR) half widths to 1500 (SR) with 95% confidence interval half widths (Table 3.7). An educated guess of 10 replications was initially selected. Then, the 10 different output results of the total cost (minimum, maximum, and half widths) were analyzed for their descriptive statistics (actual cost matched the 10 replication output). Moreover, two formulas were applied to develop (h): the desired half-width with a 95% confidence interval and depending on the (h node): the actual half width from the ten replications, (n): number of replications = 10 replications * ((standard deviation^2)

/ (h^2)) as follow: 10*((4,826.31^2) / (1500^2)) = 103.5 replications as a first approximation. The first approximation may allow for a higher value of (n) because the student ***t*** distribution value was used rather than the ***z*** value.

Finally, a second approximation was performed to estimate (n) utilizing (h node) value as follow:

(n): number of replications = 10 replications * ((ho^2) / (h^2)) as follow:

10*((3,452.532^2) / (1500^2)) = 52.97 or 55 replications. Therefore, 55 replications were performed to achieve the desired goal of 1500 (SR) total cost half-width (the initial half-width cost with one replication (h)) with a confidence interval of a 95%.

Table 3.7 Cabin Model Ten Replications Single Resource Total Cost.

NO. of Replication	Total Cost (SR)
1	56,983.89
2	59,983.33
3	60,879.87
4	61,435.77
5	58,889.21
6	49,945.23
7	64,967.33
8	67345.45
9	58,344.18
10	55,879.92

Cabin Model Ten Replications Descriptive Statistics of Cost (SR)	
Sample Mean	59,476.318
Sample Standard Deviation	4,826.307086
95% Confidence Interval Half Width	3452.532098
Minimum Summary Output Value	49,945.23
Maximum Summary Output Value	67,345.45

3.5 Airframe Department System Brief

An airframe of an aircraft is typically considered to include the fuselage, wings, and landing gears with the exclusion of the aircraft propulsion system. Airframe design is a field of aerospace engineering that combines aerodynamics, materials technology, and manufacturing methods to achieve balances of performance, reliability, and cost.

Each task should be performed under the rules and regulations authorized by Federal Aviation Authority.

One of the biggest departments in SV MRO is the Airframe Section. The airframe section covers almost 45% of the “C” check maintenance processes which utilize approximately 20% of the ATA (Air Transport Association) chapters which are used during aircraft maintenance as a reference to the Aircraft Maintenance Manual (AMM) and the Part Illustrated Catalog (IPC).

3.5.1 Airframe Department System Description

The airframe department maintenance process and routine tasks are not identical. Each system has a different type of maintenance requirements such as environmental systems, landing gears and wheels, hydraulic systems, fuel systems, cargo systems, primary and secondary flight controls rigging, and cockpit windows and windshield. Therefore, assigning the manpower is not an easy task and changing assignments will often is a challenging experience for airframe supervisors. Each process has a standard time which was modeled accordingly after model verification and validation. A simulation of the actual system was conducted to evaluate the nine airframe areas' average time, waiting time, technicians’ utilization, and system total time.

The nine areas are as follows:

1- Area 7: aircraft left-wing including all the components installed except engines and avionics parts,
2- Main landing gear wheel well areas and air-conditioning system at the aircraft belly area,
3- Engineering orders are also assigned by area and each crew has the task of EOs that is related to their area,

4- Area 9: the entire exterior areas of the fuselage including the forward and aft fairings,

5- Area 10: the empennage of the aircraft namely vertical and horizontal stabilizers at the aircraft tail section,

6- Forward cargo compartment,

7- Aft cargo compartment,

8- Bulk cargo and outflow valve area.

9- Area 8: aircraft right-wing including all the components installed except engines and avionics parts,

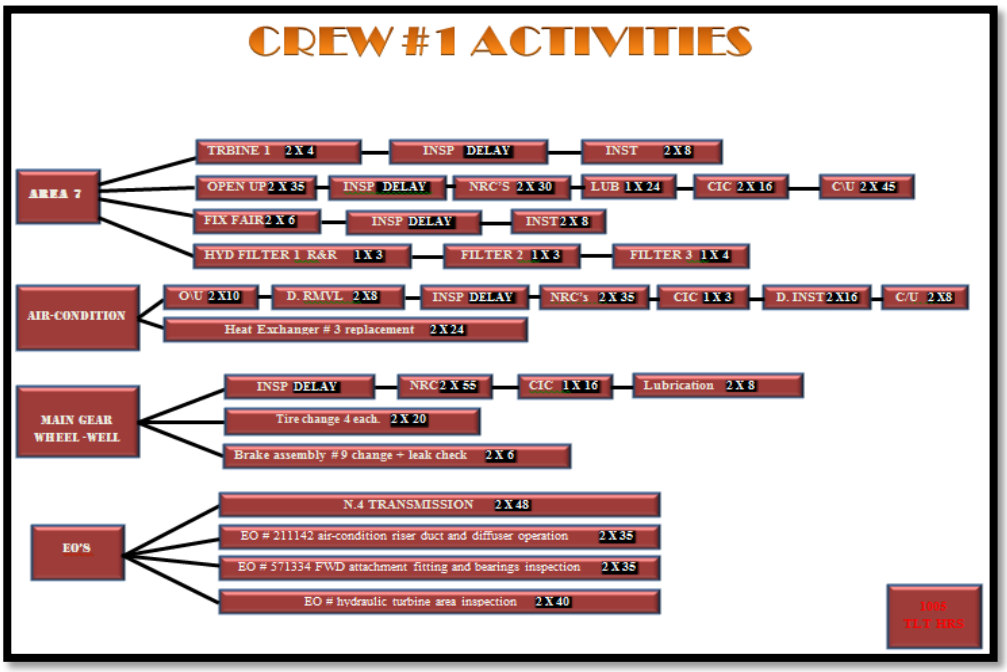

Figure 3.29 Airframe System Crew # 1 Schematic Diagram.

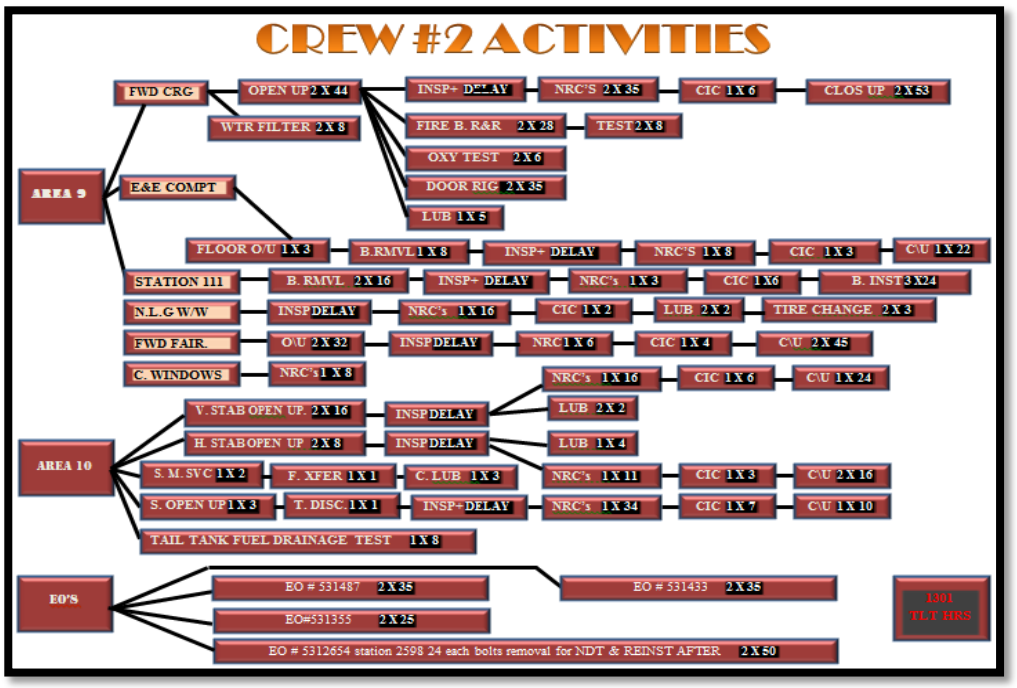

Figure 3.30 Airframe System Crew # 2 Schematic Diagram.

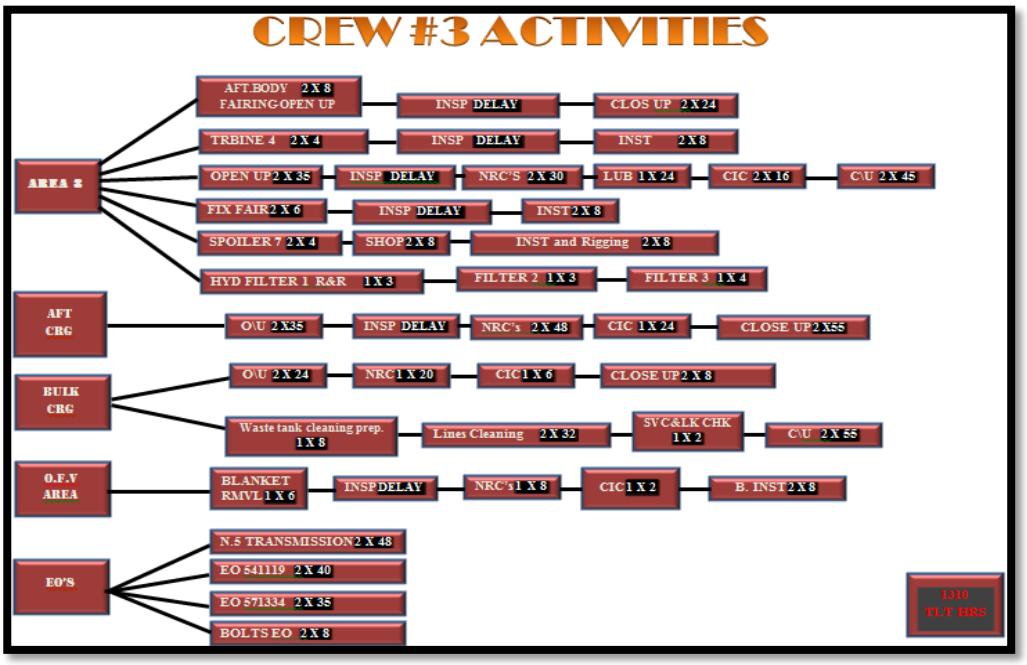

Figure 3.31 Airframe System Crew # 3 Schematic Diagram.

Each diagram above represents an airframe crew that is responsible for three of the above-mentioned nine areas.

3.5.2 Airframe Department "C" Check Maintenance Simulation Model

The airframe section was modeled as the main entity; however, it was broken into areas (e.g., left-wing area #7, and it was performed by crew #1). Crew 1 has 6 technicians each two technicians performed one set of processes in series (i.e., area 7, main landing gear wheel well, air-conditioning bays, and EOs). Also, Crew 2 has 6 technicians each two technicians performed one set of processes in series (i.e., area 9, area 10, forward cargo compartment with its EOs). Crew 3 has 6 technicians each two technicians performed one set of processes in series (i.e., area 8, aft cargo compartment with its EOs, bulk cargo, and outflow valve compartments). Certain processes will not start until both technicians are available.

Crew 1 is scheduled to arrive morning shift at the SV MRO hangar and will continue to arrive during the same shift for two consecutive weeks until shift change is due to swing to the night shift. Crew 2 also changes shift from afternoon shift to morning shift as well as crew 3 from night shift to afternoon shift. All scheduling rules were selected to be "***pre-empting.***"

Nine entities (areas) will enter the simulation system through the "**create"** module at time zero and the maximum arrival of entities will be = 1. "**Assign"** module will be available to assign airframes areas (entities) = **"index + 1"** with an attribute for the type of area (entity) of the nine types associated unique pictures. A "**branch"** block was then used to branch every three areas into a sub-model having three entrances and exits points with a decision feature that allows branching (e.g., Entity.Type == Area 7). Then, the identified entity will enter its specified branch to its sub-model entry point. Three "**sub-models"** will be available each of which will represent one of the three airframe crews (manpower). The first two technicians from crew 1 will be available to start the sub-model processes in series (area 7) until they complete all the

procedures, routine, non-routine, and close up required panels then the entity will be released to the "**dispose"** module (end of simulation replicate). This will be accomplished by a "**terminating condition"** at the main model frame. The rule was modeled by a variable that will be activated after each sub-model with the respective area (==completed + 1). Each area finishes through the termination**"assign"** module will be counted and at the run/set/up window an expression defined to airframe completed == 9. Thus, when 9 entity or area passes through the second **"assign"** module the simulation run will stop and the last entity that leaves the system will be indicating the average total time of the airframe department.

Crew 1 also has two other sets of two technicians entering the same sub-model for their respective assignments within that area (i.e., main wheel well and EOs).

Crew 2 will follow the same logic as Crew 1 in the same simulation model but crew 2 will be entering the second sub-model instead of the first sub-model. Two technicians out of six technicians will be assigned to each section of the three areas (i.e., area 9, area 10, and the forward cargo compartment). Crew 3 will follow the same logic as crew 1 and crew 2 in the same simulation model but crew 3 will be entering the third sub-model instead of the first or second sub-model. Two technicians out of six technicians will be assigned to each section of the three areas (i.e., area 8, aft cargo, and bulk cargo compartments).

Furthermore, every two technicians will be working in parallel and therefore, the three crews will be working simultaneously each with its technicians' assigned schedule for their assigned shift.

Finally, equipment failure was added to the simulation model for 8-hours per day based time, and another scenario was simulated for 24-hour based time per day. This attempt

was modeled to check on model validation by comparing the simulation outputs (Chapter 4).

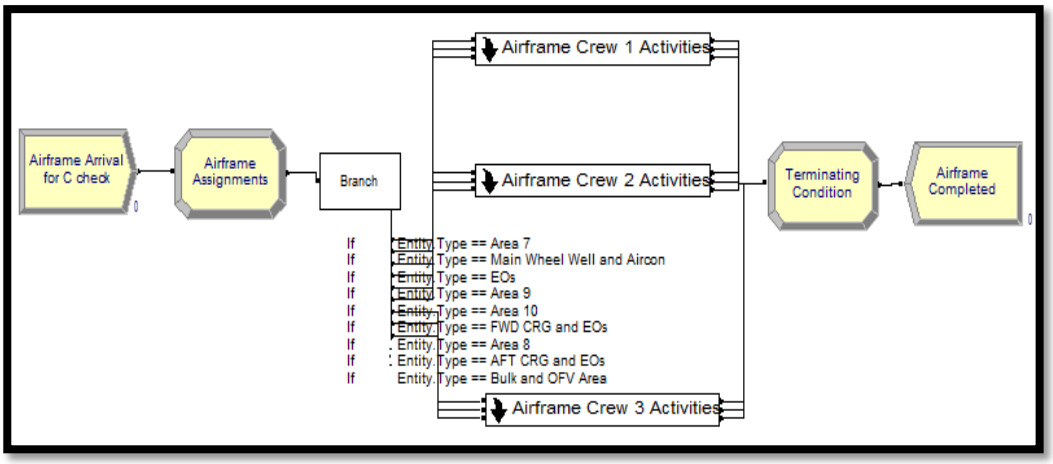

Figure 3.32 Airframe Model Top View.

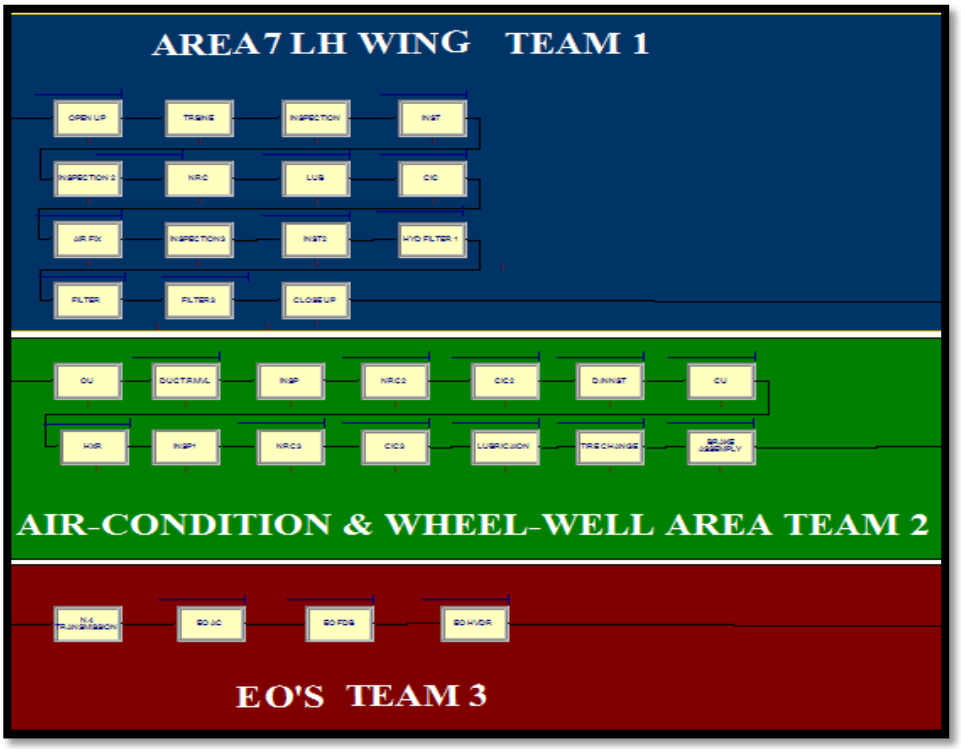

Figure 3.33 Airframe Sub-Model Crew # 1 Activities.

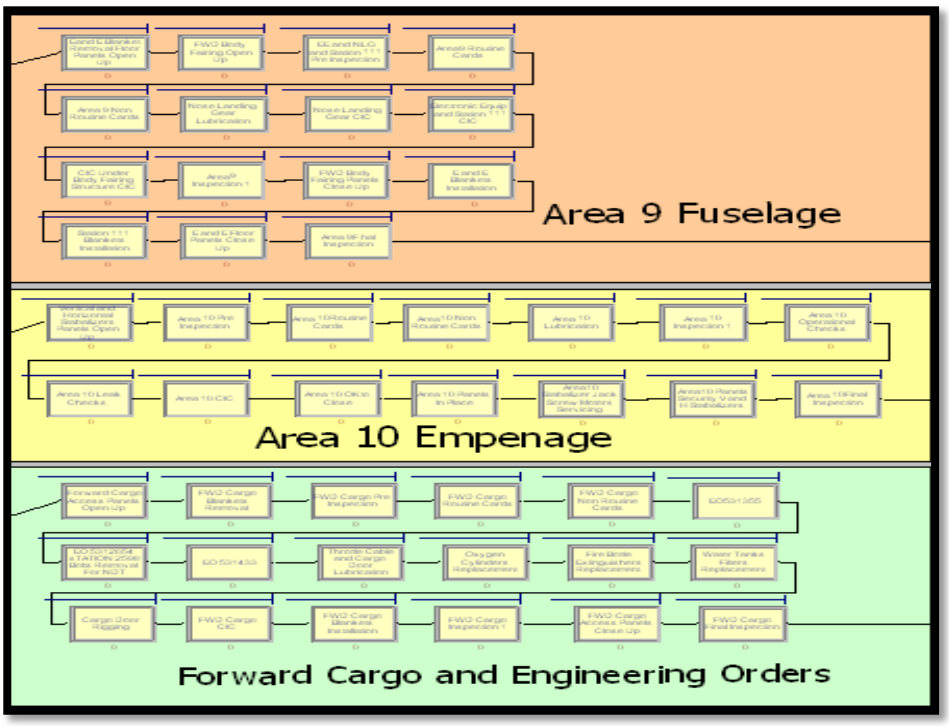

Figure 3.34 Airframe Sub-Model Crew # 2 Activities.

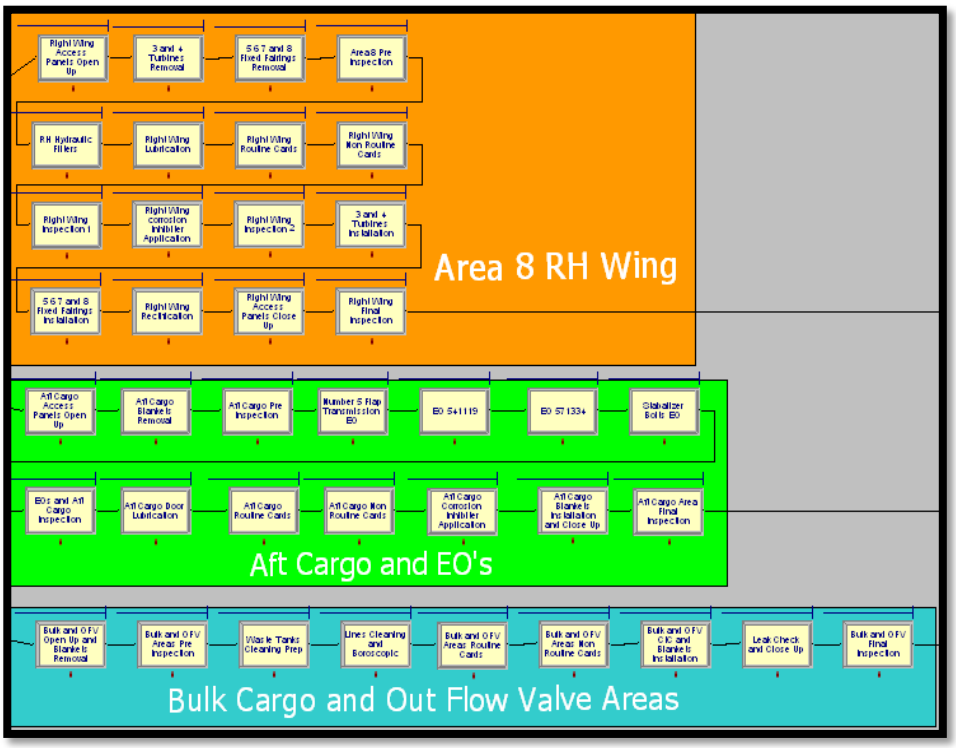

Figure 3.35 Airframe Sub-Model Crew # 3 Activities.

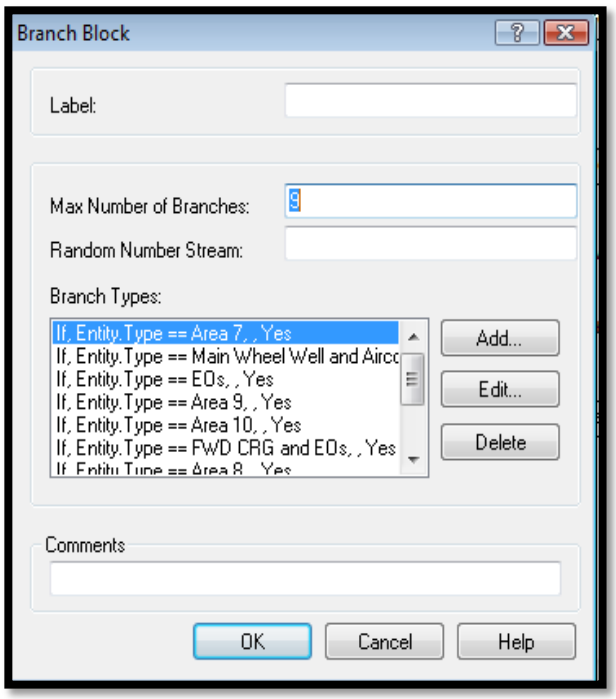

Figure 3.36 Airframe Model Branch Block.

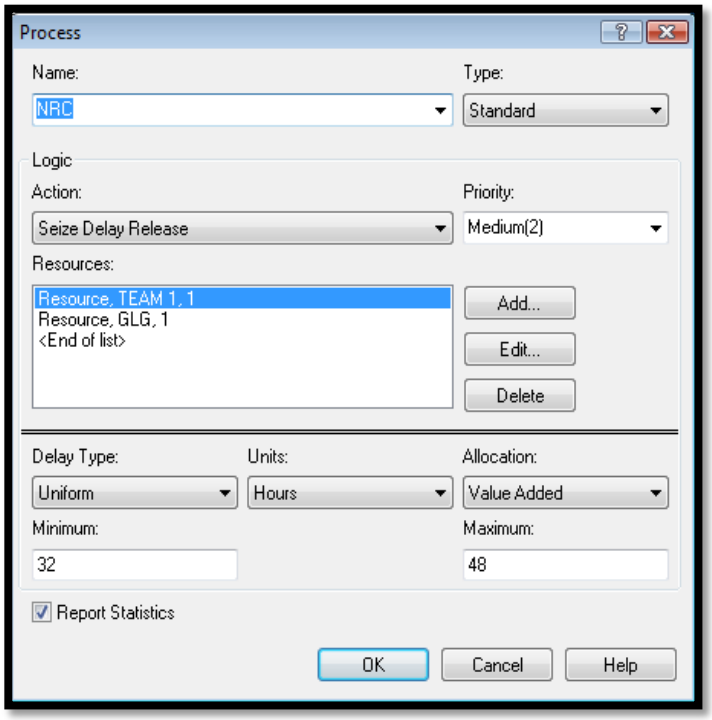

Figure 3.37 Airframe Model Non-Routine Cards Process.

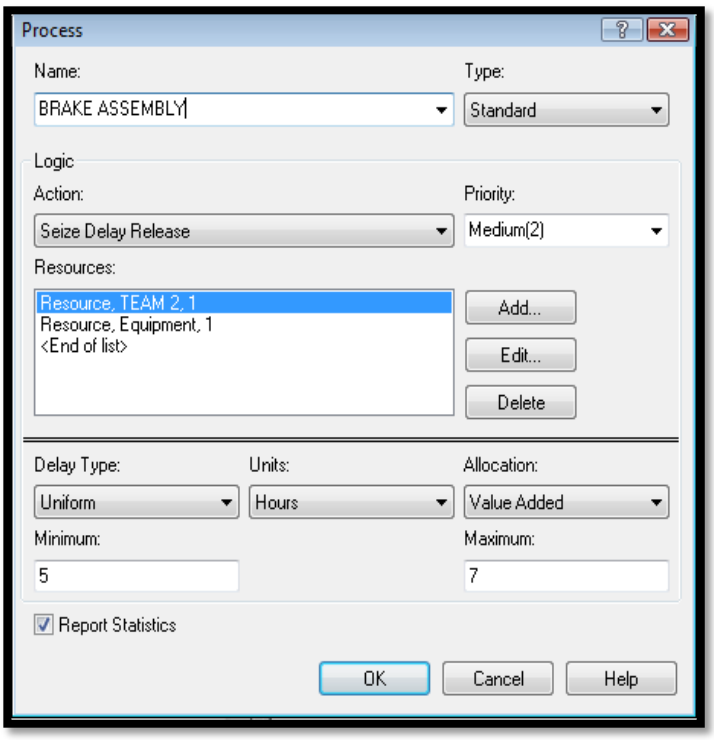

Figure 3.38 Airframe Model Brake Assembly Process.

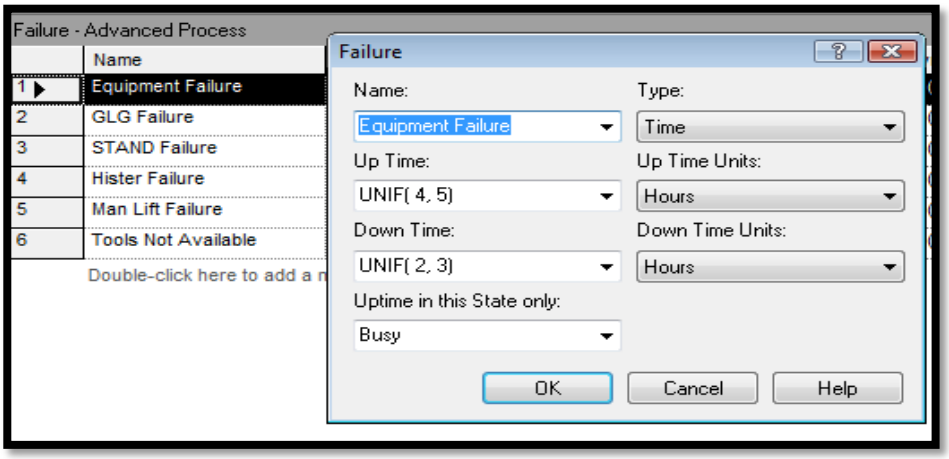

Figure 3.39 Airframe Model Failure Windows.

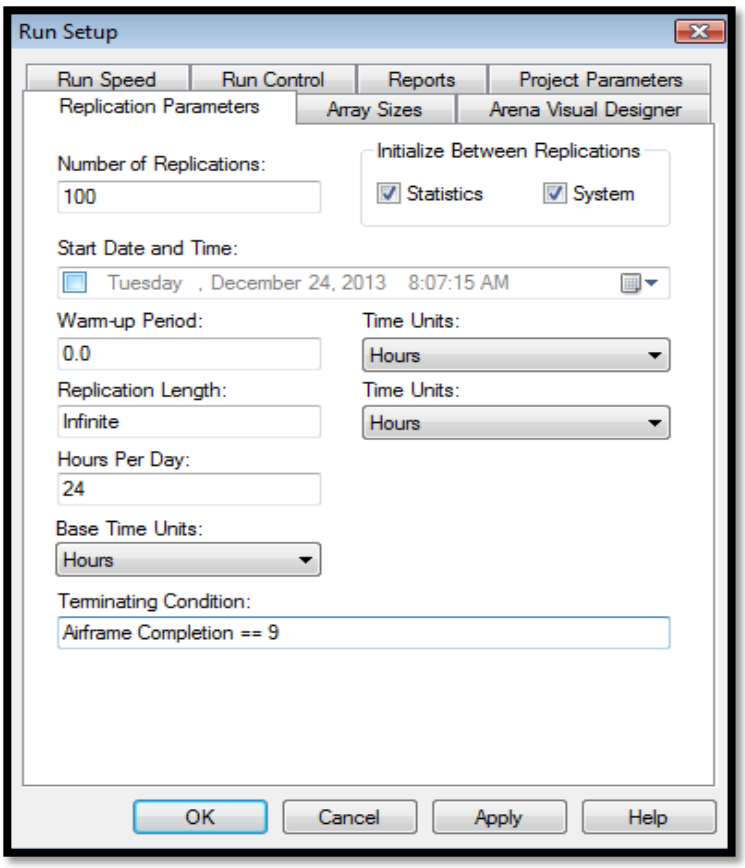

Figure 3.40 Airframe Model Run/Set/Up Window.

3.5.3 Airframe Model Verification and Validation

Model validation is the lengthiest step of modeling [3], and as a user of the system for more than ten years. It is found that the outputs (dynamic statistics) were representing the actual system with an average total time and waiting time which may vary depending on delays and some other uncontrollable factors. However, the variability was accounted for in this modeling where the uniform distribution was utilized to estimate all potential times between the minimum and maximum values with- of 20% of the actual process time.

The nine areas were modeled for 8 – hour based time per day at the same time for 24 – based hour days per day. Then, it was compared with the ACFT complete model in section 3.7, simulation results were satisfactory with some statistical variability due to

uniform distribution selected with + 20% for the maximum value and – 20% for the minimum value to reflect the real-world processing variability. Also, the model was validated by utilizing a scenario of equipment failure that was associated with the model running for 8 – hours based time, then, for 24 – hours based time. Simulation results were indicative of a valid airframe model of maintenance processes after comparing the two simulations' actual systems output and the scenario output.

3.5.4 Airframe Model Sample Size Estimation

An adequate number of replications was selected with a 95% confidence interval for calculated cost and at the same time to avoid skewed total time. A 100 replications were the optimum number that would produce the total cost range and reduce it from 8739.76 (SR) half widths to 1500 (SR) with 95% confidence interval half widths (Table 3.8). An educated guess of 10 replications was initially selected. Then, the 10 different output results of the total cost (minimum, maximum, and half widths) were analyzed for their descriptive statistics (actual cost matched the 10 replication output). Moreover, two formulas were applied to develop (h): the desired half-width with a 95% confidence interval and depending on the (h node): the actual half width from the ten replications, (n): number of replications = 10 replications * ((standard deviation^2) / (h^2)) as follow: 10*((4416.653^2) / (1500^2)) = 86.7 or 90 replications as a first approximation. The first approximation may allow for a higher value of (n) because the student ***t*** distribution value was used rather than the ***z*** value.

Finally, a second approximation was performed to estimate (n) utilizing (h node) value as follow:

(n): number of replications = 10 replications * ((ho^2) / (h^2)) as follow:

10*((3159.448^2) / (1500^2)) = 44.3 replications. Therefore, 45 replications were performed to achieve the desired goal of 1500 (SR) total cost half-width (the initial half-width cost with one replication (h)) with a confidence interval of a 95%.

Table 3.8 Airframe Model Ten Replications Single Resource Total Cost.

NO. of Replication	Total Cost (SR)
1	166,768.87
2	176,984.34
3	172,453.46
4	174,895.44
5	167,876.45
6	162,875.89
7	166,109.13
8	170,486.59
9	173,991.19
10	169,567.27

Airframe Model Ten Replications Descriptive Statistics of Cost (SR)	
Sample Mean	170,200.863
Sample Standard Deviation	4,416.603089
95% Confidence Interval Half Width	3,159.447514
Minimum Summary Output Value	162,875.89
Maximum Summary Output Value	176984.34

3.6 Avionics Department System Description

The term *avionics* is a portmanteau of the words *aviation* and *electronics*. Avionics is the electronic system used on aircraft (e.g., artificial satellites and spacecraft). Avionic systems include communications, navigation, the display and management of multiple systems, and hundreds of systems that are fitted to the aircraft to perform specific functions. These can be as simple as a searchlight for a police helicopter or as complicated as the tactical system for an airborne early warning platform or even a laser light to strike a target in military attacker aircraft.

The avionics department at SV MRO is one of the most important departments among the entire fleet because most of the failures in several systems may cause a catastrophe. Nowadays, technology has boomed widely especially in aircraft so most of the systems

are incorporated with avionics-related components/devices that so-called “fly by wire.”

At SV MRO, this particular department has eight electricians a shift and they are distributed among the wide-body hangars (i.e., B747, B777, MD-11, and Airbus A330). Normally, two technicians per shift are assigned to each model. The avionics electricians are responsible for various systems such as engines, cabin, airframe, and cockpit. The morning shift’s crew is assigned to the powerplant section, the afternoon shift’s crew is assigned to the cabin, and cockpit, and the night shift’s crew is assigned to the fuselage, empennage, and fuel system. The scheduling pattern organizes the manpower and fosters experienced decisions, however, it restricts other areas to waiting until the responsible shift is available. In some urgent cases, rarely the supervision will reassign electricians.

Thus, there are three major branches (segments of processes) for the avionics department as follows:

1- Turbine engines in areas 1, 2, 3, and 4. Also, Auxiliary Power Unit (APU) in area 11 plus related Engineering Orders (EOs).
2- Main cabin in areas 5 and 6. Also, are the cockpit compartment (flight crew compartment).
3- Airframe in areas 7, 8, 9, and 10 which comprise the wings (area 7 and 8), exterior fuselage, all three cargo compartments (area 9), and the empennage in the tail section (area 10).

Avionics electricians participate in some engineering orders (EOs) and airworthiness directives (ADs) and these items will vary from one check to another, therefore, variability of the statistics output was necessary to mimic maintenance check start (i.e., busted engineering order # 281442) (Figure 3.41).

Avionics processes are often non-routine maintenance and mainly may be referred to as troubleshooting of systems and/or correcting system discovered failure during a routine maintenance task such as measuring a fuel pump resistance or reading power voltage at a certain wire either for continuity examination in a failure case or precedence in a routine maintenance task. EOs and ADs are considered to be routine tasks and often will consume most of the scheduled time followed by the NRCs.

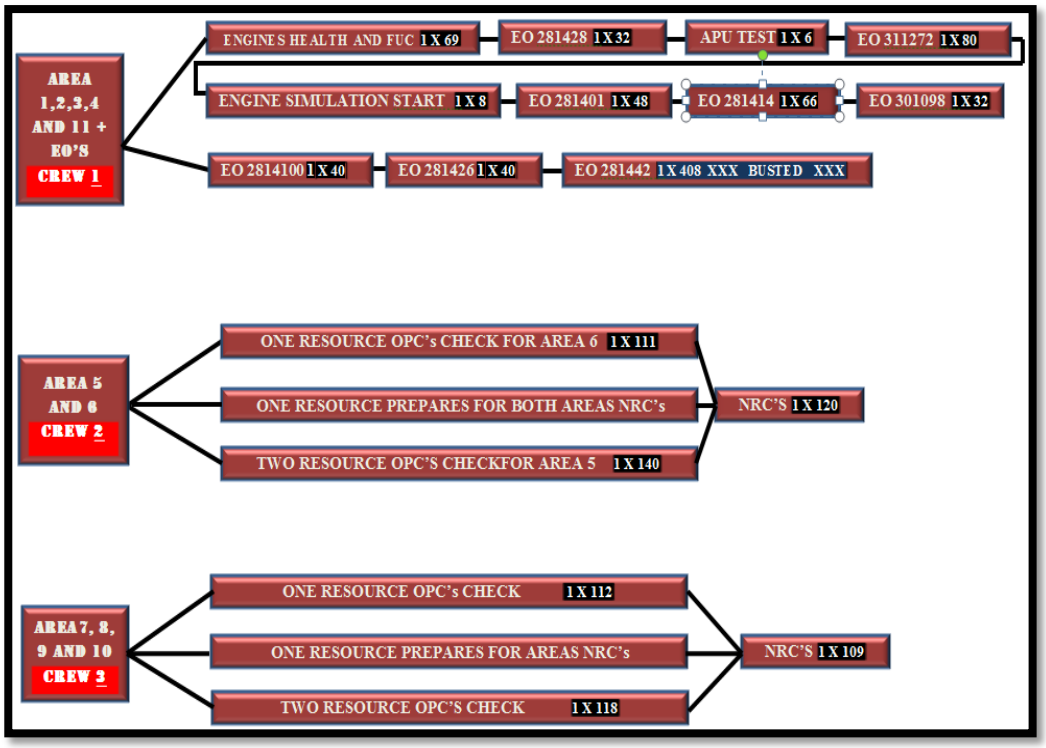

Figure 3.41 Avionics Department System Schematic Diagram.

3.6.1 Avionics Department "C" Check Maintenance Simulation Model

As an actual system for this particular aircraft model, crew 1 is scheduled for the morning shift and is responsible for all engine routine tasks. Crew 2 is scheduled for the cabin and cockpit areas during the second shift (afternoon). Crew 3 is mainly scheduled for the airframe areas and joint cards during the night shift. Each of the processes shown in the schematic diagram 3.41 contains many procedures and steps, and for the sake of simplification were added up from 113 sub-processes in which to

represent the actual model. For example, a process that takes 109 hours performed by a single resource will consume half or little more than half the time if it was executed by two resources. This procedure was considered in all combined sub-processes.

Additionally, details about delays and distribution of assignments were considered within the simulation model.

First, the entities (avionics areas) will enter the system as a single entity through a "**create"** module and this single entity will arrive at an "**assign"** module for the entity type and picture identification. Then, it is duplicated into three entities at the "**duplicate"** block, each of which entity will go through a series of processes and sub-processes simultaneously by two electrician for each entity.

After that, the three entities (avionics areas) are batched permanently in a "**combine"** block, and a new entity will be created and other entities will be disposed at the **"dispose"** module and will not be reintroduced in the system, this is one feature of the the **"combine"** block. The simulation will stop once the entity Number.Out of the last process of each segment == 1 and this expression was defined by the "**terminating condition"** at the run/set/up window.

The avionics resources will be in a pool available to be assigned fairly, with two electricians (a senior and a junior) for each aircraft per shift.

The maintenance cost formula was used to address the manpower cost and the lost revenue. The first one is to visualize the lost revenue (i.e., aircraft on ground cost). The other cost of interest was the employees' salary and it was recorded for each electrician per hour, it was SR 80 per hour for the junior electrician and SR 125 per hour for the senior electrician. The formula was computed as follows: (the resources pay rates per hour (125+80 * 24/8 multiplied by the average total time) + (the lost net revenue (SR

15,000) multiplied by the average total time multiplied by 0.667 (16 / 24 to convert the net revenue (SR15,000) to daily base revenue).

*(615 * TAVG (Avionics.TotalTime)) + (0.667 * TAVG (Avionics.TotalTime) * 15000).*

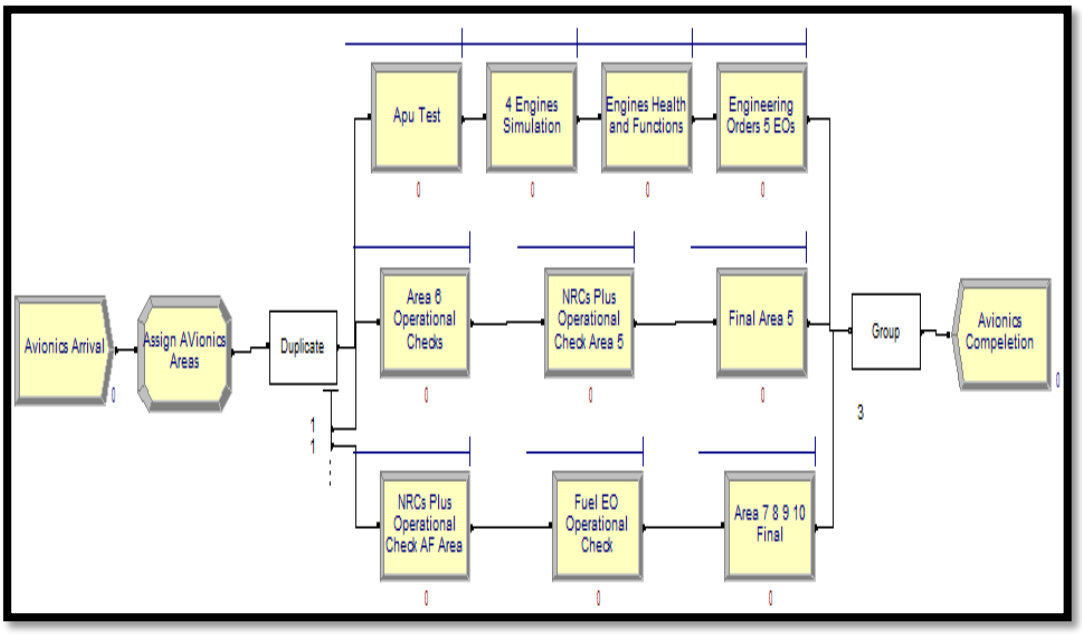

Figure 3.42 Avionics Department Model.

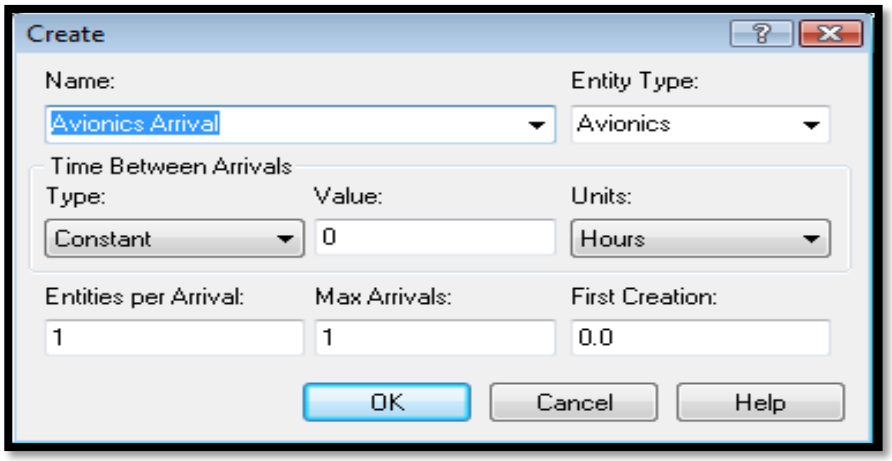

Figure 3.43 Avionics Model Create Module.

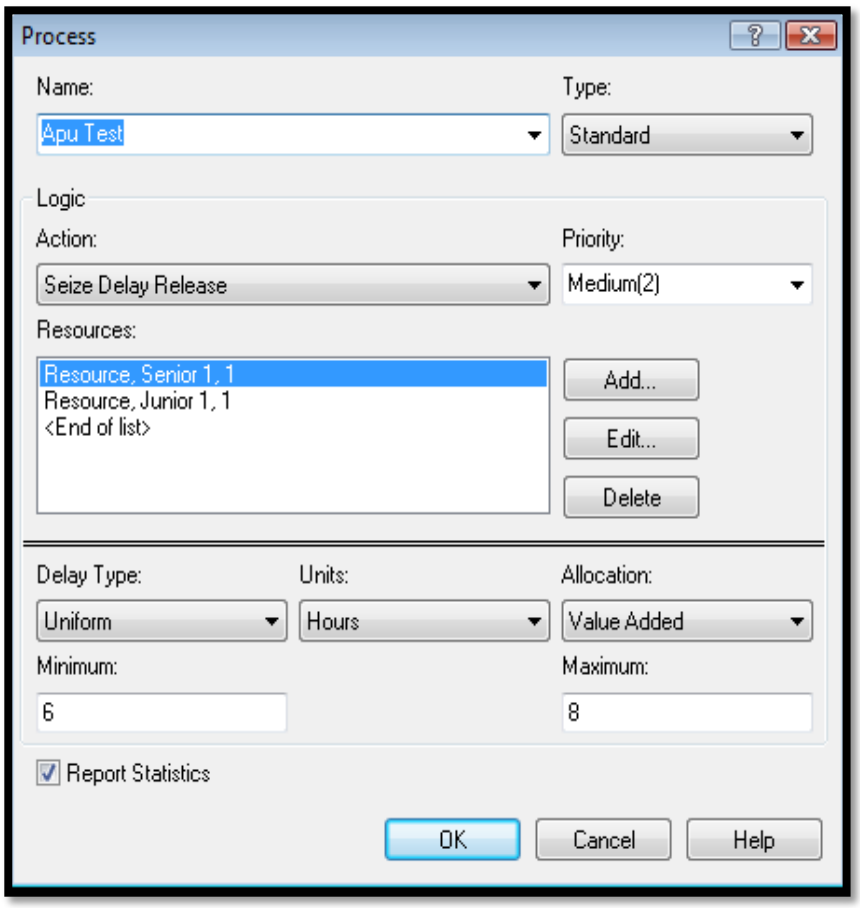

Figure 3.44 Avionics Model APU Test on Process Module.

Resource - Basic Process

	Name	Type	Schedule Name	Schedule Rule	Busy / Hour	Idle / Hour
1	Senior 1	Based on Schedule	Morning Shift	Preempt	125	125
2	Senior 2	Based on Schedule	Afternoon Shift	Preempt	125	125
3	Senior 3	Based on Schedule	Night Shift	Preempt	125	125
4	Junior 1	Based on Schedule	Morning Shift	Preempt	90	90
5	Junior 2	Based on Schedule	Afternoon Shift	Preempt	90	90
6	Junior 3	Based on Schedule	Night Shift	Preempt	90	90

Figure 3.45 Avionics Department Resources – Basic Process Elements.

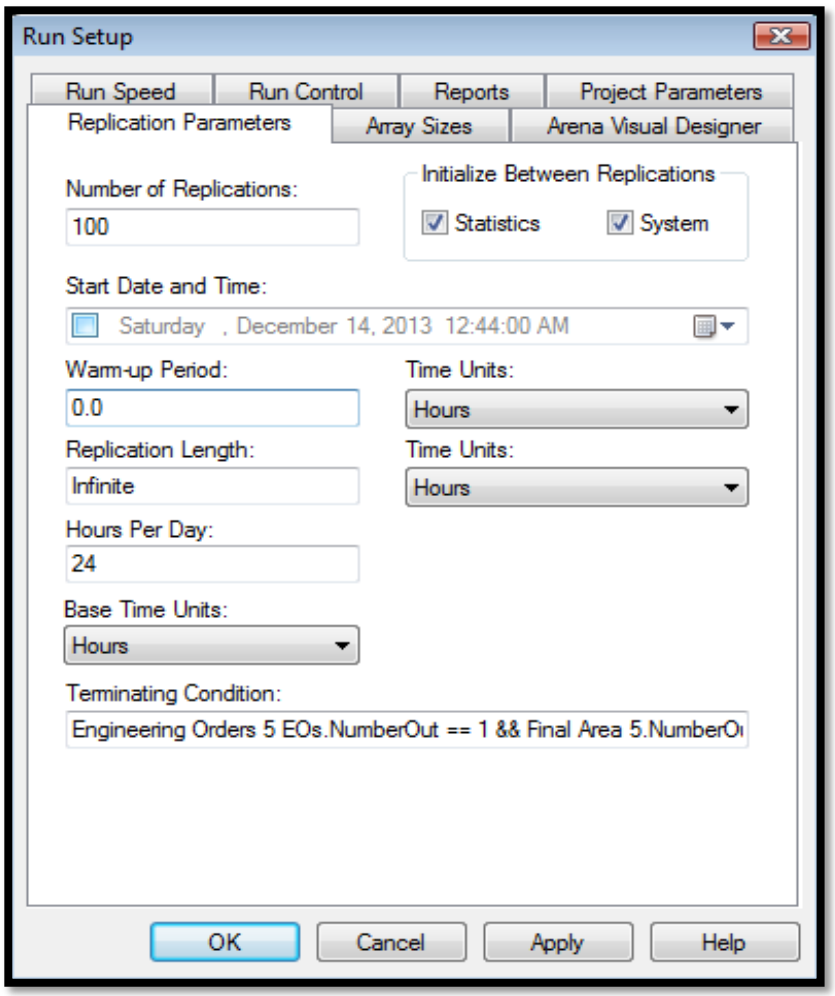

Figure 3.46 Avionics Model Run / Set / Up Window.

3.6.2 Avionics Model Sample Size Estimation

An adequate number of replications was selected with a 95% confidence interval for calculated cost and at the same time to avoid skewed total time. A 100 replications were the optimum number that would produce the total cost range and reduce it from 60,000 (SR) half widths to 34,000 (SR) with 95% confidence interval half widths (Table 3.9). An educated guess of 10 replications was initially selected. Then, the 10 different output results of the total cost (minimum, maximum, and half widths) were analyzed for their descriptive statistics (actual cost matched the 10 replication output). Moreover, two formulas were applied to develop (h): the desired half-width with a 95% confidence interval and depending on the (h node): the actual half width from the

ten replications, (n): number of replications = 10 replications * ((standard deviation^2) / (h^2)) as follow: 10*((107,435.28^2) / (34000^2)) = 99.8 or 100 replications as a first approximation. The first approximation may allow for a higher value of (n) because the student ***t*** distribution value was used rather than the ***z*** value.

Table 3.9 Avionics Model Ten Replications Single Resource Total Cost.

NO. of Replication	Total Cost (SR)
1	4,904,628.70
2	4,594,046.60
3	4.570,884.62
4	4.728,692.72
5	4,761,198.44
6	4,769,166.65
7	4,752,619.29
8	4,899,377.26
9	4,758,056.80
10	4,765,387.41

Avionics Model Ten Replications Descriptive Statistics of Cost (SR)	
Sample Mean	4,750,405.85
Sample Standard Deviation	107,435.28
95% Confidence Interval Half Width	76,854.57
Minimum Summary Output Value	4,570,884.62
Maximum Summary Output Value	4,904,628.70

Finally, a second approximation was performed to estimate (n) utilizing (h node) value as follow:

(n): number of replications = 10 replications * ((ho^2) / (h^2)) as follow:

10*((76,854.57^2) / (34000^2)) = 51 replications. Therefore, 51 replications were performed to achieve the desired goal of 34,000 (SR) total cost half-width (the initial half-width cost with one replication (h)) with a confidence interval of a 95%. The model was verified and validated.

3.7 Aircraft Complete "C" Check Maintenance Simulation Model

The four major departments (i.e., powerplant, cabin, airframe, and avionics) were independently modeled, gathered, and combined into a complete "C" check maintenance simulation model. Validation was successful after many replications that were attempted and simulated with a thorough review of the simulation outputs comparing each independent model with its results (Figure 3.47).

This model starts with an entity, B747- 400 aircraft, that was created through the "**create"** module to enter the simulation model. This entity will have the aircraft picture identification and as it passes through, it will enter a "**duplicate"** block in which to generate a copied entity of the same aircraft traveling for each **sub-model** within the simulation model that will be processed in parallel throughout each department. Each department sub-model will execute the copied entity which will complete all the required processes and then wait in a **"hold"** module queue until all other copied entities completed their processes and then released these copied entities at once. Then, the original entity, B747- 400 aircraft, will be disposed to the top view **"dispose"** module carried with all the statistical data from each department, unlike the internal duplicated entities (aircraft copies) that were disposed inside the sub-model and won't show in the top view. Furthermore, each of which original entities (four departments) will go through an **"assign"** module at the top view for the simulation termination condition. This condition is governed by a variable named **"department completion"** and is given a value of **"department completion + 1."** Then, this variable is matched through the **Run/Set/Up** window at the terminating entry icon and an expression is used to allow terminating the simulation once the completed department == 4 is met.

Each sub-model has the previously described model as when it was modeled independently and reads the same measures with some statistical variability.

The powerplant department sub-model has two sub-models each of which has its model **(APU and EOs) and (engines)**. Each of these two models was combined in the complete model with no changes in their elements and will be disposed inside the sub-model after their entities leave to arrive in the **"assign"** module. A variable counter was created to the desired number of disposed entities == 6 (i.e., 4 engines, APU, and EOs). Then, the original entity that represented the powerplant department will then be disposed, but at the top view and this is done by a condition in the **"hold"** module (if processing entities disposed inside the sub-model == 6) (Figure 3.49).

The cabin department sub-model has two models within the department sub-model (**cockpit and cabin)**. Each of these two models was combined in the complete model with no changes in their elements and will be disposed inside the sub-model after their entities leave to arrive in the **"assign"** module. A variable counter was created to the desired number of disposed entities == 2 (i.e., cockpit and cabin). Then, the original entity that represented the cabin department will then be disposed, but at the top view and this is done by a condition in the **"hold"** module (if processing entities disposed inside the sub-model == 2) (Figure 3.50).

The airframe department sub-model has three sub-models each of which represented the shift for each crew (i.e., crew 1, crew 2, and crew 3). Also, the airframe model contains 9 duplicated entities that will be assigned based on the **"branch"** module based on what crew (shift) performs that task**.** The airframe model was combined in the complete model with no changes in its elements and will be disposed inside the sub-model after their 9 entities leave to arrive in the **"assign"** module. A variable counter was created to the desired number of disposed entities == 9 (Figure

3.32). Then, the original entity that represented the airframe department will then be disposed, but at the top view and this is done by a condition in the **"hold"** module (if processing entities disposed inside the sub-model == 9) (Figure 3.51).

The avionics department sub-model has the department model at the top view (Figure 3.47). One entity entered the system and then was duplicated to three entities to represent the three crews within the avionics department. The powerplant-related processes, cabin-related processes, and airframe-related processes. These three types with their unique pictures will be disposed inside the sub-model after the completion of processes and the original entity then will be released from the "**hold"** module queue (if processing entities disposed inside the sub-model == 3).

Aircraft is Out Of Service (O.O.S) and arrived in the hangar area will trigger the simulation to start until it is released from the hangar and not necessarily it is considered Back In Service (B.I.S), the simulation will end.

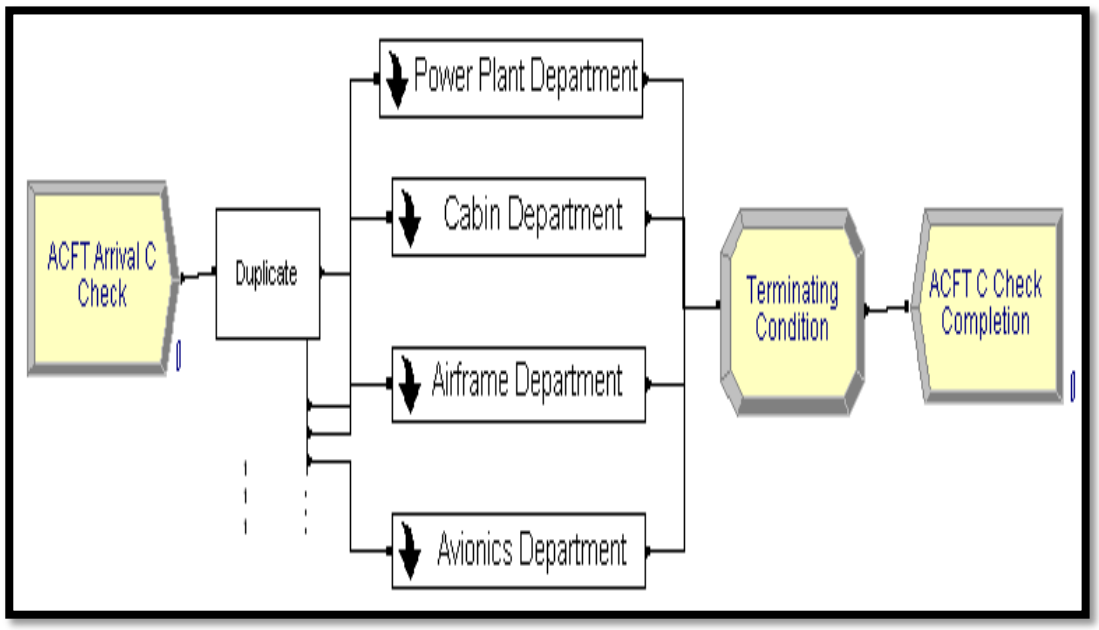

Figure 3.47 ACFT Complete Model.

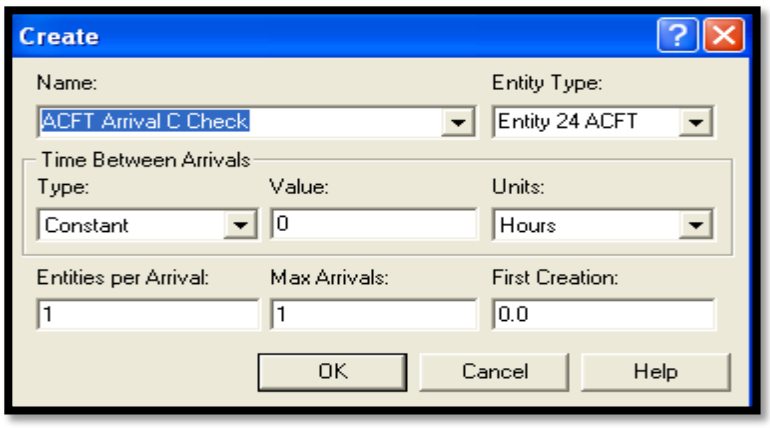

Figure 3.48 ACFT Complete Model Create Module.

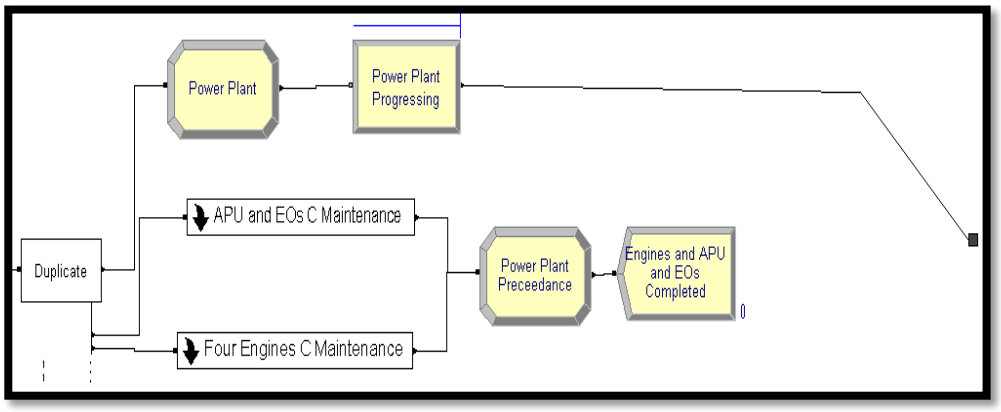

Figure 3.49 ACFT Complete Model PowerPlant Department Sub Model.

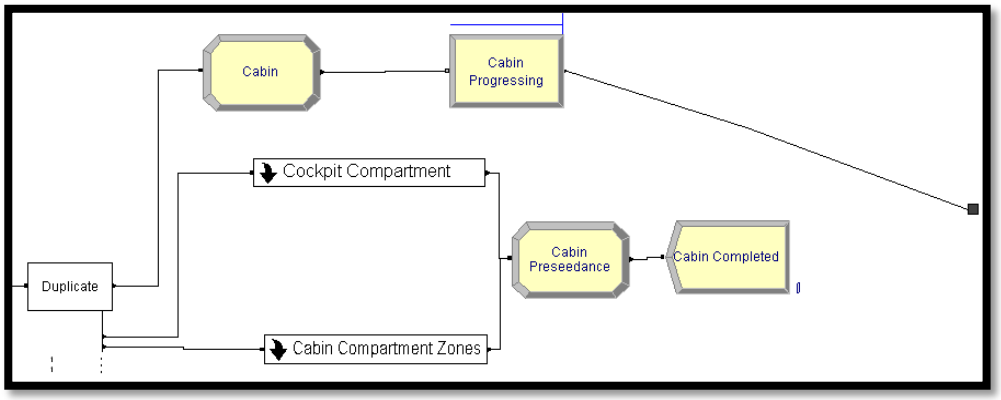

Figure 3.50 ACFT Complete Model Cabin Department Sub Model.

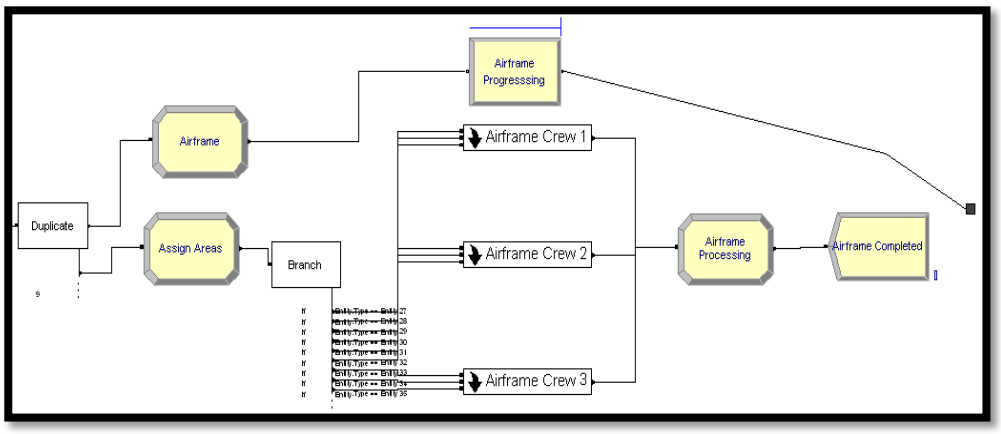

Figure 3.51 ACFT Complete Model Airframe Department Sub Model.

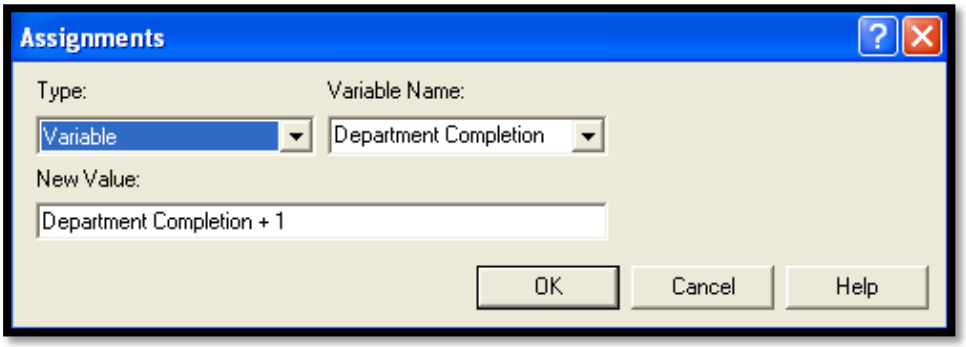

Figure 3.52 ACFT Complete Model Assign Module Terminating Preference.

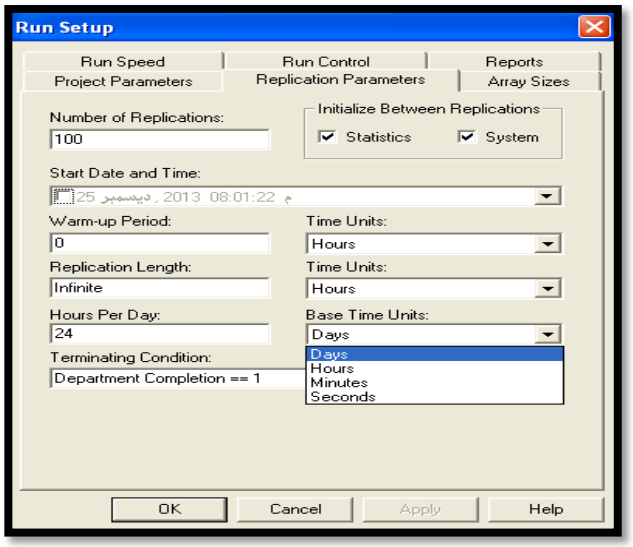

Figure 3.53 ACFT Complete Model Run / Set / Up Window.

Chapter IV

Results and Discussion

4.1 Introduction

Simulation output for each of the four departments and the complete model was presented and discussed. Also, demonstration of each model for important statistical outputs (i.e., average process time, average waiting time, manpower utilization average cost, and lost revenues) for each entity were presented and discussed.

4.2 PowerPlant Department Results and Discussion

The difference between actual and simulated results existed due to the variability of the uniform distribution which was utilized with + or – 20% of the average time of an engine process. Also, the variability was reduced when uniform distribution was used with less than + or - 20% of the average time of an engine process. This calculation was also utilized to confirm the model validity (Table 2.2 and Table 3.2)

The manufacturer engine maintenance total process time was almost half the SV MRO process time (91.93 hours – 186.38 hours / 91.93 hours). This shows the excessive time SV MRO consumes to maintain an engine due to wait time. Simulation results and actual collected data indicated the stability of the model; totals showed similarities

in the engine maintenance value-added hours and other processing times such as inspection.

Table 4.1 PowerPlant Department Simulation Model Results.

	AVG Maint. VA Hours	AVG Insp. VA Hours	AVG Wait Hours	AVG Total Hours
Engine 1	169.84	11.59	479.89	661.31
Engine 2	169.46	11.35	479.30	660.11
Engine 3	170.64	11.41	520.88	**702.93**
Engine 4	170.00	11.50	520.43	701.92
EOs	152.34	24.89	519.14	696.37
APU	107.68	29.18	404.91	541.77

The “C” check maintenance average total time comes from operations, inspections, and wait time.

The value-added hours were maintenance activity tasks and inspection while the wait time was a waste due to improper scheduling and lack of resource utilization, which indicated more than 40%.

Engine 1 and Engine 2 were performed for an 8-hour shift per day and for the remaining time of the day (16-hour) the engines were free of technicians (idle), see section 3.3.3.

All four engines were being performed in parallel which was why the total time of maintaining one engine represents the total time of completing all engine maintenance for the powerplant department. Therefore, the longest time to complete the maintenance of an engine was considered as the total time to complete the maintenance for all four engines and to be the total ground time that the aircraft spends in the SV MRO hangar for the “C” check maintenance.

APU and Engineering Orders (EOs) tasks were performed by crew 3 while engines # 1 and # 2 were performed by crew 1 and engines # 3 and # 4 were performed by crew 2. These crews operate simultaneously in different shifts.

Also from the simulation results, the EOs segment showed a higher value-added time for both maintenance processes and inspections activities than APU, however, longer wait times were observed. APU was performed by two technicians and EOs were performed by two technicians to complete all routine and nonroutine maintenance. The EOs was recording very close average total time like engine #3.

Table 4.2 Powerplant Department Technicians Utilization Simulation Results.

Resources	Instan. Utiliz.	NO. Busy	NO. Sched.	Sched. Utiliz.	Busy Cost	Idle Cost
Engine 1 Junior 1	0.48	0.48	0.27	1.76	28402	2599
Engine 2 Junior 2	0.55	0.55	0.27	2.01	31434	2535
Engine 3 Junior 3	0.58	0.58	0.25	2.32	33194	1115
Engine 4 Junior 4	0.57	0.57	0.25	2.28	32345	1056
Engine 1 Senior 1	0.58	0.58	0.27	2.12	51661	4060
Engine 2 Senior 2	0.52	0.52	0.27	1.89	47582	3961
Engine 3 Senior 3	0.58	0.58	0.25	2.34	51833	1742
Engine 4 Senior 4	0.59	0.59	0.25	2.37	53182	1649
APU Junior 1	0.40	0.4	0.26	1.58	35938	9775
EOs Junior 2	0.68	0.68	0.26	2.67	39027	76
APU Senior 1	0.39	0.39	0.26	1.52	34852	6031
EOs Senior 2	0.56	0.56	0.26	2.18	31915	76

Technician-utilization indicated 50% - 60% while technician-cost showed proper allocation of pay among busy costs. This is not accurate because the idle cost was a result of the calculation that was considered as inactivity rather than idleness. Therefore, technicians' inactive times must be associated and calculated to obtain the adequate idle cost of each technician to indicate the accurate allocation of the total cost. This is out of the study scope and the total cost was verified to be accurate for calculating the total ground time cost or the SV MRO lost revenue with the addition of the inactive time that was considered idle time (Table 4.3).

As mentioned earlier, the longest total time of engine maintenance will be considered as the total time for the powerplant department associated with its total cost which will be translated into the total lost revenue for SV MRO.

Lost revenue is the airline maintenance ground time cost. An hour of maintenance means the aircraft was not utilized for an hour flight and that net revenue could be generated from such an hour flight which was estimated to be 10,000 SR.

Table 4.3 PowerPlant Technicians Cost (SR) Based on Longest Time (Hours).

Entity	AVG Total Hours	Maint. Cost	Insp. Cost	Maint. + Insp. Cost
Engine 1	661.31	135,076.55	1521	136597.55
Engine 2	660.11	135,623.90	1532	137155.9
Engine 3	702.93	148,087.90	1517	149604.9
Engine 4	701.92	148,914.05	1525	150439.05
EOs	699.13	143,322.49	5553	148,875.49
APU	541.77	111,062.02	3915	114977.02
	Longest AVG	**Total Cost**	**Total Cost**	**Technicians Total Cost**
	702.93	**822,086.91**	**15,563**	**837,649.91**

Engine # 3 had the longest average ground total time during maintenance and therefore, it will be used to calculate the lost revenue.

Thus, both collected costs will be added and the results show more than **7** million, and the majority of the cost is lost revenue.

Technicians Cost + Powerplant Department Lost Revenue = Overall Total Cost.

(SR) 837,649.91 + (SR) 7,029,300 = <u>(SR) 7,866,949.91</u>

Table 4.4 PowerPlant Lost Revenue (SR) Based on Longest Time (Hours).

Entity	Longest AVG Total Hours	Standard Net Revenue (SR) per Hour	ACFT Total Lost Revenue (SR)
Engine 3	702.93	10,000	7,029,300

4.3 Cabin Department Results and Discussion

The cabin department has four zones. Cockpit, Forward (zone 1), middle (zone 2), and aft (zone 3). The cockpit zone is performed during the “C” check maintenance by a single technician and the average total time of all cockpit processes was completed on average in about 741.37 hours. Zone 2 represented the longest time zone 2 because it is the last zone to complete during the “C” check maintenance.

Table 4.5 Cabin Department Simulation Results.

Entity	AVG Maint. VA Hours	AVG Insp. VA Hours	AVG Wait Hours	AVG Total Hours
Cockpit Zone	161.77	41.4187	538.19	741.37
Zone 1	152.32	16.12	586.32	754.76
Zone 2	150.78	44.86	585.12	**780.76**
Zone 3	154.23	16.56	584.53	755.32

Each zone consumed value-added maintenance average hours and value-added inspection average hours. This wait time represented the periods that no technician was performing maintenance and the break time represented the idle time. Both of these hours were non-value-added hours. The long duration besides the break time was the 16 hours per day that each zone is free from the responsible crew or technicians. In another word, the assignment was to occupy one zone per shift. Crew 1 is assigned to zone 1, crew 2 is assigned to zone 2, crew 3 is assigned to zone 3, and a single technician is assigned to the cockpit zone.

For example crew 1 is working on the morning shift and only maintains zone 1, crew 2, and 3 in other shifts respectively. Zone 1 has to wait 16 hours (second and third shifts) or until crew 1 arrives at the schedule again the next morning (first shift).

This pattern of work on maintaining these zones accumulate a large wait time and this time almost represents two-thirds of the total time.

The cabin department consumes around 33.3% of busy time. At the same time, the cabin department completes all processes last or after the airframe department has announced “hands off.”

It was also apparent that the airframe completes last more often than the cabin and take the representation of the aircraft delay during the 100 simulation replications.

One more comparison between the cabin and other departments is that the inspection time was much larger. This is due to the high number of emergency equipment, many seats, numerous parts and control modules, and also because of the avionics shared

activities in the cockpit zone. Zone 2 often completes last and that is because the afternoon shift has more break times and also because the cabin department is assigned to a fixed shift, unlike other departments they swing every two weeks (morning, afternoon, and night)

Table 4.6 Cabin Technicians Cost (SR) Based on Longest Time (Hours).

Entity	AVG Total Hours	Maint. Cost	Insp. Cost	Maint. + Insp. Cost
Cockpit	741.37	96,378.72	5,508	101,886.72
Zone 1	614.78	245,913.98	6,989.06	252,903.04
Zone 2	799.46	319,783.89	9,553.60	329,337.49
Zone 3	799.46	319,783.89	7,538.32	327,322.21
	Longest AVG	**Maint. Total Cost**	**Insp. Total Cost**	**Technicians Total Cost**
	799.46	**981,860.49**	**29,588.98**	**1,011,449.46**

Nine technicians per crew per zone with scheduled utilization of around 30% – 40% on average. The cockpit zone technician's utilization was approximately 80% on average. The cost of the technicians in the other zones was less because 70% of their technicians were contractors with cheaper pay rates ranging from 30 - 35 (SR) per hour per technician. Other costs were recognized during the aircraft's ground time or lost revenue.

Table 4.7 Cabin Lost Revenue Cost (SR) Based on Longest Time (Hours).

Entity	Longest VA Total Hours	Standard Net Revenue (SR) per Hour	ACFT Lost Revenue
Zone 2	799.46	10,000	7,994,597

The total cost for technicians' costs and the lost revenue costs were approximately **nine million** (SR) during the "C" check maintenance.

4.4 Airframe Department Results and Discussion

The airframe department area's average total maintenance time varies depending on the amount of the non-routine tasks. These total times include maintenance and inspection value-added times plus the wait time for each area.

Table 4.8 Air frame Department Model Simulation Results.

(Entity) Frames	AVG Maint. VA Hours	AVG Insp. VA Hours	AVG Wait Hours	AVG Total Hours
1- (area 7)	191.89	12.96	542.42	747.28
2- (main Wheel Well)	170.07	5.01	463.77	638.85
3- (engineering orders)	198.62	4.85	537.49	740.96
4- (area 9)	167.14	10.82	511.98	689.94
5- (area 10)	154.01	7.9	469.87	631.78
6- (forward cargo)	204.78	4.94	595.95	**805.67**
7- (area 8)	190.21	13.15	594.3	797.65
8- (aft cargo)	193.33	5.15	582.33	780.81
9- (bulk cargo)	157.11	4.05	482.54	643.69

The forward cargo compartment as an area of the airframe department consumes the longest maintenance time and the longest total time. Forward cargo wait time is 595.95 hours and this number is slightly higher than the aft cargo compartment area. Logically, the longest total time is considered for the entire airframe department. This shows that the airframe department consumes around 805 hours when the nonvalue added time is added to the 595.95 hours.

Each area of the airframe department has two technicians to perform the tasks. Crew 1 has 6 technicians assigned among 3 teams, each team has two technicians per area. Therefore, the first three areas are crew 1 responsibility. Crew 2 performs the middle three areas. Crew 3 handles the last three areas (Table 4.8). Utilization of each resource (technician) was within 60 - 70% over their schedule times. Idle times results were minimum of 7% because the rest of the percentage is considered the inactive time of a technician (technicians' out of work hours)

Table 4.9 Air frame Technicians Cost (SR) Based on Longest Time (Hours).

Entity	AVG Total Hours	Maint. Cost	Insp. Cost	Maint. + Insp. Cost
1- (area 7)	747.28	153,192.27	27,450	180,642.27
2- (main Wheel Well)	638.85	130,963.83	24,765	155,728.83
3- (engineering orders)	740.96	151,896.41	26,934	178,830.41
4- (area 9)	689.94	141,438.66	25,054	166,492.66
5- (area 10)	631.78	129,515.60	24,954	154,469.60
6- (forward cargo)	**805.67**	165,161.94	32,457	197,618.94
7- (area 8)	797.65	163,518.60	30,751	194,269.60
8- (aft cargo)	780.81	160,066.34	30,813	190,879.34
9- (bulk cargo)	643.69	131,957.04	24,844	156,801.04
	Longest AVG	**Total Cost**	**Total Cost**	**Technicians Total Cost**
	805.67	**1,486,461.15**	**248,022**	**1,734,483.15**

The utilization efficacy influenced the cost results because of the inactive state of a technician as idle time was considered in the payroll. Costs were calculated for both inactive state and idle time as well as the busy time cost of the technician. Note that total costs also were considered for the longest average total time (the department maintenance finishing time) and were multiplied by each technician's hourly pay rate.

Table 4.10 Air frame Lost Revenue Cost (SR) Based on Longest Time (Hours).

Entity	AVG Total Hours	Standard Net Revenue (SR) Per Hour	ACFT Lost Revenue
6- (forward cargo)	805.67	10,000	8,056,700

Another cost that was considered other than the technicians' costs is the airframe areas costs. This cost represents the aircraft's wait time or the ground time during maintenance or the aircraft lost revenue. Lost revenue costs are very important because each hour the aircraft is in operations will earn 10,000 SR per hour as net revenue. This 10,000 SR was multiplied by the total process time of the longest area. The wait time of the airframe represented 2/3 of the department's total process time. This is a very large proportion when comparing the lost revenue with the technicians' costs, lost revenue cost was around 75% of the total costs of the airframe department.

Two scenarios were modeled to evaluate the massive amount of assignments that will wait for equipment failures. The “as-is” scenario yields in terms of time, some interruptions were caused by many equipment failures of total time 272 hours and 59 hours of wait time. This is representing 59/8 = 7 shifts or days that were wasted in wait time and 272/8 = 34 shifts per crew on average for the airframe (entity) total time. Moreover, 7 shifts of wait time reflected directly to the total time and the cause was the equipment failure. Creating a modified model that reduces equipment and tools idle time, the airframe department may be ahead of all other specialties because many of the airframe department tasks are removing and reinstalling parts rather than repairing parts (e.g., blanket/panels removal and reinstallation, servicing equipment). Therefore, reducing equipment failure might help achieve this study’s objectives. As a result, after proper equipment uses, preventive maintenance of equipment, and correct handling of tools before and after use had reflected in simulating the modified model to make the 272 hours total time 258 hours, which is equal to around 32 shifts or days and that was reported from crew 2, afternoon shift. The reduction of time (improvement) was around 2 days, which was statistically not significant ($P = 0.07$).

As mentioned above these results were manipulated for the simulation modeling validation process. The investigation of the model showed that the equipment was not the main factor for the excessive wasted time, the entity wait time (entity is waiting for two consecutive shifts for its seizing turn) was the noticeable bottleneck. If six crews were assigned at different times or overlapping, this may show significant development of the maintenance work pattern as well as a significant reduction of the lost revenue.

Table 4.11 Airframe Improvement Trial Simulation Results, 8 hours per day for Validation Confirmation.

Case	Average Wait Time (hours)	Average Total Time (hours)
As-is Model	(Crew 1) 49	(Crew 1) 259
	(Crew 2) 59	(Crew 2) 272
	(Crew 3) 51	(Crew 3) 264
Modified Model	(Crew 1) 28	(Crew 1) 227
	(Crew 2) 30	(Crew 2) 258
	(Crew 3) 26	(Crew 3) 231

The airframe model showed validity by comparing results between different based time modeling (8-hr per day and 24-hr per day). This model was valid and was utilized to simulate the "C" check maintenance of the B747 – 400.

Now, the airframe department uses equipment more than other departments. Failure of equipment was simulated and remodeled to optimize one by reducing failure mean times of the uniform distribution. This optimization of airframe time was only a day or two shorter, therefore, the wait time (areas inactivity) represented 2/3 of the total time during all processes of the airframe department. 8 hours the crew is processing and 16 hours the areas were waiting for their technicians to be performing again.

4.5 Avionics Department Results and Discussion

Avionics Crew 1, 2, and 3 perform in parallel on three different segments of tasks and activities of electronic maintenance, their average times in hours are different.

Crew 1 and crew 3 perform engines electronics and airframe areas electronics, respectively. The airframe areas for the avionics technicians consume more value-added or maintenance time which results in a more average total time of 625 hours.

Table 4.12 Avionic Department Model Simulation Results.

Specialty	AVG Maint. VA Hours	AVG Insp. VA Hours	AVG Wait Hours	AVG Total Hours	AVG Maint. VA Cost (SR)	AVG Insp. VA Cost (SR)	AVG Wait Cost (SR)	AVG Total Cost (SR)
Avionics Crew 1	122.54	32.51	452.14	607.2	25120	4064	28471	57655
Avionics Crew 2	52.36	105.07	411.78	569.2	9163	21540	29321	60023
Avionics Crew 3	127.14	29.9	467.98	**625**	26064	3738	28559	58360

Crew 2 results from the simulation showed more average time spent in the inspections hours compared to crew 1 and 2, even though, crew 2 wait time was less than crew 1 and crew 2. Maintenance processes and value-added inspection average hours plus the average wait time equals the average total time for each crew. The longest in the avionics department considered the average total time for all crews. The avionics department consumes around 26 days' average time. This average comes from the longest crew takes to finish the processes of crew 3 responsible areas. Comparing crew 2 processes value-added maintenance time or total crew average time, it was less than both crew1 and crew 3. This means that crew 1 and crew 3 were able to support crew 2 to shorten the department's total average time.

The cost of a busy technician represented the average value-added hours on activities either for the inspection team or the maintenance personnel. Idle cost of technician and inspector was represented by the break time and may include the inactive times as well. Correct technicians' cost was calculated for the department time consumed on maintenance time. The technician's hourly pay rate was multiplied by the longest total average hour. Therefore, the avionics technicians' total cost needs the inactive state

cost for each technician to be added up to the busy and idle time, just like all previous departments. Frequency statistics were used to confirm the percentage of the inactive state of a technician. Avionics department senior technicians were inefficiently utilized during the tasks. Juniors were efficiently utilized because they were assigned individually in some processes and as helpers to the senior technicians.

Table 4.13 Avionics Department Technicians Utilization Simulation Results.

Resource	Instantaneous Utilization	NO. Busy	NO. Schedule	Busy Cost	Idle Cost
Junior 1	0.79	0.79	0.2634	52950	2734
Junior 2	0.77	0.77	0.2176	62347	488
Junior 3	0.78	0.78	0.2386	58112	891
Senior 1	0.25	0.25	0.2634	18898	3797
Senior 2	0.24	0.24	0.2176	18725	525
Senior 3	0.25	0.25	0.2386	19320	1238

Moreover, the cost of labor was combined with aircraft being on the ground cost. This cost was called a lost revenue cost and it represented a large amount of approximately 85% of the total cost calculated for this department.

Table 4.14 Avionics Department Technicians and Lost Revenue Cost (SR) Based on Longest Average Total Time.

Avionics Department Cost	**(A+B)**	**4,936,119.87**
Avionics Technicians Cost	**(A)**	416,707.44
Lost Net Revenue	**(B)**	4,519,412.42

4.6 ACFT Complete Model Results and Discussion

The results shown in Table 4.15 were stable, which confirms the validity of each previous model. This model adds the department statistics for the average wait time and average total time. The last department to complete their tasks represented the aircraft's average total time.

Each department collected had its statistic for average wait hours and average total hours. However, the time may be different because the department collects the average of the last areas' average time, which represented an average of the average). Department's average total hours was very similar to the average total hours of the last areas that completed their job.

Table 4.15 ACFT Complete Model Simulation Results.

Entity	AVG Maint. VA Hours	AVG Insp. VA Hours	AVG Wait Hours	AVG Total Hours
Area 7 Cargo (AF Depart.)	191.91	12.77	542.27	746.95
Wheel Well (AF Depart.)	169.96	5.09	463.45	638.5
EOs (AF Depart.)	197.92	4.93	535.11	737.96
Area 9 (AF Depart.)	167.91	11.03	513.72	692.67
Area 10 (AF Depart.)	154.29	7.93	470.57	632.79
Forward Cargo (AF Depart.)	204.28	4.97	595.15	**804.41**
Area 8 (AF Depart.)	189.65	13.05	592.36	795.06
Aft Cargo (AF Depart.)	193.47	4.96	582.99	781.42
Bulk Cargo (AF Depart.)	156.42	3.97	479.18	639.57
Airframe Department	-	-	810.35	**810.35**
Engine 1 (PP Depart.)	170.16	11.46	480.58	662.21
Engine 2 (PP Depart.)	169.2	11.41	478.6	659.21
Engine 3 (PP Depart.)	170.35	11.46	520.78	**702.60**
Engine 4 (PP Depart.)	170.2	11.42	520.61	702.23
APU (PP Depart.)	108.31	28.72	405.21	542.24
EOs (PP Depart.)	150.59	24.39	522.43	697.41
PowerPlant Department	-	-	705.28	**705.28**
Cabin Zone 1 (CB Depart.)	151.99	15.97	584.85	752.81
Cabin Zone 2 (CB Depart.)	153.18	42.52	583.87	**779.57**
Cabin Zone 3 (CB Depart.)	159.85	15.76	581.94	757.55
Cockpit (CB Depart.)	162.52	41.56	540.63	744.71
Cabin Department	-	-	783.13	**783.13**
Avionics Area 1 (AV Dept.)	52.53	105	413.2	570.73
Avionics Area 2 (AV Dept.)	122.04	32.25	449.24	603.52
Avionics Area 3 (AV Dept.)	127.15	30.11	468.97	**626.24**
Avionics Department	-	-	628.88	**628.88**

The cabin department maintenance processes consumed a similar time when compared with the airframe department and in some replicates, the cabin department was the last to finish and represented the aircraft's average total time. The aircraft's overall cost may be collected from previous models except for the cost of the resources because the last department that completes the maintenance tasks represents all departments in

terms of average total time. This actually will increase the resources cost slightly due to the lack of accuracy of representation.

Also, the resource utilization of some departments was different. Avionics, APU, and cabin zone 1 recorded less utilization than when their maintenance tasks were simulated individually. This was expected because the terminating condition or the replication length of the simulation run did not stop until all departments called for "hands off." Therefore, departments that have already accomplished the tasks and their technicians were idle. This was true and once again, this represented the actual life scenario at the SV MRO maintenance 747 hangars and assures model validity as well. Lost revenue cost will be calculated from the last department that completed their tasks and also can be added from previous individual departments' models.

Finally, the aircraft 747 -400 consumes at the SV MRO hangar on average 33 – 34 days from 100 months (8 years) of simulation modeling.

Table 4.16 ACFT Model Results Summary.

"C" Check of Aircraft	**B 747- 400**
Average Value added Days	10
Average Wait Days	24
Average Total Days	34
Technicians Total Cost	4,110,250.00
Total Lost Revenue	8,120,000.00
Total Cost	**12,230,250.00**

Chapter V

Conclusion and Recommendations

5.1 Conclusion

- Maintenance “C” check routines were performed only once a day for 8 hours shift. No maintenance was performed on the engines during the other two shifts of the day.
- Engine average total time for maintenance duration was represented by the longest engine maintenance time. Thus, this was the time that the powerplant department considered completed.
- Engines’ wait time was large and it represented at least two-thirds of the total hours of engine maintenance routines because the maintenance was performed only during one shift.
- APU and EOs were having two unbalanced segments of processes which helped APU “C” check procedures to finish ahead of EOs. Also, the EOs average total time was close to engine #3 average total times. Thus, the EOs area represented the longest time after engine #4 in many replications.
- The cost of the powerplant departments’ technicians was around 837,650 (SR) and this was approximately 11% of the aircraft's total cost.

- Powerplant department technician utilization was at 50% during each shift. The inactive time showed a high percentage when compared to the idle time where 50% busy state of resources, only 5% idle state, and the rest are the inactivity percentage of resources (16 hours of no maintenance on each engine).
- The afternoon shift crew consumes more breaks due to prayer times. This makes the afternoon shift less productive when compared to other shifts.
- The cabin department processes were performed in a single shift each. This is why the wait time was accumulated and resulted in 22 days of lost time for the cabin zones.
- The average total time of the cabin department was 33 days. However, the actual maintenance process average time was only 10 days to complete all maintenance tasks for all zones. This is because a single shift was utilized for each zone.
- Zone 2 in the cabin department was the zone that consumed the longest time performing maintenance routines. This zone was performed by crew 2 in the afternoon shift. Since the afternoon shift had an excessive amount of breaks, this zone was the last to be completed.
- Zone 2 in the cabin department was consuming a similar time to the forward cargo compartment in the airframe department. This indicated that these two areas were representing the aircraft's total time.
- The cost of the cabin department’s technicians was less compared to other departments, but the lost revenue cost was still as high as the airframe lost revenue cost.
- One important note to mention is that the cabin department had more routine and non-routine tasks and activities when compared to all other departments.

- Airframe consumes extended wait times and that was directly reflected in the average total time of the whole department. Also, it was found that the airframe department represented the whole aircraft's average total time because it was the last department that completed its maintenance tasks.
- The cabin department also represented the aircraft's average total time in many of the replications over 100 simulation runs. This indicated that both the airframe and cabin departments were the last two departments that completed the maintenance check. However, the airframe department was the last one that completed its “C” check maintenance routines 20% of the time.
- Costs of the Airframe departments’ technicians were only 25% of the total cost and the lost revenue cost of the airframe areas indicated the majority of the airframe department's total cost.
- Also, the afternoon shift accumulated wait times more than other shifts because of the excessive breaks, but still was a small proportion of the total wait cost recorded.
- Forward cargo and aft cargo were the two areas of the airframe department that could be nominated for the longest time. Though, 50% of the time the forward cargo compartment completes its maintenance routines last to represent the department's total time.
- The avionics department consumes on average 26 days to complete its department maintenance “C” check processes. Value-added time included both inspection and maintenance processes which were only 1/3 of the 26 days. The remaining times were waiting times and 80% of these waits were a waste of time that was driven by areas not being maintained waiting for a resource(s).

- In the avionics department, crew utilization between senior and junior technicians was significantly different ($P = 0.19$). Juniors were utilized more efficiently than seniors and that is because when they had their assignments and when were assigned as helpers.
- The validity of the aircraft model to represent the maintenance "C" check tasks and activities of various aircraft areas by many departments crews was confirmed.
- Aircraft consume on average 33.5 days for more than 8 years (100 months) of simulation replications. The minimum average total time indicated the possibility of achieving the completion in 26 days whereas the maximum showed 35 days.
- It was concluded that the chance and opportunity of improvement are significant because 2/3 of the average total time was waiting time.
- The total cost of both technicians and lost revenue were around 12,120,000 (SR).
- Four million of the total cost was for technicians' salaries during the maintenance "C" check period.
- The lost revenue cost was represented as double the technicians' total cost during the maintenance check. The wait time was indicated to be two-thirds of the total time in the aircraft complete model for the maintenance "C" check of the B747 – 400, and in each maintenance department model, the same observation was consistent.

5.2 Recommendations

- Maintenance routines on all engines may be performed during all shifts of the day. This means each engine has an assigned team to work on it around the clock instead of one shift per engine(s). This could be by hiring more technicians and merging helpers by distributing them on easy jobs like open-ups and close-ups under senior or lead technicians' supervision to expedite the removal process for inspection and the reinstallation process for final inspections.
- After the APU team completes their tasks, they may join the EOs team, especially during the last two maintenance processes of the EOs segment. This may reduce the time of the EOs tasks and activities. This can be called a process reorder or a technician reassignment and utilization.
- All cabin department zones should be performed during all shifts during the day. This means each zone of the cabin zones has an assigned crew instead of working only one 8 hours shift per day. This may also reduce the workload and increase resource utilization.
- Since the cabin crew operates on a fixed shift and no swings between crews exist. The number of operators per shift may be reconsidered especially for the afternoon shift. This also may apply to the avionics department.
- The processes and tasks differ from one department's area to another. Therefore, re-ranking or reordering processes may be necessary. This attempt may keep one department's area's total time of each crew similar to each other or close enough and this may reduce the department maintenance total time.

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Appendix A

Arena ACFT Model Results Overview

Values Across All Replications

B 747- 400 “C” Check Maintenance

Replications: 100 Time Units: Hours

Key Performance Indicators

System	Average
Number Out	26

Values Across All Replications

747

Replications: 100 Time Units: Hours

Entity

Time

VA Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	162.36	0.84	153.01	172.49	153.01	172.49
Engine 1	170.49	0.73	160.63	178.84	160.63	178.84
Engine 2	169.80	0.79	159.63	177.66	159.63	177.66
Engine 3	170.22	0.88	162.03	183.15	162.03	183.15
Engine 4	170.26	0.79	158.28	179.42	158.28	179.42
Air frame Department	0.00	0.00	0.00	0.00	0.00	0.00
Power plant EOs	150.67	0.83	141.81	160.06	141.81	160.06
Avionics Crew 2	122.04	1.18	111.44	132.74	111.44	132.74
APU	108.11	0.74	98.3659	116.26	98.3659	116.26
Avionics Crew 1	52.5298	0.50	47.9914	57.9576	47.9914	57.9576
Area 7 Left Wing	191.86	0.81	182.10	202.00	182.10	202.00
Air-condition Area and W/W	169.89	1.14	156.46	184.31	156.46	184.31
Airframe EOs	198.09	0.97	188.42	209.76	188.42	209.76
Avionics Crew 3	127.17	0.66	120.89	133.65	120.89	133.65
Area 9 Fuselage	167.76	0.69	159.46	173.78	159.46	173.78
Area 10 Empennage	154.40	0.61	144.60	160.22	144.60	160.22
FWD Cargo and EOs	204.37	0.72	197.56	212.61	197.56	212.61
Area 8 Right Wing	189.44	0.72	179.54	197.82	179.54	197.82
Aft Cargo and EOs	193.57	0.81	184.54	206.24	184.54	206.24
Bulk Cargo and OFV Area	156.43	0.67	149.20	164.26	149.20	164.26
Avionics Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Department	0.00	0.00	0.00	0.00	0.00	0.00
Power Plant Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 1	151.99	0.94	412.69	435.91	412.69	435.91
Cabin Zone 2	153.13	0.91	398.38	418.28	398.38	418.28
Cabin Zone 3	159.85	0.86	412.67	435.13	412.67	435.13

747

Replications: 100 Time Units: Hours

Entity

Time

NVA Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	0.00	0.00	0.00	0.00	0.00	0.00
Engine 1	0.00	0.00	0.00	0.00	0.00	0.00
Engine 2	0.00	0.00	0.00	0.00	0.00	0.00
Engine 3	0.00	0.00	0.00	0.00	0.00	0.00
Engine 4	0.00	0.00	0.00	0.00	0.00	0.00
Air frame Department	0.00	0.00	0.00	0.00	0.00	0.00
Power plant EOs	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Crew 2	0.00	0.00	0.00	0.00	0.00	0.00
APU	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Crew 1	0.00	0.00	0.00	0.00	0.00	0.00
Area 7 Left Wing	0.00	0.00	0.00	0.00	0.00	0.00
Air-condition Area and W/W	0.00	0.00	0.00	0.00	0.00	0.00
Air frame EOs	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Crew 3	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Fuselage	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Empennage	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo and EOs	0.00	0.00	0.00	0.00	0.00	0.00
Area 8 Right Wing	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo and EOs	0.00	0.00	0.00	0.00	0.00	0.00
Bulk Cargo and OFV Area	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Department	0.00	0.00	0.00	0.00	0.00	0.00
Power Plant Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 1	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 2	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 3	0.00	0.00	0.00	0.00	0.00	0.00

747

Replications: 100 Time Units: Hours

Entity

Time

Wait Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	540.27	2.35	508.25	560.75	508.25	560.75
Engine 1	481.95	2.24	450.00	502.75	450.00	502.75
Engine 2	478.57	2.54	449.00	502.75	449.00	502.75
Engine 3	520.36	2.20	501.50	547.25	501.50	547.25
Engine 4	520.24	1.88	484.75	546.25	484.75	546.25
Air frame Department	810.42	2.15	785.16	834.70	785.16	834.70
Power plant EOs	522.10	2.72	494.25	541.00	494.25	541.00
Avionics Crew 2	449.70	3.19	414.75	484.00	414.75	484.00
APU	404.06	3.25	366.00	439.00	366.00	439.00
Avionics Crew 1	413.17	2.20	379.00	432.75	379.00	432.75
Area 7 Left Wing	542.30	2.90	512.75	585.74	512.75	585.74
Air-condition Area and W/W	462.91	3.67	431.25	506.41	431.25	506.41
Air frame EOs	536.13	3.09	502.75	567.75	502.75	567.75
Avionics Crew3	468.43	2.52	440.50	494.25	440.50	494.25
Area 9 Fuselage	514.11	1.93	484.75	529.82	484.75	529.82
Area 10 Empennage	469.45	1.96	449.00	484.75	449.00	484.75
FWD Cargo and EOs	595.91	2.15	565.00	620.25	565.00	620.25
Area 8 Right Wing	592.10	2.40	558.50	611.00	558.50	611.00
Aft Cargo and EOs	583.17	2.49	558.25	611.36	558.25	611.36
Bulk Cargo and OFV Area	479.17	2.32	457.75	514.07	457.75	514.07
Avionics Department	628.72	2.98	591.58	659.55	591.58	659.55
Cabin Department	781.49	2.12	752.88	803.91	752.88	803.91
Power Plant Department	712.96	2.18	687.96	742.67	687.96	742.67
Cabin Zone 1	1604.56	5.64	1543.03	1665.48	1543.03	1665.48
Cabin Zone 2	1661.33	5.43	1604.74	1725.42	1604.74	1725.42
Cabin Zone 3	1605.71	6.38	1552.05	1681.36	1552.05	1681.36

747

Replications: 100 Time Units: Hours

Entity

Time

Transfer Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	0.00	0.00	0.00	0.00	0.00	0.00
Engine 1	0.00	0.00	0.00	0.00	0.00	0.00
Engine 2	0.00	0.00	0.00	0.00	0.00	0.00
Engine 3	0.00	0.00	0.00	0.00	0.00	0.00
Engine 4	0.00	0.00	0.00	0.00	0.00	0.00
Air frame Department	0.00	0.00	0.00	0.00	0.00	0.00
Power plant EOs	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Crew 2	0.00	0.00	0.00	0.00	0.00	0.00
APU	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Crew 1	0.00	0.00	0.00	0.00	0.00	0.00
Area 7 Left Wing	0.00	0.00	0.00	0.00	0.00	0.00
Air-condition Area and W/W	0.00	0.00	0.00	0.00	0.00	0.00
Air frame EOs	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Crew 3	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Fuselage	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Empennage	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo and EOs	0.00	0.00	0.00	0.00	0.00	0.00
Area 8 Right Wing	0.00	0.00	0.00	0.00	0.00	0.00
AFT Cargo and EOs	0.00	0.00	0.00	0.00	0.00	0.00
Bulk Cargo and OFV Area	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Department	0.00	0.00	0.00	0.00	0.00	0.00
Power Plant Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 1	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 2	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 3	0.00	0.00	0.00	0.00	0.00	0.00

747

Replications: 100 Time Units: Hours

Entity

Time

Other Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	41.5704	0.23	39.1947	43.5452	39.1947	43.5452
Engine 1	11.5904	0.22	8.8356	13.8017	8.8356	13.8017
Engine 2	11.4971	0.22	9.2220	13.9294	9.2220	13.9294
Engine 3	11.4402	0.21	9.4338	13.7262	9.4338	13.7262
Engine 4	11.5534	0.20	8.7328	13.5090	8.7328	13.5090
Air frame Department	0.00	0.00	0.00	0.00	0.00	0.00
Power plant EOs	24.2328	0.53	20.1152	29.9757	20.1152	29.9757
Avionics Crew 2	32.3249	0.28	30.0227	34.9671	30.0227	34.9671
APU	28.7803	0.62	24.2484	34.6444	24.2484	34.6444
Avionics Crew 1	104.96	0.58	100.07	109.90	100.07	109.90
Area 7 Left Wing	13.1486	0.20	10.7651	15.5098	10.7651	15.5098
Air-condition Area and W/W	5.0708	0.14	3.4519	6.4724	3.4519	6.4724
Air frame EOs	5.0149	0.17	3.2314	6.7729	3.2314	6.7729
Avionics Crew 3	29.9160	0.22	28.0381	31.9560	28.0381	31.9560
Area 9 Fuselage	11.0338	0.28	7.3703	13.6696	7.3703	13.6696
Area 10 Empennage	7.9355	0.20	5.5943	10.0791	5.5943	10.0791
FWD Cargo and EOs	4.9123	0.12	3.2862	5.9796	3.2862	5.9796
Area 8 Right Wing	12.8275	0.23	10.5353	15.3616	10.5353	15.3616
AFT Cargo and EOs	4.9408	0.12	3.5195	6.2805	3.5195	6.2805
Bulk Cargo and OFV Area	3.9730	0.11	2.8892	5.1799	2.8892	5.1799
Avionics Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Department	0.00	0.00	0.00	0.00	0.00	0.00
Power Plant Department	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Zone 1	15.1290	0.34	12.1422	17.9062	12.1422	17.9062
Cabin Zone 2	42.3777	0.47	37.1982	47.6557	37.1982	47.6557
Cabin Zone 3	15.1334	0.36	12.1076	17.9520	12.1076	17.9520

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Replications: 100 Time Units: Hours

Entity

Time

Total Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	744.20	3.12	702.17	774.93	702.17	774.93
Engine 1	664.03	2.94	622.30	693.70	622.30	693.70
Engine 2	659.87	3.33	618.55	694.02	618.55	694.02
Engine 3	702.01	3.08	674.94	742.67	674.94	742.67
Engine 4	702.05	2.66	654.00	737.87	654.00	737.87
Air frame Department	810.42	2.15	785.16	834.70	785.16	834.70
Power plant EOs	697.00	3.67	659.27	726.68	659.27	726.68
Avionics Crew 2	604.07	4.34	558.19	650.82	558.19	650.82
APU	540.95	4.21	489.17	585.50	489.17	585.50
Avionics Crew 1	570.66	2.87	527.19	599.90	527.19	599.90
Area 7 Left Wing	747.31	3.66	709.60	801.31	709.60	801.31
Air-condition Area and W/W	637.86	4.78	593.55	695.21	593.55	695.21
Air frame EOs	739.23	4.01	694.79	782.66	694.79	782.66
Avionics Crew 3	625.51	3.21	589.70	659.55	589.70	659.55
Area 9 Fuselage	692.90	2.62	654.93	715.97	654.93	715.97
Area 10 Empennage	631.79	2.54	600.40	653.54	600.40	653.54
FWD Cargo and EOs	805.19	2.78	766.53	834.70	766.53	834.70
Area 8 Right Wing	794.37	3.10	750.19	821.44	750.19	821.44
AFT Cargo and EOs	781.69	3.25	747.82	822.56	747.82	822.56
Bulk Cargo and OFV Area	639.57	2.94	610.85	680.40	610.85	680.40
Avionics Department	628.72	2.98	591.58	659.55	591.58	659.55
Cabin Department	781.49	2.12	752.88	803.91	752.88	803.91
Power Plant Department	712.96	2.18	687.96	742.67	687.96	742.67
Cabin Zone 1	752.81	3.15	722.80	774.86	722.80	774.86
Cabin Zone 2	779.57	2.52	752.88	803.91	752.88	803.91
Cabin Zone 3	757.55	2.61	737.70	785.97	737.70	785.97

Other

747

Replications: 100 Time Units: Hours

Entity

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
Cockpit	1.00	0.00	1.00	1.00
Engine 1	1.00	0.00	1.00	1.00
Engine 2	1.00	0.00	1.00	1.00
Engine 3	1.00	0.00	1.00	1.00
Engine 4	1.00	0.00	1.00	1.00
Air frame Department	1.00	0.00	1.00	1.00
Power plant EOs	1.00	0.00	1.00	1.00
Avionics Crew 2	1.00	0.00	1.00	1.00
ACFT	0.00	0.00	0.00	0.00
APU	1.00	0.00	1.00	1.00
Avionics Crew 1	1.00	0.00	1.00	1.00
Area 7 Left Wing	1.00	0.00	1.00	1.00
Air-condition Area and W/W	1.00	0.00	1.00	1.00
Air frame EOs	1.00	0.00	1.00	1.00
Avionics Crew 3	1.00	0.00	1.00	1.00
Area 9 Fuselage	1.00	0.00	1.00	1.00
Area 10 Empennage	1.00	0.00	1.00	1.00
FWD Cargo and EOs	1.00	0.00	1.00	1.00
Area 8 Right Wing	1.00	0.00	1.00	1.00
AFT Cargo and EOs	1.00	0.00	1.00	1.00
Bulk Cargo and OFV Area	1.00	0.00	1.00	1.00
Avionics Department	1.00	0.00	1.00	1.00
Cabin Department	1.00	0.00	1.00	1.00
Power Plant Department	1.00	0.00	1.00	1.00
Cabin Zone 1	1.00	0.00	1.00	1.00
Cabin Zone 2	1.00	0.00	1.00	1.00
Cabin Zone 3	1.00	0.00	1.00	1.00

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Replications: 100 Time Units: Hours

Entity

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
Cockpit	1.00	0.00	1.00	1.00
Engine 1	1.00	0.00	1.00	1.00
Engine 2	1.00	0.00	1.00	1.00
Engine 3	1.00	0.00	1.00	1.00
Engine 4	1.00	0.00	1.00	1.00
Air frame Department	1.00	0.00	1.00	1.00
Power plant EOs	1.00	0.00	1.00	1.00
Avionics Crew 2	1.00	0.00	1.00	1.00
ACFT	0.00	0.00	0.00	0.00
APU	1.00	0.00	1.00	1.00
Avionics Crew 1	1.00	0.00	1.00	1.00
Area 7 Left Wing	1.00	0.00	1.00	1.00
Air-condition Area and W/W	1.00	0.00	1.00	1.00
Air frame EOs	1.00	0.00	1.00	1.00
Avionics Crew 3	1.00	0.00	1.00	1.00
Area 9 Fuselage	1.00	0.00	1.00	1.00
Area 10 Empennage	1.00	0.00	1.00	1.00
FWD Cargo and EOs	1.00	0.00	1.00	1.00
Area 8 Right Wing	1.00	0.00	1.00	1.00
AFT Cargo and EOs	1.00	0.00	1.00	1.00
Bulk Cargo and OFV Area	1.00	0.00	1.00	1.00
Avionics Department	1.00	0.00	1.00	1.00
Cabin Department	1.00	0.00	1.00	1.00
Power Plant Department	1.00	0.00	1.00	1.00
Cabin Zone 1	1.00	0.00	1.00	1.00
Cabin Zone 2	1.00	0.00	1.00	1.00
Cabin Zone 3	1.00	0.00	1.00	1.00

Values Across All Replications

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Replications: 100 Time Units: Hours

Entity

Other

WIP	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit	0.9168	0.00	0.8712	0.9776	0.00	1.0000
Engine 1	0.8167	0.00	0.7726	0.8629	0.00	1.0000
Engine 2	0.8116	0.00	0.7557	0.8673	0.00	1.0000
Engine 3	0.8642	0.00	0.8214	0.9104	0.00	1.0000
Engine 4	0.8642	0.00	0.8056	0.9256	0.00	1.0000
Air frame Department	0.9994	0.00	0.9901	1.0000	0.00	1.0000
Power plant EOs	0.8579	0.01	0.7892	0.9108	0.00	1.0000
Avionics Crew 2	0.7419	0.01	0.6804	0.8113	0.00	1.0000
ACFT	0.00	0.00	0.00	0.00	0.00	0.00
APU	0.6630	0.01	0.5965	0.7189	0.00	1.0000
Avionics Crew 1	0.7001	0.00	0.6394	0.7496	0.00	1.0000
Area 7 Left Wing	0.9208	0.01	0.8718	0.9943	0.00	1.0000
Air-condition Area and W/W	0.7841	0.01	0.7091	0.8657	0.00	1.0000
Air frame EOs	0.9107	0.01	0.8427	0.9743	0.00	1.0000
Avionics Crew 3	0.7687	0.00	0.7173	0.8244	0.00	1.0000
Area 9 Fuselage	0.8528	0.00	0.7992	0.8854	0.00	1.0000
Area 10 Empennage	0.7765	0.00	0.7394	0.8243	0.00	1.0000
FWD Cargo and EOs	0.9929	0.00	0.9557	1.0000	0.00	1.0000
Area 8 Right Wing	0.9794	0.00	0.9221	1.0000	0.00	1.0000
AFT Cargo and EOs	0.9637	0.00	0.9009	1.0000	0.00	1.0000
Bulk Cargo and OFV Area	0.7862	0.00	0.7326	0.8470	0.00	1.0000
Avionics Department	0.7727	0.00	0.7245	0.8244	0.00	1.0000
Cabin Department	0.9635	0.00	0.9253	1.0000	0.00	1.0000
Power Plant Department	0.8778	0.00	0.8342	0.9256	0.00	1.0000
Cabin Zone 1	0.7415	0.01	0.4041	0.6584	0.00	1.0000
Cabin Zone 2	0.8257	0.01	0.4956	0.7460	0.00	1.0000
Cabin Zone 3	0.7425	0.01	0.4103	0.7192	0.00	1.0000

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Replications: 100 Time Units: Hours

Process

Time per Entity

747

Replications: 100 Time Units: Hours

Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
1 2 3 and 4 Fixed Fairings Installation	7.9282	0.12	7.0065	8.9828	7.0065	8.9828
1 2 3 and 4 Fixed Fairings Removal	5.9545	0.11	5.0042	6.9579	5.0042	6.9579
1 and 2 Turbines Installation	8.0314	0.12	7.0088	8.9873	7.0088	8.9873
1 and 2 Turbines Removal	4.2611	0.09	3.5025	4.9881	3.5025	4.9881
3 and 4 Turbines Installation	8.0175	0.12	7.0310	8.9927	7.0310	8.9927
3 and 4 Turbines Removal	4.2608	0.09	3.5242	4.9960	3.5242	4.9960
4 Engines Simulation	12.9546	0.35	10.0019	15.9786	10.0019	15.9786
5 6 7 and 8 Fixed Fairings Installation	7.9584	0.11	7.0103	8.9849	7.0103	8.9849
5 6 7 and 8 Fixed Fairings Removal	5.8834	0.12	5.0004	6.9982	5.0004	6.9982
AC EO	51.7206	0.73	46.0341	57.6511	46.0341	57.6511
AF Fuel EO Operational Checks Avionics	22.1593	0.23	20.1124	23.9982	20.1124	23.9982
Aft Cargo Access Panels Open Up	10.9145	0.12	10.0007	11.9765	10.0007	11.9765
Aft Cargo Blankets Installation and Close Up	28.8983	0.34	26.1175	31.8704	26.1175	31.8704
Aft Cargo Blankets Removal	14.0217	0.24	12.0207	15.9974	12.0207	15.9974
Aft Cargo Corrosion Inhibiter Application	2.5113	0.06	2.0421	2.9963	2.0421	2.9963
Aft Cargo Door Lubrication	0.9790	0.06	0.5098	1.4968	0.5098	1.4968
Aft Cargo Non Routine Cards	24.9105	0.38	22.0541	27.9934	22.0541	27.9934
Aft Cargo Routine Cards	20.1930	0.48	16.0195	23.9708	16.0195	23.9708
Air-condition Access Panels Open Up	10.0830	0.12	9.0017	10.9647	9.0017	10.9647
Air-condition Area Access Panels Close Up	14.9248	0.32	12.0034	17.9040	12.0034	17.9040
Air-condition Area Corrosion Inhibiter Application	9.8495	0.24	8.0160	11.9324	8.0160	11.9324
Air-condition Area Non Routine Cards	67.2414	0.86	60.0120	74.4398	60.0120	74.4398
APU and Area Non Routine Cards	17.0633	0.34	14.0189	19.9128	14.0189	19.9128
APU Close Up and Rectifications	19.5345	0.45	16.1040	23.8385	16.1040	23.8385
APU Operational Checks	18.5249	0.18	17.0241	19.9917	17.0241	19.9917
APU Team House Keeping	14.0371	0.23	12.0027	15.9675	12.0027	15.9675
APU Test	5.7937	0.59	0.00	7.9934	0.00	7.9934
Area 10 CIC	3.5203	0.06	3.0049	3.9971	3.0049	3.9971
Area 10 Leak Checks	13.2265	0.36	10.2753	15.9564	10.2753	15.9564
Area 10 Lubrication	10.0706	0.22	8.0133	11.9572	8.0133	11.9572
Area 10 Non Routine Cards	26.4751	0.16	25.0130	27.9873	25.0130	27.9873
Area 10 OK to Close	2.4930	0.06	2.0366	2.9885	2.0366	2.9885

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Replications: 100 Time Units: Hours

Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Area 10 Operational Checks	24.8535	0.36	22.0526	27.9067	22.0526	27.9067
Area 10 Panels In Place	1.9844	0.06	1.5199	2.4820	1.5199	2.4820
Area 10 Panels Security V and H Stabilizers	14.0564	0.25	12.0924	15.9784	12.0924	15.9784
Area 10 Routine Cards	29.1333	0.11	28.0504	29.9994	28.0504	29.9994
Area 10 Stabilizer Jack Screw Motors Servicing	2.4631	0.05	2.0125	2.9811	2.0125	2.9811
Area 5 Cabin Non Routine Cards and Operational Checks	106.10	1.14	97.1253	114.91	97.1253	114.91
Area 6 Cockpit Operational Checks Avionics	15.9425	0.22	14.0307	17.9267	14.0307	17.9267
Area 9 Non Routine Cards	59.3849	0.29	57.0458	61.9896	57.0458	61.9896
Area 9 Routine Cards	24.2691	0.49	20.0198	27.9604	20.0198	27.9604
Body and WIng Landing Gears and Doors Lubrication	7.0526	0.11	6.0342	7.9840	6.0342	7.9840
Breake Assembly Change	3.4721	0.06	3.0003	3.9874	3.0003	3.9874
Bulk and OFV Areas Non Routine Cards	37.4235	0.29	35.0163	39.9990	35.0163	39.9990
Bulk and OFV Areas Routine Cards	14.8250	0.33	12.0302	17.9749	12.0302	17.9749
Bulk and OFV CIC and Blankets Installation	31.0951	0.12	30.0417	31.9878	30.0417	31.9878
Bulk and OFV Open Up and Blankets Removal	24.8127	0.36	22.0175	27.9879	22.0175	27.9879
Cabin Carpet Replacement and Close Up 1	132.60	0.29	130.01	134.91	130.01	134.91
Cabin Carpet Replacement and Close Up 2	132.80	0.27	130.03	134.97	130.03	134.97
Cabin Carpet Replacement and Close Up 3	132.21	0.30	130.04	134.83	130.04	134.83
Cabin Filters Replacement and Routine Cards	13.0193	0.11	12.0299	13.9984	12.0299	13.9984
Cabin Filters Replacement and Routine Cards 2	13.0876	0.12	12.0109	13.9993	12.0109	13.9993
Cabin Filters Replacement and Routine Cards 3	12.9654	0.12	12.0301	13.9849	12.0301	13.9849
Cabin Lubrication and CIC 1	22.1423	0.23	20.0169	23.9939	20.0169	23.9939
Cabin Lubrication and CIC 3	21.9115	0.24	20.0087	23.9635	20.0087	23.9635
Canted Pressure Deck Area	104.79	0.59	100.03	109.97	100.03	109.97
Captain and First Officer Seats Installation	16.9072	0.12	16.0225	17.9905	16.0225	17.9905
Captain and First Officer Seats Removal	4.0150	0.12	3.0066	4.9715	3.0066	4.9715
Cargo Door Rigging	6.9624	0.11	6.0080	7.9642	6.0080	7.9642
CIC Under Body Fairing Structure CIC	1.0110	0.05	0.5053	1.4939	0.5053	1.4939
Cockpit Carpet Replacement	32.5000	0.28	30.0556	34.9199	30.0556	34.9199

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Replications: 100 Time Units: Hours

Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit Close Up and Final Inspection	32.3393	0.29	30.0324	34.9947	30.0324	34.9947
Cockpit Open Up and Disconnection	20.6490	0.33	18.0062	23.9866	18.0062	23.9866
Cockpit Routine and Non Routine Cards	45.1459	0.62	40.0408	49.7462	40.0408	49.7462
Corrosion Inhibiter and Prep Close Up	5.9861	0.11	4.4340	7.2141	4.0105	7.9971
Corrosion Inhibiter Applications	2.2658	0.03	2.0084	2.4964	2.0084	2.4964
Crew Rest Area	105.12	0.59	100.13	109.84	100.13	109.84
Door Open Up	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
Ducts Reinstallation	13.1131	0.12	12.0082	13.9902	12.0082	13.9902
Ducts Removal	7.2926	0.28	5.0068	9.7794	5.0068	9.7794
E and E Blankets Installation	9.9495	0.22	8.0935	11.9663	8.0935	11.9663
E and E Floor Panels Close Up	4.5214	0.06	4.0028	4.9846	4.0028	4.9846
E and E Blanket Removal Floor Panels Open Up	2.4557	0.06	2.0032	2.9983	2.0032	2.9983
Electronic Equip and Station 111 CIC	1.4724	0.06	1.0038	1.9977	1.0038	1.9977
Engine Baroscopic	3.9586	0.06	3.4128	4.6717	3.0068	4.9937
Engine Baroscopic Close Up and Rectification	4.0092	0.06	3.3880	4.7827	3.0002	4.9993
Engine Close Up	24.1189	0.22	22.1658	26.7426	20.0158	27.9775
Engine Health and Functions	32.5365	0.29	30.1728	34.9707	30.1728	34.9707
Engine Oil Change and Routine	2.0254	0.03	1.6371	2.3670	1.5008	2.4990
Engine Open Up	12.0143	0.13	10.4226	13.5610	10.0033	13.9973
EO 5312654 station 2598 Bolts Removal for NDT	32.5655	0.30	30.0094	34.9812	30.0094	34.9812
EO 531355	14.9641	0.33	12.0257	17.9694	12.0257	17.9694
EO 531433	12.5188	0.30	10.0660	14.9841	10.0660	14.9841
EO 541119	18.0472	0.25	16.0569	19.9960	16.0569	19.9960
EO 541180	37.3331	0.32	35.0046	39.9867	35.0046	39.9867
EO 571334	24.9425	0.11	24.0175	25.9794	24.0175	25.9794
EO 731258	30.2663	0.61	25.0050	34.9731	25.0050	34.9731
EO 731292	32.5008	0.29	30.0266	34.9923	30.0266	34.9923
EO 781350	50.5683	0.57	45.1083	54.9257	45.1083	54.9257
Fan Blades and Shaft Lubrication	14.9897	0.06	14.3687	15.6524	14.0129	15.9945
FDB EO	38.4768	0.18	37.0052	39.9815	37.0052	39.9815
Filter and Oil and Lubrication Plus Routine Cards	35.6852	0.29	33.0217	37.9904	33.0217	37.9904
Filter Replacement	6.5317	0.06	6.0320	6.9959	6.0320	6.9959
Filters Change and Oil Routine	14.9663	0.06	14.3194	15.7366	14.0043	15.9907
Fire Bottle Extinguishers Replacement	3.4462	0.06	3.0056	3.9894	3.0056	3.9894

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Replications: 100 Time Units: Hours

Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Forward Cargo Access Panels Open Up	9.7567	0.23	8.0496	11.9798	8.0496	11.9798
FWD Body Fairing Open Up	26.1659	0.21	24.0346	27.9039	24.0346	27.9039
FWD Body Fairing Panels Close Up	30.0160	0.22	28.0679	31.9090	28.0679	31.9090
FWD Cargo Access Panels Close Up	26.9898	0.12	26.0213	27.9918	26.0213	27.9918
FWD Cargo Blankets Installation	29.9668	0.24	28.0034	31.9896	28.0034	31.9896
FWD Cargo Blankets Removal	13.0786	0.11	12.0446	13.9987	12.0446	13.9987
FWD Cargo CIC	1.2603	0.03	1.0054	1.4896	1.0054	1.4896
FWD Cargo Non Routine Cards	30.0355	0.21	28.0650	31.9034	28.0650	31.9034
FWD Cargo Routine Cards	16.9148	0.12	16.0120	17.9382	16.0120	17.9382
Galley Lift Maintenance	104.80	0.55	100.04	109.99	100.04	109.99
Heat Exchanger Reinstallation	9.0323	0.12	8.0380	9.9980	8.0380	9.9980
Heat Exchanger Removal	14.8956	0.34	12.0358	17.9590	12.0358	17.9590
HVDR EO	52.6549	0.31	50.0138	54.9478	50.0138	54.9478
Integrated Drive Generator and Routine	12.0412	0.13	10.7717	13.5128	10.0012	13.9990
Leak Check and Close Up	8.9464	0.12	8.0338	9.9864	8.0338	9.9864
Left Wing Access Panels Close Up	30.3129	0.23	28.1537	31.9873	28.1537	31.9873
Left Wing Access Panels Open Up	25.0020	0.11	24.0470	25.9788	24.0470	25.9788
Left Wing Area Rectification	11.9655	0.46	8.1187	15.9984	8.1187	15.9984
Left Wing corrosion Inhibiter Application	15.8079	0.35	13.1132	18.9420	13.1132	18.9420
Left Wing Hydraulic Filters	2.5297	0.06	2.0063	2.9993	2.0063	2.9993
Left Wing Lubrication	17.9745	0.23	16.0403	19.9025	16.0403	19.9025
Left Wing Non Routine Cards	47.5311	0.29	45.1260	49.9946	45.1260	49.9946
Left Wing Routine Cards	14.5639	0.17	13.0507	15.9987	13.0507	15.9987
Lines Cleaning and Baroscopic	32.3745	0.28	30.0157	34.7949	30.0157	34.7949
Lubrication	2.4688	0.06	2.0058	2.9921	2.0058	2.9921
Non Routine Cards	42.4210	0.29	40.0511	44.9419	40.0511	44.9419
Non Routine Cards 2	47.5749	0.28	45.0282	49.9325	45.0282	49.9325
Non Routine Cards 3	42.2736	0.28	40.1121	44.9766	40.1121	44.9766
Non Routine Cards and Operational Checks AF Avionics	105.01	0.61	100.30	109.97	100.30	109.97
Non Routine Cards Rectification	30.0615	0.14	28.3475	31.4589	28.0081	31.9899
Nose Landing Gear CIC	1.0217	0.06	0.5148	1.4971	0.5148	1.4971
Nose Landing Gear Lubrication	1.0229	0.05	0.5025	1.4930	0.5025	1.4930
Number 4 Flap Transmission EO	55.2355	0.61	50.0694	59.9226	50.0694	59.9226

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Replications: 100 Time Units: Hours

Process

Time per Entity

VA Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Number 5 Flap Transmission EO	34.1150	0.25	32.0485	35.9532	32.0485	35.9532
Operational and Functional Checks	30.0395	0.12	28.2595	31.0777	28.0071	31.9959
Operational Checks A	52.4865	0.29	50.0540	54.9714	50.0540	54.9714
Operational Checks A 2	52.4542	0.30	50.0075	54.9890	50.0075	54.9890
Operational Checks A 3	52.7204	0.29	50.0698	54.9573	50.0698	54.9573
Operational Checks B	22.0386	0.26	20.0065	23.9714	20.0065	23.9714
Operational Checks B 2	22.0055	0.25	20.0213	23.9763	20.0213	23.9763
Operational Checks B 3	21.8384	0.23	20.0226	23.9153	20.0226	23.9153
Operational Checks C	21.9660	0.24	20.0415	23.9981	20.0415	23.9981
Operational Checks C 2	22.1038	0.22	20.0537	23.9989	20.0537	23.9989
Operational Checks C 3	21.9407	0.26	20.0184	23.9690	20.0184	23.9690
Oxygen Cylinders Replacement	1.7431	0.03	1.5006	1.9944	1.5006	1.9944
RH Hydraulic Filters	2.5272	0.06	2.0051	2.9973	2.0051	2.9973
Right Wing Access Panels Close Up	30.1632	0.23	28.0283	31.9670	28.0283	31.9670
Right Wing Access Panels Open Up	25.0354	0.11	24.0123	25.9640	24.0123	25.9640
Right Wing corrosion Inhibiter Application	13.8696	0.22	12.0898	15.9385	12.0898	15.9385
Right Wing Lubrication	18.0067	0.22	16.0546	19.9782	16.0546	19.9782
Right Wing Non Routine Cards	47.4597	0.30	45.0146	49.9486	45.0146	49.9486
Right Wing Rectification	11.8028	0.43	8.0737	15.5830	8.0737	15.5830
Right Wing Routine Cards	14.4578	0.17	13.0019	15.9503	13.0019	15.9503
Stabilizer Bolts EO	14.0399	0.24	12.0147	15.9939	12.0147	15.9939
Station 111 Blankets Installation	6.4681	0.17	5.0139	7.9865	5.0139	7.9865
Stow Thrust Reverse Plus Routine	8.0105	0.06	7.4530	8.6979	7.0010	8.9968
Throttle Cable and Cargo Door Lubrication	3.4410	0.06	3.0003	3.9956	3.0003	3.9956
Tire Change	12.9303	0.11	12.0045	13.9882	12.0045	13.9882
Vertical and Horizontal Stabilizers Panels Open Up	26.1285	0.24	24.0847	27.9405	24.0847	27.9405
VIGV Rigging and Routine	7.9713	0.11	6.5274	9.3482	6.0017	9.9991
Waste Tanks Cleaning Prep	6.9497	0.12	6.0033	7.9969	6.0033	7.9969
Water Tanks Filters Replacement	0.7307	0.03	0.5083	0.9955	0.5083	0.9955
Window Water Service and Routine	1.8046	0.15	0.5235	2.9797	0.5235	2.9797
Zone 1 Open Up	13.9606	0.24	12.0164	15.9786	12.0164	15.9786
Zone 2 Open Up	13.9954	0.23	12.0758	15.9276	12.0758	15.9276
Zone 3 Open Up	14.0290	0.23	12.0437	15.8912	12.0437	15.8912

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Replications: 100 Time Units: Hours

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
1 2 3 and 4 Fixed Fairings Installation	22.2200	1.43	17.7500	34.7500	17.7500	34.7500
1 2 3 and 4 Fixed Fairings Removal	17.3250	0.05	16.7500	18.0000	16.7500	18.0000
1 and 2 Turbines Installation	21.8950	1.39	17.7500	34.7500	17.7500	34.7500
1 and 2 Turbines Removal	17.0825	0.05	16.7500	17.5000	16.7500	17.5000
3 and 4 Turbines Installation	25.9725	1.59	18.2500	36.0000	18.2500	36.0000
3 and 4 Turbines Removal	8.6800	1.65	0.7500	17.7500	0.7500	17.7500
4 Engines Simulation	31.3300	1.86	18.2500	51.2500	18.2500	51.2500
5 6 7 and 8 Fixed Fairings Installation	24.7325	1.53	18.2500	36.0000	18.2500	36.0000
5 6 7 and 8 Fixed Fairings Removal	17.8175	0.34	17.0000	34.5000	17.0000	34.5000
AC EO	131.77	2.34	114.50	149.75	114.50	149.75
AF Fuel EO Operational Checks Avionics	70.5825	1.21	55.7500	89.7500	55.7500	89.7500
Aft Cargo Access Panels Open Up	34.9625	0.02	34.7500	35.0000	34.7500	35.0000
Aft Cargo Area Final Inspection	5.7400	1.54	0.00	16.7500	0.00	16.7500
Aft Cargo Blankets Installation and Close Up	73.6875	1.66	62.7500	82.2500	62.7500	82.2500
Aft Cargo Blankets Removal	44.1050	1.69	35.2500	52.5000	35.2500	52.5000
Aft Cargo Corrosion Inhibiter Application	8.8700	1.58	0.5000	17.7500	0.5000	17.7500
Aft Cargo Door Lubrication	2.9250	1.19	0.00	16.7500	0.00	16.7500
Aft Cargo Non Routine Cards	78.7950	1.79	56.2500	91.2500	56.2500	91.2500
Aft Cargo Pre Inspection	7.4984	1.63	0.00	20.0839	0.00	20.0839
Aft Cargo Routine Cards	64.2400	1.88	38.0000	89.2500	38.0000	89.2500
Air-condition Access Panels Open Up	18.2975	0.05	17.7500	18.5000	17.7500	18.5000
Air-condition and Wheel Well Inspection	2.2025	1.08	0.00	16.7500	0.00	16.7500
Air-condition Area Access Panels Close Up	42.0425	1.76	19.0000	53.2500	19.0000	53.2500
Air-condition Area Corrosion Inhibiter Application	23.6600	1.71	9.5000	35.0000	9.5000	35.0000
Air-condition Area Final Inspection	5.4750	1.51	0.00	17.0000	0.00	17.0000
Air-condition Area Non Routine Cards	174.08	2.05	150.50	201.50	150.50	201.50
APU and Area Non Routine Cards	48.1400	1.62	35.5000	70.0000	35.5000	70.0000
APU Baroscopic	68.8975	2.34	53.0000	88.5000	53.0000	88.5000
APU Close Up and Rectifications	62.1975	1.85	38.0000	74.0000	38.0000	74.0000
APU Inspection	1.0000	0.00	1.0000	1.0000	1.0000	1.0000
APU Operational Checks	49.8850	1.35	30.0000	63.7500	30.0000	63.7500

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Replications: 100 Time Units: Hours

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU Team House Keeping	43.2350	1.57	36.5000	54.7500	36.5000	54.7500
APU Test	14.2000	1.43	0.00	17.7500	0.00	17.7500
Area 10 CIC	9.7975	1.61	0.2500	17.2500	0.2500	17.2500
Area 10 Final Inspection	4.8850	1.47	0.00	16.7500	0.00	16.7500
Area 10 Inspection 1	5.2500	1.50	0.00	16.7500	0.00	16.7500
Area 10 Leak Checks	34.8725	1.38	18.2500	51.7500	18.2500	51.7500
Area 10 Lubrication	22.2625	1.25	10.0000	35.0000	10.0000	35.0000
Area 10 Non Routine Cards	79.8050	1.13	73.5000	91.2500	73.5000	91.2500
Area 10 OK to Close	6.6050	1.58	0.00	16.7500	0.00	16.7500
Area 10 Operational Checks	67.5100	1.58	52.5000	86.7500	52.5000	86.7500
Area 10 Panels In Place	5.6275	1.52	0.00	16.7500	0.00	16.7500
Area 10 Panels Security V and H Stabilizers	37.5000	1.47	18.2500	51.7500	18.2500	51.7500
Area 10 Pre Inspection	14.1775	1.33	0.5000	18.2500	0.5000	18.2500
Area 10 Routine Cards	92.5125	1.07	75.0000	108.00	75.0000	108.00
Area 10 Stabilizer Jack Screw Motors Servicing	6.4775	1.57	0.00	16.7500	0.00	16.7500
Area 5 Cabin Non Routine Cards and Operational Checks	313.62	3.16	281.75	349.75	281.75	349.75
Area 6 Cockpit Operational Checks Avionics	48.6325	1.22	45.2500	63.0000	45.2500	63.0000
Area 7 8 9 10 Avionics Final	95.3875	1.47	75.0000	108.50	75.0000	108.50
Area 7 Pre Inspection	11.7142	1.60	0.7500	20.1565	0.7500	20.1565
Area 8 Pre Inspection	5.7800	1.56	0.00	17.0000	0.00	17.0000
Area 9 Final Inspection	10.4333	1.56	0.2500	17.5346	0.2500	17.5346
Area 9 Inspection 1	6.6850	1.60	0.00	16.7500	0.00	16.7500
Area 9 Non Routine Cards	166.11	1.53	153.25	187.00	153.25	187.00
Area 9 Routine Cards	77.7675	2.02	55.2500	91.2500	55.2500	91.2500
Body and Wing Landing Gears and Doors Lubrication	19.7100	1.04	17.5000	34.5000	17.5000	34.5000
Break Assembly Change	10.2925	1.60	0.2500	17.7500	0.2500	17.7500
Bulk and OFV Areas Non Routine Cards	108.75	1.66	100.50	119.75	100.50	119.75
Bulk and OFV Areas Pre Inspection	7.0451	1.59	0.00	18.2423	0.00	18.2423
Bulk and OFV Areas Routine Cards	42.9725	1.65	35.0000	53.2500	35.0000	53.2500
Bulk and OFV CIC and Blankets Installation	98.2650	1.55	91.2500	109.00	91.2500	109.00
Bulk and OFV Final Inspection	5.7850	1.48	0.00	17.2500	0.00	17.2500
Bulk and OFV Open Up and Blankets Removal	77.7475	1.69	70.2500	88.0000	70.2500	88.0000
Cabin Carpet Replacement and Close Up 1	357.96	1.64	350.00	367.50	350.00	367.50
Cabin Carpet Replacement and Close Up 2	357.31	1.62	350.00	367.50	350.00	367.50

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Replications: 100 Time Units: Hours

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cabin Carpet Replacement and Close Up 3	358.75	1.45	350.00	367.50	350.00	367.50
Cabin Filters Replacement and Routine Cards	34.7150	0.80	18.5000	51.5000	18.5000	51.5000
Cabin Filters Replacement and Routine Cards 2	36.4750	1.14	19.0000	51.5000	19.0000	51.5000
Cabin Filters Replacement and Routine Cards 3	34.6350	0.84	18.0000	52.0000	18.0000	52.0000
Cabin Lubrication and CIC 1	59.0100	1.57	52.5000	70.0000	52.5000	70.0000
Cabin Lubrication and CIC 2	74.8450	1.61	53.5000	87.0000	53.5000	87.0000
Cabin Lubrication and CIC 3	58.9600	1.64	52.5000	70.0000	52.5000	70.0000
Canted Pressure Deck Area	281.94	2.24	263.00	297.50	263.00	297.50
Captain and First Officer Seats Installation	46.1600	1.59	35.2500	52.5000	35.2500	52.5000
Captain and First Officer Seats Removal	10.2525	1.64	0.2500	17.5000	0.2500	17.5000
Cargo Door Rigging	19.5625	1.17	1.2500	34.2500	1.2500	34.2500
CIC under Body Fairing Structure CIC	2.0000	1.03	0.00	16.7500	0.00	16.7500
Cockpit AV Connection	91.0450	1.50	70.7500	104.50	70.7500	104.50
Cockpit Carpet Replacement	87.6825	1.22	70.7500	104.25	70.7500	104.25
Cockpit Close Up and Final Inspection	86.4900	1.57	70.7500	104.25	70.7500	104.25
Cockpit Open Up and Disconnection	47.4100	1.58	35.7500	53.2500	35.7500	53.2500
Cockpit Pre Inspection	19.6050	1.09	17.5000	34.2500	17.5000	34.2500
Cockpit Routine and Non Routine Cards	122.74	2.05	105.00	139.75	105.00	139.75
Corrosion Inhibiter and Prep Close Up	16.3650	0.67	5.0000	22.0000	0.7500	34.5000
Corrosion Inhibiter Applications	8.4175	1.59	0.5000	16.7500	0.5000	16.7500
Crew Rest Area	284.94	2.14	263.00	297.50	263.00	297.50
Door Open Up	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
Ducts Reinstallation	36.2475	0.97	18.5000	51.7500	18.5000	51.7500
Ducts Removal	19.4150	1.06	16.7500	34.5000	16.7500	34.5000
E and E Blankets Installation	28.2375	1.59	17.5000	35.0000	17.5000	35.0000
E and E Floor Panels Close Up	12.5550	1.47	0.7500	17.5000	0.7500	17.5000
E and E Blanket Removal Floor Panels Open Up	8.7500	0.00	8.7500	8.7500	8.7500	8.7500
EE and NLG and Station 111 Pre Inspection	14.8592	1.53	1.5000	34.5000	1.5000	34.5000
Electronic Equip and Station 111 CIC	3.3825	1.29	0.00	16.7500	0.00	16.7500
Engine Baroscopic	11.1356	0.83	4.9375	17.6250	0.5000	18.2500
Engine Baroscopic Close Up and Rectification	11.5869	0.83	1.0625	17.8750	0.5000	18.2500
Engine Close Up	65.1600	0.85	57.5000	76.7500	45.2500	87.7500

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Replications: 100 Time Units: Hours

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Engine Health and Functions	87.3375	1.52	70.7500	104.25	70.7500	104.25
Engine Oil Change and Routine	5.0000	0.72	0.3750	12.7500	0.00	17.2500
Engine Open Up	31.1194	0.81	23.1875	40.1250	18.2500	45.2500
Engineering Orders 5 EOs	280.01	2.07	256.25	291.75	256.25	291.75
EO 5312654 station 2598 Bolts Removal for NDT	83.6850	1.25	70.7500	96.2500	70.7500	96.2500
EO 531355	43.6525	1.20	28.5000	54.7500	28.5000	54.7500
EO 531433	34.1200	1.45	18.2500	51.7500	18.2500	51.7500
EO 541119	52.1075	1.49	36.5000	70.0000	36.5000	70.0000
EO 541180	101.79	1.42	89.7500	116.00	89.7500	116.00
EO 571334	68.5500	1.40	63.7500	81.7500	63.7500	81.7500
EO 722047	74.8150	1.80	55.5000	92.0000	55.5000	92.0000
EO 731258	95.5925	2.37	73.5000	110.50	73.5000	110.50
EO 731292	99.04	1.55	83.5000	109.50	83.5000	109.50
EO 781350	150.86	1.75	140.25	159.00	140.25	159.00
EOs and Aft Cargo Inspection	4.2900	1.38	0.00	16.7500	0.00	16.7500
Fan Blades and Shaft Lubrication	43.4756	0.79	36.6250	52.8750	35.0000	54.7500
FDB EO	106.73	0.97	89.7500	122.75	89.7500	122.75
Filter and Oil and Lubrication Plus Routine Cards	106.03	0.09	105.50	106.50	105.50	106.50
Filter Replacement	17.5000	0.48	0.7500	34.2500	0.7500	34.2500
Filters Change and Oil Routine	44.2694	0.89	36.2500	53.0000	35.0000	54.7500
Final Area 5 Cabin Avionics	87.4525	1.25	70.7500	104.25	70.7500	104.25
Final Inspection	12.4231	0.72	0.8750	17.4375	0.2500	17.7500
Fire Bottle Extinguishers Replacement	8.2950	1.62	0.5000	17.2500	0.5000	17.2500
Forward Cargo Access Panels Open Up	29.0650	0.94	27.0000	44.7500	27.0000	44.7500
FWD Body Fairing Open Up	81.9825	1.67	74.0000	91.2500	74.0000	91.2500
FWD Body Fairing Panels Close Up	79.8700	1.63	70.0000	87.5000	70.0000	87.5000
FWD Cargo Access Panels Close Up	70.5475	1.46	62.7500	79.7500	62.7500	79.7500
FWD Cargo Blankets Installation	79.3475	1.56	70.0000	87.5000	70.0000	87.5000
FWD Cargo Blankets Removal	42.8650	1.56	36.5000	53.2500	36.5000	53.2500
FWD Cargo CIC	3.6100	1.35	0.00	16.7500	0.00	16.7500
FWD Cargo Final Inspection	5.9850	1.54	0.00	17.0000	0.00	17.0000
FWD Cargo Inspection 1	3.9572	1.37	0.00	22.6114	0.00	22.6114
FWD Cargo Non Routine Cards	93.3900	1.19	75.0000	109.00	75.0000	109.00
FWD Cargo Pre Inspection	7.9175	1.61	0.00	17.2500	0.00	17.2500
FWD Cargo Routine Cards	53.6500	1.03	38.0000	71.0000	38.0000	71.0000
Galley Lift Maintenance	281.94	2.04	262.50	297.50	262.50	297.50

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Replications: 100 Time Units: Hours

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Heat Exchanger Reinstallation	26.6925	1.63	17.5000	35.0000	17.5000	35.0000
Heat Exchanger Removal	41.3275	1.75	18.7500	52.5000	18.7500	52.5000
HVDR EO	142.29	1.68	133.00	159.00	133.00	159.00
Inspection 2	12.5981	0.74	1.2500	17.6250	0.5000	18.2500
Inspection Paper Work	14.4800	1.40	1.0000	35.2500	1.0000	35.2500
Integrated Drive Generator and Routine	35.9713	0.69	27.3125	44.0000	18.2500	53.2500
Leak Check and Close Up	28.5675	1.59	18.7500	36.5000	18.7500	36.5000
Left Wing Access Panels Close Up	78.2625	1.50	63.7500	98.5000	63.7500	98.5000
Left Wing Access Panels Open Up	53.6150	0.04	53.5000	54.0000	53.5000	54.0000
Left Wing Area Rectification	34.3975	1.93	17.7500	52.5000	17.7500	52.5000
Left Wing corrosion Inhibiter Application	44.2075	1.68	35.2500	54.0000	35.2500	54.0000
Left Wing Final Inspection	18.4900	1.31	1.5000	35.2500	1.5000	35.2500
Left Wing Hydraulic Filters	5.9675	1.54	0.00	16.7500	0.00	16.7500
Left Wing Inspection 1	6.5175	1.57	0.00	16.5000	0.00	16.5000
Left Wing Inspection 2	3.8150	1.38	0.00	16.7500	0.00	16.7500
Left Wing Lubrication	48.9400	1.33	35.7500	52.5000	35.7500	52.5000
Left Wing Non Routine Cards	119.87	1.52	114.50	132.00	114.50	132.00
Left Wing Routine Cards	37.9825	1.21	35.0000	51.7500	35.0000	51.7500
Lines Cleaning and Baroscopic	90.1750	1.36	71.7500	105.25	71.7500	105.25
Lubrication	6.4850	1.60	0.00	17.0000	0.00	17.0000
Non Routine Cards	113.18	1.64	105.00	122.50	105.00	122.50
Non Routine Cards 2	128.79	1.57	122.50	139.50	122.50	139.50
Non Routine Cards 3	115.56	1.65	105.00	122.50	105.00	122.50
Non Routine Cards and Operational Checks AF Avionics	302.46	1.83	293.00	312.75	293.00	312.75
Non Routine Cards Rectification	75.0756	0.75	65.0625	83.0625	62.0000	87.5000
Nose Landing Gear CIC	1.6675	0.94	0.00	16.7500	0.00	16.7500
Nose Landing Gear Lubrication	3.6075	1.35	0.00	16.7500	0.00	16.7500
Number 4 Flap Transmission EO	140.86	2.04	123.50	157.75	123.50	157.75
Number 5 Flap Transmission EO	94.0300	1.52	88.5000	106.25	88.5000	106.25
Operational and Functional Checks	82.4481	0.77	71.1875	91.8750	70.0000	105.25
Operational Checks A	140.79	1.41	123.00	157.00	123.00	157.00
Operational Checks A 2	142.03	1.50	123.50	156.50	123.50	156.50
Operational Checks A 3	143.21	1.71	123.00	157.00	123.00	157.00
Operational Checks B	60.2350	1.64	52.5000	69.5000	52.5000	69.5000
Operational Checks B 2	58.9950	1.59	52.5000	70.0000	52.5000	70.0000

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Replications: 100 Time Units: Hours

Process

Time per Entity

Wait Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Operational Checks B 3	58.3600	1.60	52.5000	70.0000	52.5000	70.0000
Operational Checks C	58.3900	1.54	52.5000	70.0000	52.5000	70.0000
Operational Checks C 2	59.1750	1.58	52.5000	69.5000	52.5000	69.5000
Operational Checks C 3	59.4350	1.67	52.5000	70.0000	52.5000	70.0000
Oxygen Cylinders Replacement	5.0150	1.49	0.00	16.7500	0.00	16.7500
Pre Inspection	8.5444	0.76	0.8750	17.0000	0.00	17.7500
Pre Inspection Phase	43.6244	1.28	24.1118	48.5859	24.1118	48.5859
Pre Inspection Phase 2	45.7278	1.73	36.5000	71.0000	36.5000	71.0000
Pre Inspection Phase 3	42.6602	1.72	19.2500	53.2500	19.2500	53.2500
RH Hydraulic Filters	11.0750	1.54	0.00	16.7500	0.00	16.7500
Right Wing Access Panels Close Up	80.1300	1.38	63.7500	98.2500	63.7500	98.2500
Right Wing Access Panels Open Up	79.4775	1.67	70.5000	87.2500	70.5000	87.2500
Right Wing corrosion Inhibiter Application	43.3325	1.58	36.5000	54.7500	36.5000	54.7500
Right Wing Final Inspection	15.2300	1.21	0.7500	34.2500	0.7500	34.2500
Right Wing Inspection 1	6.5500	1.54	0.00	17.2500	0.00	17.2500
Right Wing Inspection 2	9.8200	1.58	0.5000	17.7500	0.5000	17.7500
Right Wing Lubrication	49.7025	1.31	36.2500	53.7500	36.2500	53.7500
Right Wing Non Routine Cards	137.55	1.67	119.75	154.00	119.75	154.00
Right Wing Rectification	37.0125	1.76	19.2500	54.0000	19.2500	54.0000
Right Wing Routine Cards	39.2300	1.31	35.5000	52.5000	35.5000	52.5000
Stabilizer Bolts EO	43.3725	1.60	36.5000	54.7500	36.5000	54.7500
Station 111 Blankets Installation	16.2000	1.40	0.7500	34.2500	0.7500	34.2500
Stow Thrust Reverse Plus Routine	23.7656	0.77	18.1250	34.3750	17.5000	35.5000
Throttle Cable and Cargo Door Lubrication	9.3000	1.62	0.5000	17.5000	0.5000	17.5000
Tire Change	36.4000	0.87	18.7500	52.2500	18.7500	52.2500
Vertical and Horizontal Stabilizers Panels Open Up	82.1700	0.12	81.2500	82.7500	81.2500	82.7500
VIGV Rigging and Routine	21.3388	0.70	14.0625	30.5000	1.2500	36.0000
Waste Tanks Cleaning Prep	19.8575	1.08	17.7500	34.5000	17.7500	34.5000
Water Tanks Filters Replacement	1.9425	1.02	0.00	16.7500	0.00	16.7500
Window Water Service and Routine	4.8975	1.50	0.00	17.0000	0.00	17.0000
Zonal Inspection	7.0619	1.69	0.00	21.6730	0.00	21.6730
Zone 1 Open Up	33.9400	1.98	23.5000	45.0000	23.5000	45.0000
Zone 2 Open Up	38.5050	1.48	26.5000	43.5000	26.5000	43.5000
Zone 3 Open Up	41.5850	1.67	33.5000	50.0000	33.5000	50.0000

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Replications: 100 Time Units: Hours

Process

Time per Entity

Other Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Aft Cargo Area Final Inspection	1.9882	0.07	1.1111	2.7422	1.1111	2.7422
Aft Cargo Pre Inspection	1.9755	0.07	1.1280	2.8494	1.1280	2.8494
Air-condition and Wheel Well Inspection	1.0027	0.04	0.5380	1.4454	0.5380	1.4454
Air-condition Area Final Inspection	2.0439	0.08	1.0520	2.8893	1.0520	2.8893
APU Baroscopic	24.7392	0.62	20.1253	29.9510	20.1253	29.9510
APU Inspection	4.0411	0.09	3.0608	4.8919	3.0608	4.8919
Area 10 Final Inspection	1.9896	0.09	1.1683	2.9035	1.1683	2.9035
Area 10 Inspection 1	1.9848	0.08	1.1469	2.8331	1.1469	2.8331
Area 10 Pre Inspection	3.9611	0.17	2.2633	5.7287	2.2633	5.7287
Area 7 8 9 10 Avionics Final	29.9160	0.22	28.0381	31.9560	28.0381	31.9560
Area 7 Pre Inspection	3.9451	0.08	3.0837	4.9379	3.0837	4.9379
Area 8 Pre Inspection	2.0189	0.08	1.0718	2.9267	1.0718	2.9267
Area 9 Final Inspection	4.1093	0.17	2.2612	5.7257	2.2612	5.7257
Area 9 Inspection 1	1.9814	0.07	1.1122	2.8006	1.1122	2.8006
Bulk and OFV Areas Pre Inspection	1.9867	0.08	1.0676	2.9772	1.0676	2.9772
Bulk and OFV Final Inspection	1.9863	0.09	1.0794	2.9010	1.0794	2.9010
Cabin Lubrication and CIC 2	27.5063	0.30	25.0299	29.9733	25.0299	29.9733
Cockpit AV Connection	34.0641	0.22	32.0453	35.9149	32.0453	35.9149
Cockpit Pre Inspection	7.5063	0.06	7.0172	7.9844	7.0172	7.9844
EE and NLG and Station 111 Pre Inspection	4.9431	0.18	3.2617	6.9410	3.2617	6.9410
Engineering Orders 5 EOs	104.96	0.58	100.07	109.90	100.07	109.90
EO 722047	24.2328	0.53	20.1152	29.9757	20.1152	29.9757
EOs and Aft Cargo Inspection	0.9771	0.04	0.5508	1.4210	0.5508	1.4210
Final Area 5 Cabin Avionics	32.3249	0.28	30.0227	34.9671	30.0227	34.9671
Final Inspection	4.4919	0.09	3.2642	5.4755	3.0012	5.9871
FWD Cargo Final Inspection	1.9760	0.08	1.1704	2.8662	1.1704	2.8662
FWD Cargo Inspection 1	1.0016	0.04	0.5372	1.4530	0.5372	1.4530
FWD Cargo Pre Inspection	1.9348	0.08	1.0376	2.9362	1.0376	2.9362
Inspection 2	3.9964	0.04	3.4875	4.4403	3.0787	4.9482
Inspection Paper Work	5.0149	0.17	3.2314	6.7729	3.2314	6.7729
Left Wing Final Inspection	6.1392	0.16	4.1481	7.6631	4.1481	7.6631
Left Wing Inspection 1	2.0461	0.08	1.0757	2.8695	1.0757	2.8695
Left Wing Inspection 2	1.0182	0.04	0.5684	1.4348	0.5684	1.4348
Pre Inspection	3.0320	0.04	2.4728	3.5400	2.0245	3.8983
Pre Inspection Phase	15.1290	0.34	12.1422	17.9062	12.1422	17.9062
Pre Inspection Phase 2	14.8714	0.34	12.0237	17.9586	12.0237	17.9586
Pre Inspection Phase 3	15.1334	0.36	12.1076	17.9520	12.1076	17.9520
Right Wing Final Inspection	5.8821	0.18	4.2602	7.8192	4.2602	7.8192
Right Wing Inspection 1	1.9468	0.08	1.1382	2.9330	1.1382	2.9330

Values Across All Replications

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Replications: 100 Time Units: Hours

Process

Time per Entity

Other Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Right Wing Inspection 2	2.9798	0.07	2.2441	3.7523	2.2441	3.7523
Zonal Inspection	2.0242	0.10	1.0861	2.9895	1.0861	2.9895

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Replications: 100 Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
1 2 3 and 4 Fixed Fairings Installation	30.1482	1.47	24.7806	43.6397	24.7806	43.6397
1 2 3 and 4 Fixed Fairings Removal	23.2795	0.15	21.8188	24.9478	21.8188	24.9478
1 and 2 Turbines Installation	29.9264	1.42	24.7588	43.6793	24.7588	43.6793
1 and 2 Turbines Removal	21.3436	0.13	20.2525	22.4881	20.2525	22.4881
3 and 4 Turbines Installation	33.9900	1.62	25.2967	44.8791	25.2967	44.8791
3 and 4 Turbines Removal	12.9408	1.65	4.3028	22.7460	4.3028	22.7460
4 Engines Simulation	44.2846	2.12	28.2519	66.7736	28.2519	66.7736
5 6 7 and 8 Fixed Fairings Installation	32.6909	1.57	25.3619	44.7783	25.3619	44.7783
5 6 7 and 8 Fixed Fairings Removal	23.7009	0.39	22.0004	41.4700	22.0004	41.4700
AC EO	183.49	2.94	160.55	207.37	160.55	207.37
AF Fuel EO Operational Checks Avionics	92.7418	1.34	76.0935	113.39	76.0935	113.39
Aft Cargo Access Panels Open Up	45.8770	0.13	44.7507	46.9765	44.7507	46.9765
Aft Cargo Area Final Inspection	7.7282	1.55	1.1111	19.4922	1.1111	19.4922
Aft Cargo Blankets Installation and Close Up	102.59	1.86	89.6677	113.29	89.6677	113.29
Aft Cargo Blankets Removal	58.1267	1.88	47.2707	68.3443	47.2707	68.3443
Aft Cargo Corrosion Inhibiter Application	11.3813	1.60	2.5421	20.7390	2.5421	20.7390
Aft Cargo Door Lubrication	3.9040	1.20	0.5256	18.2240	0.5256	18.2240
Aft Cargo Non Routine Cards	103.71	2.06	78.3041	119.24	78.3041	119.24
Aft Cargo Pre Inspection	9.4740	1.64	1.4111	21.9855	1.4111	21.9855
Aft Cargo Routine Cards	84.4330	2.28	54.0400	113.06	54.0400	113.06
Air-condition Access Panels Open Up	28.3805	0.16	26.7517	29.4647	26.7517	29.4647
Air-condition and Wheel Well Inspection	3.2052	1.09	0.5380	18.1307	0.5380	18.1307
Air-condition Area Access Panels Close Up	56.9673	1.96	31.4468	71.0752	31.4468	71.0752
Air-condition Area Corrosion Inhibiter Application	33.5095	1.82	17.5678	46.9324	17.5678	46.9324
Air-condition Area Final Inspection	7.5189	1.53	1.1781	19.8893	1.1781	19.8893
Air-condition Area Non Routine Cards	241.32	2.77	212.00	275.94	212.00	275.94
APU and Area Non Routine Cards	65.2033	1.81	50.0661	89.8011	50.0661	89.8011
APU Baroscopic	93.6367	2.88	73.1253	118.45	73.1253	118.45
APU Close Up and Rectifications	81.7320	2.22	54.3095	97.5298	54.3095	97.5298
APU Inspection	5.0411	0.09	4.0608	5.8919	4.0608	5.8919
APU Operational Checks	68.4099	1.44	47.5067	83.6266	47.5067	83.6266

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Replications: 100 Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU Team House Keeping	57.2721	1.67	48.5027	70.2234	48.5027	70.2234
APU Test	19.9937	2.02	0.00	25.7434	0.00	25.7434
Area 10 CIC	13.3178	1.61	3.2549	21.2471	3.2549	21.2471
Area 10 Final Inspection	6.8746	1.47	1.2030	19.5590	1.2030	19.5590
Area 10 Inspection 1	7.2348	1.51	1.1933	19.4253	1.1933	19.4253
Area 10 Leak Checks	48.0990	1.60	28.5253	67.6454	28.5253	67.6454
Area 10 Lubrication	32.3331	1.38	18.0500	46.4572	18.0500	46.4572
Area 10 Non Routine Cards	106.28	1.17	98.5130	118.47	98.5130	118.47
Area 10 OK to Close	9.0980	1.58	2.0605	19.6869	2.0605	19.6869
Area 10 Operational Checks	92.3635	1.81	74.6148	114.61	74.6148	114.61
Area 10 Panels In Place	7.6119	1.52	1.5359	19.1956	1.5359	19.1956
Area 10 Panels Security V and H Stabilizers	51.5564	1.60	30.3627	67.6071	30.3627	67.6071
Area 10 Pre Inspection	18.1386	1.41	2.7890	23.9787	2.7890	23.9787
Area 10 Routine Cards	121.65	1.12	103.09	137.99	103.09	137.99
Area 10 Stabilizer Jack Screw Motors Servicing	8.9406	1.58	2.0374	19.7137	2.0374	19.7137
Area 5 Cabin Non Routine Cards and Operational Checks	419.72	4.21	379.13	464.34	379.13	464.34
Area 6 Cockpit Operational Checks Avionics	64.5750	1.38	59.2807	80.9267	59.2807	80.9267
Area 7 8 9 10 Avionics Final	125.30	1.59	103.11	140.20	103.11	140.20
Area 7 Pre Inspection	15.6594	1.64	3.8620	24.7657	3.8620	24.7657
Area 8 Pre Inspection	7.7989	1.58	1.3218	19.7902	1.3218	19.7902
Area 9 Final Inspection	14.5427	1.63	2.7785	23.1928	2.7785	23.1928
Area 9 Inspection 1	8.6664	1.61	1.1122	19.3769	1.1122	19.3769
Area 9 Non Routine Cards	225.50	1.69	210.55	248.71	210.55	248.71
Area 9 Routine Cards	102.04	2.40	75.3099	119.16	75.3099	119.16
Body and Wing Landing Gears and Doors Lubrication	26.7626	1.07	23.5342	42.4390	23.5342	42.4390
Break Assembly Change	13.7646	1.61	3.4222	21.5996	3.4222	21.5996
Bulk and OFV Areas Non Routine Cards	146.18	1.83	136.14	159.34	136.14	159.34
Bulk and OFV Areas Pre Inspection	9.0318	1.61	1.0676	20.9219	1.0676	20.9219
Bulk and OFV Areas Routine Cards	57.7975	1.86	47.2598	71.1133	47.2598	71.1133
Bulk and OFV CIC and Blankets Installation	129.36	1.58	121.33	140.98	121.33	140.98
Bulk and OFV Final Inspection	7.7713	1.49	1.5017	19.8355	1.5017	19.8355
Bulk and OFV Open Up and Blankets Removal	102.56	2.01	92.2675	115.99	92.2675	115.99
Cabin Carpet Replacement and Close Up 1	490.56	1.78	480.01	502.31	480.01	502.31
Cabin Carpet Replacement and Close Up 2	490.11	1.77	480.03	502.41	480.03	502.41

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Replications: 100 Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cabin Carpet Replacement and Close Up 3	486.31	1.63	480.04	502.33	480.04	502.33
Cabin Filters Replacement and Routine Cards	47.7343	0.85	30.6137	65.4383	30.6137	65.4383
Cabin Filters Replacement and Routine Cards 2	49.5626	1.20	31.0982	65.4012	31.0982	65.4012
Cabin Filters Replacement and Routine Cards 3	47.6004	0.88	30.0312	65.7670	30.0312	65.7670
Cabin Lubrication and CIC 1	81.1523	1.67	72.5513	93.6569	72.5513	93.6569
Cabin Lubrication and CIC 2	102.35	1.79	78.5453	116.97	78.5453	116.97
Cabin Lubrication and CIC 3	80.8715	1.76	72.5087	93.7839	72.5087	93.7839
Canted Pressure Deck Area	386.73	2.73	363.03	407.26	363.03	407.26
Captain and First Officer Seats Installation	63.0672	1.62	51.4287	70.3409	51.4287	70.3409
Captain and First Officer Seats Removal	14.2675	1.69	3.2879	22.4578	3.2879	22.4578
Cargo Door Rigging	26.5249	1.23	7.2580	42.1433	7.2580	42.1433
CIC under Body Fairing Structure CIC	3.0110	1.04	0.5636	18.1395	0.5636	18.1395
Cockpit AV Connection	125.11	1.61	102.83	140.41	102.83	140.41
Cockpit Carpet Replacement	120.18	1.36	100.88	138.32	100.88	138.32
Cockpit Close Up and Final Inspection	118.83	1.74	100.78	138.85	100.78	138.85
Cockpit Open Up and Disconnection	68.0590	1.85	53.7562	77.2366	53.7562	77.2366
Cockpit Pre Inspection	27.1113	1.09	24.5172	42.2014	24.5172	42.2014
Cockpit Routine and Non Routine Cards	167.89	2.50	145.19	189.04	145.19	189.04
Corrosion Inhibiter and Prep Close Up	22.3511	0.72	9.4340	29.0513	4.7605	42.4400
Corrosion Inhibiter Applications	10.6833	1.59	2.5231	19.2464	2.5231	19.2464
Crew Rest Area	390.06	2.61	363.13	407.34	363.13	407.34
Door Open Up	17.2500	0.00	17.2500	17.2500	17.2500	17.2500
Ducts Reinstallation	49.3606	1.01	30.5824	65.4703	30.5824	65.4703
Ducts Removal	26.7076	1.23	21.8891	44.2794	21.8891	44.2794
E and E Blankets Installation	38.1870	1.66	25.6513	46.9471	25.6513	46.9471
E and E Floor Panels Close Up	17.0764	1.48	4.7573	22.4517	4.7573	22.4517
E and E Blanket Removal Floor Panels Open Up	11.2057	0.06	10.7532	11.7483	10.7532	11.7483
EE and NLG and Station 111 Pre Inspection	19.8023	1.62	5.0660	41.4357	5.0660	41.4357
Electronic Equip and Station 111 CIC	4.8549	1.29	1.0038	18.6857	1.0038	18.6857
Engine Baroscopic	15.0942	0.84	8.5706	21.9567	3.5511	23.1488
Engine Baroscopic Close Up and Rectification	15.5961	0.84	4.4505	22.6577	3.6213	23.2482
Engine Close Up	89.2789	1.00	79.7908	103.40	67.3445	115.53

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Replications: 100 Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Engine Health and Functions	119.87	1.69	101.23	138.89	101.23	138.89
Engine Oil Change and Routine	7.0254	0.73	2.1143	14.9238	1.5033	19.7055
Engine Open Up	43.1337	0.92	33.6101	53.6860	28.2621	59.2204
Engineering Orders 5 EOs	384.97	2.57	356.32	401.40	356.32	401.40
EO 5312654 station 2598 Bolts Removal for NDT	116.25	1.42	100.98	131.20	100.98	131.20
EO 531355	58.6166	1.39	40.5932	72.2997	40.5932	72.2997
EO 531433	46.6388	1.63	28.4323	66.5999	28.4323	66.5999
EO 541119	70.1547	1.62	52.5569	89.9960	52.5569	89.9960
EO 541180	139.12	1.61	124.75	155.99	124.75	155.99
EO 571334	93.4925	1.44	87.9923	107.72	87.9923	107.72
EO 722047	99.05	2.22	75.6717	121.98	75.6717	121.98
EO 731258	125.86	2.90	98.9779	145.17	98.9779	145.17
EO 731292	131.54	1.71	113.73	144.49	113.73	144.49
EO 781350	201.43	2.26	185.36	213.93	185.36	213.93
EOs and Aft Cargo Inspection	5.2671	1.39	0.5508	18.0598	0.5508	18.0598
Fan Blades and Shaft Lubrication	58.4653	0.81	51.1410	68.0055	49.0171	70.7018
FDB EO	145.20	1.05	127.04	162.33	127.04	162.33
Filter and Oil and Lubrication plus Routine Cards	141.72	0.38	138.52	144.49	138.52	144.49
Filter Replacement	24.0317	0.49	6.8843	41.0427	6.8843	41.0427
Filters Change and Oil Routine	59.2357	0.91	50.7310	68.5312	49.0262	70.7407
Final Area 5 Cabin Avionics	119.78	1.41	100.96	138.59	100.96	138.59
Final Inspection	16.9150	0.76	4.7775	22.6519	3.3814	23.7371
Fire Bottle Extinguishers Replacement	11.7412	1.63	3.5463	21.2017	3.5463	21.2017
Forward Cargo Access Panels Open Up	38.8217	1.10	35.0496	56.7298	35.0496	56.7298
FWD Body Fairing Open Up	108.15	1.85	98.0346	119.15	98.0346	119.15
FWD Body Fairing Panels Close Up	109.89	1.72	98.1027	119.37	98.1027	119.37
FWD Cargo Access Panels Close Up	97.5373	1.51	88.8198	107.74	88.8198	107.74
FWD Cargo Blankets Installation	109.31	1.70	98.0034	119.46	98.0034	119.46
FWD Cargo Blankets Removal	55.9436	1.60	48.5446	67.2487	48.5446	67.2487
FWD Cargo CIC	4.8703	1.35	1.0054	18.1408	1.0054	18.1408
FWD Cargo Final Inspection	7.9610	1.57	1.1704	19.7133	1.1704	19.7133
FWD Cargo Inspection 1	4.9588	1.38	0.5372	23.5478	0.5372	23.5478
FWD Cargo Non Routine Cards	123.43	1.28	103.14	140.88	103.14	140.88
FWD Cargo Pre Inspection	9.8523	1.64	1.1642	20.1862	1.1642	20.1862
FWD Cargo Routine Cards	70.5648	1.08	54.0783	88.7848	54.0783	88.7848
Galley Lift Maintenance	386.74	2.49	362.54	407.49	362.54	407.49

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Replications: 100 Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Heat Exchanger Reinstallation	35.7248	1.66	25.6089	44.8710	25.6089	44.8710
Heat Exchanger Removal	56.2231	1.98	31.3681	70.1115	31.3681	70.1115
HVDR EO	194.94	1.91	183.10	213.03	183.10	213.03
Inspection 2	16.5945	0.74	5.0729	22.0028	3.6166	22.8888
Inspection Paper Work	19.4949	1.49	4.2314	41.7147	4.2314	41.7147
Integrated Drive Generator and Routine	48.0124	0.78	38.0913	57.5020	28.2827	67.1763
Leak Check and Close Up	37.5139	1.62	26.9368	46.4604	26.9368	46.4604
Left Wing Access Panels Close Up	108.58	1.64	92.0757	130.08	92.0757	130.08
Left Wing Access Panels Open Up	78.6170	0.14	77.5470	79.9788	77.5470	79.9788
Left Wing Area Rectification	46.3630	2.26	25.8687	68.2221	25.8687	68.2221
Left Wing corrosion Inhibiter Application	60.0154	1.91	48.6132	72.9117	48.6132	72.9117
Left Wing Final Inspection	24.6292	1.39	5.9786	42.8932	5.9786	42.8932
Left Wing Hydraulic Filters	8.4972	1.55	2.0063	19.7493	2.0063	19.7493
Left Wing Inspection 1	8.5636	1.59	1.0757	19.3695	1.0757	19.3695
Left Wing Inspection 2	4.8332	1.38	0.5729	18.1848	0.5729	18.1848
Left Wing Lubrication	66.9145	1.48	51.7903	72.4025	51.7903	72.4025
Left Wing Non Routine Cards	167.40	1.69	159.63	181.82	159.63	181.82
Left Wing Routine Cards	52.5464	1.25	48.0507	67.7487	48.0507	67.7487
Lines Cleaning and Baroscopic	122.55	1.51	101.86	139.76	101.86	139.76
Lubrication	8.9538	1.61	2.0678	19.9258	2.0678	19.9258
Non Routine Cards	155.60	1.79	145.37	167.35	145.37	167.35
Non Routine Cards 2	176.36	1.72	167.53	189.42	167.53	189.42
Non Routine Cards 3	157.83	1.79	145.11	167.48	145.11	167.48
Non Routine Cards and Operational Checks AF Avionics	407.47	2.40	393.30	422.72	393.30	422.72
Non Routine Cards Rectification	105.14	0.81	94.5674	113.80	90.0337	119.37
Nose Landing Gear CIC	2.6892	0.95	0.5148	18.2143	0.5148	18.2143
Nose Landing Gear Lubrication	4.6304	1.36	0.5025	18.2186	0.5025	18.2186
Number 4 Flap Transmission EO	196.10	2.59	173.57	217.67	173.57	217.67
Number 5 Flap Transmission EO	128.14	1.65	120.55	142.14	120.55	142.14
Operational and Functional Checks	112.49	0.83	100.71	122.76	98.3092	137.11
Operational Checks A	193.27	1.58	173.05	211.97	173.05	211.97
Operational Checks A 2	194.48	1.68	174.15	211.46	174.15	211.46
Operational Checks A 3	195.93	1.89	173.25	211.93	173.25	211.93
Operational Checks B	82.2736	1.77	72.5065	93.4714	72.5065	93.4714
Operational Checks B 2	81.0005	1.74	72.5295	93.8157	72.5295	93.8157

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Replications: 100 Time Units: Hours

Process

Time per Entity

Total Time Per Entity	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Operational Checks B 3	80.1984	1.69	72.5897	93.9153	72.5897	93.9153
Operational Checks C	80.3560	1.64	72.5659	93.8256	72.5659	93.8256
Operational Checks C 2	81.2788	1.68	72.5537	93.4235	72.5537	93.4235
Operational Checks C 3	81.3757	1.82	72.5184	93.9690	72.5184	93.9690
Oxygen Cylinders Replacement	6.7581	1.49	1.5006	18.7123	1.5006	18.7123
Pre Inspection	11.5764	0.76	3.5325	20.0881	2.4626	21.5793
Pre Inspection Phase	58.7534	1.50	36.8323	66.2298	36.8323	66.2298
Pre Inspection Phase 2	60.5993	1.90	48.5405	88.5690	48.5405	88.5690
Pre Inspection Phase 3	57.7936	1.92	31.3770	71.1893	31.3770	71.1893
RH Hydraulic Filters	13.6022	1.53	2.0390	19.7438	2.0390	19.7438
Right Wing Access Panels Close Up	110.29	1.49	91.9711	130.14	91.9711	130.14
Right Wing Access Panels Open Up	104.51	1.76	94.5123	113.21	94.5123	113.21
Right Wing corrosion Inhibiter Application	57.2021	1.69	48.5898	70.2874	48.5898	70.2874
Right Wing Final Inspection	21.1121	1.31	5.1895	41.7759	5.1895	41.7759
Right Wing Inspection 1	8.4968	1.54	1.5626	19.9165	1.5626	19.9165
Right Wing Inspection 2	12.7998	1.59	2.7505	21.4984	2.7505	21.4984
Right Wing Lubrication	67.7092	1.43	52.3046	73.7282	52.3046	73.7282
Right Wing Non Routine Cards	185.01	1.87	164.81	203.90	164.81	203.90
Right Wing Rectification	48.8153	2.07	27.4977	69.3409	27.4977	69.3409
Right Wing Routine Cards	53.6878	1.34	48.5019	68.0163	48.5019	68.0163
Stabilizer Bolts EO	57.4124	1.74	48.5569	70.7156	48.5569	70.7156
Station 111 Blankets Installation	22.6681	1.50	5.7682	42.2172	5.7682	42.2172
Stow Thrust Reverse Plus Routine	31.7762	0.78	25.7052	42.6469	24.5010	44.4576
Throttle Cable and Cargo Door Lubrication	12.7410	1.62	3.5357	21.4098	3.5357	21.4098
Tire Change	49.3303	0.90	30.8062	65.8236	30.8062	65.8236
Vertical and Horizontal Stabilizers Panels Open Up	108.30	0.35	105.33	110.69	105.33	110.69
VIGV Rigging and Routine	29.3101	0.74	21.9838	39.1526	7.3521	45.2226
Waste Tanks Cleaning Prep	26.8072	1.13	23.7533	42.4969	23.7533	42.4969
Water Tanks Filters Replacement	2.6732	1.03	0.5083	17.7260	0.5083	17.7260
Window Water Service and Routine	6.7021	1.52	0.5235	19.9106	0.5235	19.9106
Zonal Inspection	9.0861	1.70	1.1264	24.0388	1.1264	24.0388
Zone 1 Open Up	47.9006	2.20	35.5164	60.9786	35.5164	60.9786
Zone 2 Open Up	52.5004	1.68	38.5758	59.4276	38.5758	59.4276
Zone 3 Open Up	55.6140	1.87	45.5437	65.8912	45.5437	65.8912

Accumulated Time

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
1 2 3 and 4 Fixed Fairings Installation	7.9282	0.12	7.0065	8.9828
1 2 3 and 4 Fixed Fairings Removal	5.9545	0.11	5.0042	6.9579
1 and 2 Turbines Installation	8.0314	0.12	7.0088	8.9873
1 and 2 Turbines Removal	4.2611	0.09	3.5025	4.9881
3 and 4 Turbines Installation	8.0175	0.12	7.0310	8.9927
3 and 4 Turbines Removal	4.2608	0.09	3.5242	4.9960
4 Engines Simulation	12.9546	0.35	10.0019	15.9786
5 6 7 and 8 Fixed Fairings Installation	7.9584	0.11	7.0103	8.9849
5 6 7 and 8 Fixed Fairings Removal	5.8834	0.12	5.0004	6.9982
AC EO	51.7206	0.73	46.0341	57.6511
AF Fuel EO Operational Checks Avionics	22.1593	0.23	20.1124	23.9982
Aft Cargo Access Panels Open Up	10.9145	0.12	10.0007	11.9765
Aft Cargo Blankets Installation and Close Up	28.8983	0.34	26.1175	31.8704
Aft Cargo Blankets Removal	14.0217	0.24	12.0207	15.9974
Aft Cargo Corrosion Inhibiter Application	2.5113	0.06	2.0421	2.9963
Aft Cargo Door Lubrication	0.9790	0.06	0.5098	1.4968
Aft Cargo Non Routine Cards	24.9105	0.38	22.0541	27.9934
Aft Cargo Routine Cards	20.1930	0.48	16.0195	23.9708
Air-condition Access Panels Open Up	10.0830	0.12	9.0017	10.9647
Air-condition Area Access Panels Close Up	14.9248	0.32	12.0034	17.9040
Air-condition Area Corrosion Inhibiter Application	9.8495	0.24	8.0160	11.9324
Air-condition Area Non Routine Cards	67.2414	0.86	60.0120	74.4398
APU and Area Non Routine Cards	17.0633	0.34	14.0189	19.9128
APU Close Up and Rectifications	19.5345	0.45	16.1040	23.8385
APU Operational Checks	18.5249	0.18	17.0241	19.9917
APU Team House Keeping	14.0371	0.23	12.0027	15.9675
APU Test	5.7937	0.59	0.00	7.9934
Area 10 CIC	3.5203	0.06	3.0049	3.9971
Area 10 Leak Checks	13.2265	0.36	10.2753	15.9564
Area 10 Lubrication	10.0706	0.22	8.0133	11.9572
Area 10 Non Routine Cards	26.4751	0.16	25.0130	27.9873
Area 10 OK to Close	2.4930	0.06	2.0366	2.9885

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
Area 10 Operational Checks	24.8535	0.36	22.0526	27.9067
Area 10 Panels In Place	1.9844	0.06	1.5199	2.4820
Area 10 Panels Security V and H Stabilizers	14.0564	0.25	12.0924	15.9784
Area 10 Routine Cards	29.1333	0.11	28.0504	29.9994
Area 10 Stabilizer Jack Screw Motors Servicing	2.4631	0.05	2.0125	2.9811
Area 5 Cabin Non Routine Cards and Operational Checks	106.10	1.14	97.1253	114.91
Area 6 Cockpit Operational Checks Avionics	15.9425	0.22	14.0307	17.9267
Area 9 Non Routine Cards	59.3849	0.29	57.0458	61.9896
Area 9 Routine Cards	24.2691	0.49	20.0198	27.9604
Body and Wing Landing Gears and Doors Lubrication	7.0526	0.11	6.0342	7.9840
Break Assembly Change	3.4721	0.06	3.0003	3.9874
Bulk and OFV Areas Non Routine Cards	37.4235	0.29	35.0163	39.9990
Bulk and OFV Areas Routine Cards	14.8250	0.33	12.0302	17.9749
Bulk and OFV CIC and Blankets Installation	31.0951	0.12	30.0417	31.9878
Bulk and OFV Open Up and Blankets Removal	24.8127	0.36	22.0175	27.9879
Cabin Carpet Replacement and Close Up 1	132.60	0.29	130.01	134.91
Cabin Carpet Replacement and Close Up 2	132.80	0.27	130.03	134.97
Cabin Carpet Replacement and Close Up 3	132.21	0.30	130.04	134.83
Cabin Filters Replacement and Routine Cards	13.0193	0.11	12.0299	13.9984
Cabin Filters Replacement and Routine Cards 2	13.0876	0.12	12.0109	13.9993
Cabin Filters Replacement and Routine Cards 3	12.9654	0.12	12.0301	13.9849
Cabin Lubrication and CIC 1	22.1423	0.23	20.0169	23.9939
Cabin Lubrication and CIC 3	21.9115	0.24	20.0087	23.9635
Canted Pressure Deck Area	104.79	0.59	100.03	109.97
Captain and First Officer Seats Installation	16.9072	0.12	16.0225	17.9905
Captain and First Officer Seats Removal	4.0150	0.12	3.0066	4.9715
Cargo Door Rigging	6.9624	0.11	6.0080	7.9642
CIC Under Body Fairing Structure CIC	1.0110	0.05	0.5053	1.4939
Cockpit Carpet Replacement	32.5000	0.28	30.0556	34.9199

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
Cockpit Close Up and Final Inspection	32.3393	0.29	30.0324	34.9947
Cockpit Open Up and Disconnection	20.6490	0.33	18.0062	23.9866
Cockpit Routine and Non Routine Cards	45.1459	0.62	40.0408	49.7462
Corrosion Inhibiter and Prep Close Up	23.9445	0.44	17.7362	28.8564
Corrosion Inhibiter Applications	2.2658	0.03	2.0084	2.4964
Crew Rest Area	105.12	0.59	100.13	109.84
Door Open Up	1.0000	0.00	1.0000	1.0000
Ducts Reinstallation	13.1131	0.12	12.0082	13.9902
Ducts Removal	7.2926	0.28	5.0068	9.7794
E and E Blankets Installation	9.9495	0.22	8.0935	11.9663
E and E Floor Panels Close Up	4.5214	0.06	4.0028	4.9846
E and E Blanket Removal Floor Panels Open Up	2.4557	0.06	2.0032	2.9983
Electronic Equip and Station 111 CIC	1.4724	0.06	1.0038	1.9977
Engine Baroscopic	15.8343	0.23	13.6514	18.6869
Engine Baroscopic Close Up and Rectification	16.0368	0.23	13.5519	19.1309
Engine Close Up	96.4758	0.90	88.6632	106.97
Engine Health and Functions	32.5365	0.29	30.1728	34.9707
Engine Oil Change and Routine	8.1015	0.11	6.5485	9.4680
Engine Open Up	48.0572	0.50	41.6905	54.2440
EO 5312654 station 2598 Bolts Removal for NDT	32.5655	0.30	30.0094	34.9812
EO 531355	14.9641	0.33	12.0257	17.9694
EO 531433	12.5188	0.30	10.0660	14.9841
EO 541119	18.0472	0.25	16.0569	19.9960
EO 541180	37.3331	0.32	35.0046	39.9867
EO 571334	24.9425	0.11	24.0175	25.9794
EO 731258	30.2663	0.61	25.0050	34.9731
EO 731292	32.5008	0.29	30.0266	34.9923
EO 781350	50.5683	0.57	45.1083	54.9257
Fan Blades and Shaft Lubrication	59.9587	0.22	57.4747	62.6098
FDB EO	38.4768	0.18	37.0052	39.9815
Filter and Oil and Lubrication Plus Routine Cards	35.6852	0.29	33.0217	37.9904
Filter Replacement	6.5317	0.06	6.0320	6.9959
Filters Change and Oil Routine	59.8652	0.23	57.2776	62.9463
Fire Bottle Extinguishers Replacement	3.4462	0.06	3.0056	3.9894

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
Forward Cargo Access Panels Open Up	9.7567	0.23	8.0496	11.9798
FWD Body Fairing Open Up	26.1659	0.21	24.0346	27.9039
FWD Body Fairing Panels Close Up	30.0160	0.22	28.0679	31.9090
FWD Cargo Access Panels Close Up	26.9898	0.12	26.0213	27.9918
FWD Cargo Blankets Installation	29.9668	0.24	28.0034	31.9896
FWD Cargo Blankets Removal	13.0786	0.11	12.0446	13.9987
FWD Cargo CIC	1.2603	0.03	1.0054	1.4896
FWD Cargo Non Routine Cards	30.0355	0.21	28.0650	31.9034
FWD Cargo Routine Cards	16.9148	0.12	16.0120	17.9382
Galley Lift Maintenance	104.80	0.55	100.04	109.99
Heat Exchanger Reinstallation	9.0323	0.12	8.0380	9.9980
Heat Exchanger Removal	14.8956	0.34	12.0358	17.9590
HVDR EO	52.6549	0.31	50.0138	54.9478
Integrated Drive Generator and Routine	48.1646	0.52	43.0869	54.0512
Leak Check and Close Up	8.9464	0.12	8.0338	9.9864
Left Wing Access Panels Close Up	30.3129	0.23	28.1537	31.9873
Left Wing Access Panels Open Up	25.0020	0.11	24.0470	25.9788
Left Wing Area Rectification	11.9655	0.46	8.1187	15.9984
Left Wing corrosion Inhibiter Application	15.8079	0.35	13.1132	18.9420
Left Wing Hydraulic Filters	2.5297	0.06	2.0063	2.9993
Left Wing Lubrication	17.9745	0.23	16.0403	19.9025
Left Wing Non Routine Cards	47.5311	0.29	45.1260	49.9946
Left Wing Routine Cards	14.5639	0.17	13.0507	15.9987
Lines Cleaning and Baroscopic	32.3745	0.28	30.0157	34.7949
Lubrication	2.4688	0.06	2.0058	2.9921
Non Routine Cards	42.4210	0.29	40.0511	44.9419
Non Routine Cards 2	47.5749	0.28	45.0282	49.9325
Non Routine Cards 3	42.2736	0.28	40.1121	44.9766
Non Routine Cards and Operational Checks AF Avionics	105.01	0.61	100.30	109.97
Non Routine Cards Rectification	120.25	0.55	113.39	125.84
Nose Landing Gear CIC	1.0217	0.06	0.5148	1.4971
Nose Landing Gear Lubrication	1.0229	0.05	0.5025	1.4930
Number 4 Flap Transmission EO	55.2355	0.61	50.0694	59.9226

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum VA Time	Average	Half Width	Minimum Average	Maximum Average
Number 5 Flap Transmission EO	34.1150	0.25	32.0485	35.9532
Operational and Functional Checks	120.16	0.47	113.04	124.31
Operational Checks A	52.4865	0.29	50.0540	54.9714
Operational Checks A 2	52.4542	0.30	50.0075	54.9890
Operational Checks A 3	52.7204	0.29	50.0698	54.9573
Operational Checks B	22.0386	0.26	20.0065	23.9714
Operational Checks B 2	22.0055	0.25	20.0213	23.9763
Operational Checks B 3	21.8384	0.23	20.0226	23.9153
Operational Checks C	21.9660	0.24	20.0415	23.9981
Operational Checks C 2	22.1038	0.22	20.0537	23.9989
Operational Checks C 3	21.9407	0.26	20.0184	23.9690
Oxygen Cylinders Replacement	1.7431	0.03	1.5006	1.9944
RH Hydraulic Filters	2.5272	0.06	2.0051	2.9973
Right Wing Access Panels Close Up	30.1632	0.23	28.0283	31.9670
Right Wing Access Panels Open Up	25.0354	0.11	24.0123	25.9640
Right Wing corrosion Inhibiter Application	13.8696	0.22	12.0898	15.9385
Right Wing Lubrication	18.0067	0.22	16.0546	19.9782
Right Wing Non Routine Cards	47.4597	0.30	45.0146	49.9486
Right Wing Rectification	11.8028	0.43	8.0737	15.5830
Right Wing Routine Cards	14.4578	0.17	13.0019	15.9503
Stabilizer Bolts EO	14.0399	0.24	12.0147	15.9939
Station 111 Blankets Installation	6.4681	0.17	5.0139	7.9865
Stow Thrust Reverse Plus Routine	32.0421	0.23	29.8118	34.7917
Throttle Cable and Cargo Door Lubrication	3.4410	0.06	3.0003	3.9956
Tire Change	12.9303	0.11	12.0045	13.9882
Vertical and Horizontal Stabilizers Panels Open Up	26.1285	0.24	24.0847	27.9405
VIGV Rigging and Routine	31.8853	0.44	26.1096	37.3930
Waste Tanks Cleaning Prep	6.9497	0.12	6.0033	7.9969
Water Tanks Filters Replacement	0.7307	0.03	0.5083	0.9955
Window Water Service and Routine	1.8046	0.15	0.5235	2.9797
Zone 1 Open Up	13.9606	0.24	12.0164	15.9786
Zone 2 Open Up	13.9954	0.23	12.0758	15.9276
Zone 3 Open Up	14.0290	0.23	12.0437	15.8912

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
1 2 3 and 4 Fixed Fairings Installation	22.2200	1.43	17.7500	34.7500
1 2 3 and 4 Fixed Fairings Removal	17.3250	0.05	16.7500	18.0000
1 and 2 Turbines Installation	21.8950	1.39	17.7500	34.7500
1 and 2 Turbines Removal	17.0825	0.05	16.7500	17.5000
3 and 4 Turbines Installation	25.9725	1.59	18.2500	36.0000
3 and 4 Turbines Removal	8.6800	1.65	0.7500	17.7500
4 Engines Simulation	31.3300	1.86	18.2500	51.2500
5 6 7 and 8 Fixed Fairings Installation	24.7325	1.53	18.2500	36.0000
5 6 7 and 8 Fixed Fairings Removal	17.8175	0.34	17.0000	34.5000
AC EO	131.77	2.34	114.50	149.75
AF Fuel EO Operational Checks Avionics	70.5825	1.21	55.7500	89.7500
Aft Cargo Access Panels Open Up	34.9625	0.02	34.7500	35.0000
Aft Cargo Area Final Inspection	5.7400	1.54	0.00	16.7500
Aft Cargo Blankets Installation and Close Up	73.6875	1.66	62.7500	82.2500
Aft Cargo Blankets Removal	44.1050	1.69	35.2500	52.5000
Aft Cargo Corrosion Inhibiter Application	8.8700	1.58	0.5000	17.7500
Aft Cargo Door Lubrication	2.9250	1.19	0.00	16.7500
Aft Cargo Non Routine Cards	78.7950	1.79	56.2500	91.2500
Aft Cargo Pre Inspection	7.4984	1.63	0.00	20.0839
Aft Cargo Routine Cards	64.2400	1.88	38.0000	89.2500
Air-condition Access Panels Open Up	18.2975	0.05	17.7500	18.5000
Air-condition and Wheel Well Inspection	2.2025	1.08	0.00	16.7500
Air-condition Area Access Panels Close Up	42.0425	1.76	19.0000	53.2500
Air-condition Area Corrosion Inhibiter Application	23.6600	1.71	9.5000	35.0000
Air-condition Area Final Inspection	5.4750	1.51	0.00	17.0000
Air-condition Area Non Routine Cards	174.08	2.05	150.50	201.50
APU and Area Non Routine Cards	48.1400	1.62	35.5000	70.0000
APU Baroscopic	68.8975	2.34	53.0000	88.5000
APU Close Up and Rectifications	62.1975	1.85	38.0000	74.0000
APU Inspection	1.0000	0.00	1.0000	1.0000
APU Operational Checks	49.8850	1.35	30.0000	63.7500

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
APU Team House Keeping	43.2350	1.57	36.5000	54.7500
APU Test	14.2000	1.43	0.00	17.7500
Area 10 CIC	9.7975	1.61	0.2500	17.2500
Area 10 Final Inspection	4.8850	1.47	0.00	16.7500
Area 10 Inspection 1	5.2500	1.50	0.00	16.7500
Area 10 Leak Checks	34.8725	1.38	18.2500	51.7500
Area 10 Lubrication	22.2625	1.25	10.0000	35.0000
Area 10 Non Routine Cards	79.8050	1.13	73.5000	91.2500
Area 10 OK to Close	6.6050	1.58	0.00	16.7500
Area 10 Operational Checks	67.5100	1.58	52.5000	86.7500
Area 10 Panels In Place	5.6275	1.52	0.00	16.7500
Area 10 Panels Security V and H Stabilizers	37.5000	1.47	18.2500	51.7500
Area 10 Pre Inspection	14.1775	1.33	0.5000	18.2500
Area 10 Routine Cards	92.5125	1.07	75.0000	108.00
Area 10 Stabilizer Jack Screw Motors Servicing	6.4775	1.57	0.00	16.7500
Area 5 Cabin Non Routine Cards and Operational Checks	313.62	3.16	281.75	349.75
Area 6 Cockpit Operational Checks Avionics	48.6325	1.22	45.2500	63.0000
Area 7 8 9 10 Avionics Final	95.3875	1.47	75.0000	108.50
Area 7 Pre Inspection	11.7142	1.60	0.7500	20.1565
Area 8 Pre Inspection	5.7800	1.56	0.00	17.0000
Area 9 Final Inspection	10.4333	1.56	0.2500	17.5346
Area 9 Inspection 1	6.6850	1.60	0.00	16.7500
Area 9 Non Routine Cards	166.11	1.53	153.25	187.00
Area 9 Routine Cards	77.7675	2.02	55.2500	91.2500
Body and Wing Landing Gears and Doors Lubrication	19.7100	1.04	17.5000	34.5000
Break Assembly Change	10.2925	1.60	0.2500	17.7500
Bulk and OFV Areas Non Routine Cards	108.75	1.66	100.50	119.75
Bulk and OFV Areas Pre Inspection	7.0451	1.59	0.00	18.2423
Bulk and OFV Areas Routine Cards	42.9725	1.65	35.0000	53.2500
Bulk and OFV CIC and Blankets Installation	98.2650	1.55	91.2500	109.00
Bulk and OFV Final Inspection	5.7850	1.48	0.00	17.2500
Bulk and OFV Open Up and Blankets Removal	77.7475	1.69	70.2500	88.0000
Cabin Carpet Replacement and Close Up 1	357.96	1.64	350.00	367.50
Cabin Carpet Replacement and Close Up 2	357.31	1.62	350.00	367.50

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
Cabin Carpet Replacement and Close Up 3	354.11	1.45	350.00	367.50
Cabin Filters Replacement and Routine Cards	34.7150	0.80	18.5000	51.5000
Cabin Filters Replacement and Routine Cards 2	36.4750	1.14	19.0000	51.5000
Cabin Filters Replacement and Routine Cards 3	34.6350	0.84	18.0000	52.0000
Cabin Lubrication and CIC 1	59.0100	1.57	52.5000	70.0000
Cabin Lubrication and CIC 2	74.8450	1.61	53.5000	87.0000
Cabin Lubrication and CIC 3	58.9600	1.64	52.5000	70.0000
Canted Pressure Deck Area	281.94	2.24	263.00	297.50
Captain and First Officer Seats Installation	46.1600	1.59	35.2500	52.5000
Captain and First Officer Seats Removal	10.2525	1.64	0.2500	17.5000
Cargo Door Rigging	19.5625	1.17	1.2500	34.2500
CIC Under Body Fairing Structure CIC	2.0000	1.03	0.00	16.7500
Cockpit AV Connection	91.0450	1.50	70.7500	104.50
Cockpit Carpet Replacement	87.6825	1.22	70.7500	104.25
Cockpit Close Up and Final Inspection	86.4900	1.57	70.7500	104.25
Cockpit Open Up and Disconnection	47.4100	1.58	35.7500	53.2500
Cockpit Pre Inspection	19.6050	1.09	17.5000	34.2500
Cockpit Routine and Non Routine Cards	122.74	2.05	105.00	139.75
Corrosion Inhibiter and Prep Close Up	65.4600	2.68	20.0000	88.0000
Corrosion Inhibiter Applications	8.4175	1.59	0.5000	16.7500
Crew Rest Area	284.94	2.14	263.00	297.50
Door Open Up	16.2500	0.00	16.2500	16.2500
Ducts Reinstallation	36.2475	0.97	18.5000	51.7500
Ducts Removal	19.4150	1.06	16.7500	34.5000
E and E Blankets Installation	28.2375	1.59	17.5000	35.0000
E and E Floor Panels Close Up	12.5550	1.47	0.7500	17.5000
E and E Blanket Removal Floor Panels Open Up	8.7500	0.00	8.7500	8.7500
EE and NLG and Station 111 Pre Inspection	14.8592	1.53	1.5000	34.5000
Electronic Equip and Station 111 CIC	3.3825	1.29	0.00	16.7500
Engine Baroscopic	44.5425	3.33	19.7500	70.5000
Engine Baroscopic Close Up and Rectification	46.3475	3.31	4.2500	71.5000
Engine Close Up	260.64	3.42	230.00	307.00

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
Engine Health and Functions	87.3375	1.52	70.7500	104.25
Engine Oil Change and Routine	20.0000	2.89	1.5000	51.0000
Engine Open Up	124.48	3.24	92.7500	160.50
Engineering Orders 5 EOs	280.01	2.07	256.25	291.75
EO 5312654 station 2598 Bolts Removal For NDT	83.6850	1.25	70.7500	96.2500
EO 531355	43.6525	1.20	28.5000	54.7500
EO 531433	34.1200	1.45	18.2500	51.7500
EO 541119	52.1075	1.49	36.5000	70.0000
EO 541180	101.79	1.42	89.7500	116.00
EO 571334	68.5500	1.40	63.7500	81.7500
EO 722047	74.8150	1.80	55.5000	92.0000
EO 731258	95.5925	2.37	73.5000	110.50
EO 731292	99.04	1.55	83.5000	109.50
EO 781350	150.86	1.75	140.25	159.00
EOs and Aft Cargo Inspection	4.2900	1.38	0.00	16.7500
Fan Blades and Shaft Lubrication	173.90	3.17	146.50	211.50
FDB EO	106.73	0.97	89.7500	122.75
Filter and Oil and Lubrication Plus Routine Cards	106.03	0.09	105.50	106.50
Filter Replacement	17.5000	0.48	0.7500	34.2500
Filters Change and Oil Routine	177.08	3.57	145.00	212.00
Final Area 5 Cabin Avionics	87.4525	1.25	70.7500	104.25
Final Inspection	49.6925	2.86	3.5000	69.7500
Fire Bottle Extinguishers Replacement	8.2950	1.62	0.5000	17.2500
Forward Cargo Access Panels Open Up	29.0650	0.94	27.0000	44.7500
FWD Body Fairing Open Up	81.9825	1.67	74.0000	91.2500
FWD Body Fairing Panels Close Up	79.8700	1.63	70.0000	87.5000
FWD Cargo Access Panels Close Up	70.5475	1.46	62.7500	79.7500
FWD Cargo Blankets Installation	79.3475	1.56	70.0000	87.5000
FWD Cargo Blankets Removal	42.8650	1.56	36.5000	53.2500
FWD Cargo CIC	3.6100	1.35	0.00	16.7500
FWD Cargo Final Inspection	5.9850	1.54	0.00	17.0000
FWD Cargo Inspection 1	3.9572	1.37	0.00	22.6114
FWD Cargo Non Routine Cards	93.3900	1.19	75.0000	109.00
FWD Cargo Pre Inspection	7.9175	1.61	0.00	17.2500
FWD Cargo Routine Cards	53.6500	1.03	38.0000	71.0000
Galley Lift Maintenance	281.94	2.04	262.50	297.50

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
Heat Exchanger Reinstallation	26.6925	1.63	17.5000	35.0000
Heat Exchanger Removal	41.3275	1.75	18.7500	52.5000
HVDR EO	142.29	1.68	133.00	159.00
Inspection 2	50.3925	2.96	5.0000	70.5000
Inspection Paper Work	14.4800	1.40	1.0000	35.2500
Integrated Drive Generator and Routine	143.89	2.75	109.25	176.00
Leak Check and Close Up	28.5675	1.59	18.7500	36.5000
Left Wing Access Panels Close Up	78.2625	1.50	63.7500	98.5000
Left Wing Access Panels Open Up	53.6150	0.04	53.5000	54.0000
Left Wing Area Rectification	34.3975	1.93	17.7500	52.5000
Left Wing corrosion Inhibiter Application	44.2075	1.68	35.2500	54.0000
Left Wing Final Inspection	18.4900	1.31	1.5000	35.2500
Left Wing Hydraulic Filters	5.9675	1.54	0.00	16.7500
Left Wing Inspection 1	6.5175	1.57	0.00	16.5000
Left Wing Inspection 2	3.8150	1.38	0.00	16.7500
Left Wing Lubrication	48.9400	1.33	35.7500	52.5000
Left Wing Non Routine Cards	119.87	1.52	114.50	132.00
Left Wing Routine Cards	37.9825	1.21	35.0000	51.7500
Lines Cleaning and Baroscopic	90.1750	1.36	71.7500	105.25
Lubrication	6.4850	1.60	0.00	17.0000
Non Routine Cards	113.18	1.64	105.00	122.50
Non Routine Cards 2	128.79	1.57	122.50	139.50
Non Routine Cards 3	115.56	1.65	105.00	122.50
Non Routine Cards and Operational Checks AF Avionics	302.46	1.83	293.00	312.75
Non Routine Cards Rectification	300.30	3.01	260.25	332.25
Nose Landing Gear CIC	1.6675	0.94	0.00	16.7500
Nose Landing Gear Lubrication	3.6075	1.35	0.00	16.7500
Number 4 Flap Transmission EO	140.86	2.04	123.50	157.75
Number 5 Flap Transmission EO	94.0300	1.52	88.5000	106.25
Operational and Functional Checks	329.79	3.08	284.75	367.50
Operational Checks A	140.79	1.41	123.00	157.00
Operational Checks A 2	142.03	1.50	123.50	156.50
Operational Checks A 3	143.21	1.71	123.00	157.00
Operational Checks B	60.2350	1.64	52.5000	69.5000
Operational Checks B 2	58.9950	1.59	52.5000	70.0000

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Wait Time	Average	Half Width	Minimum Average	Maximum Average
Operational Checks B 3	58.3600	1.60	52.5000	70.0000
Operational Checks C	58.3900	1.54	52.5000	70.0000
Operational Checks C 2	59.1750	1.58	52.5000	69.5000
Operational Checks C 3	59.4350	1.67	52.5000	70.0000
Oxygen Cylinders Replacement	5.0150	1.49	0.00	16.7500
Pre Inspection	34.1775	3.03	3.5000	68.0000
Pre Inspection Phase	43.6244	1.28	24.1118	48.5859
Pre Inspection Phase 2	45.7278	1.73	36.5000	71.0000
Pre Inspection Phase 3	42.6602	1.72	19.2500	53.2500
RH Hydraulic Filters	11.0750	1.54	0.00	16.7500
Right Wing Access Panels Close Up	80.1300	1.38	63.7500	98.2500
Right Wing Access Panels Open Up	79.4775	1.67	70.5000	87.2500
Right Wing corrosion Inhibiter Application	43.3325	1.58	36.5000	54.7500
Right Wing Final Inspection	15.2300	1.21	0.7500	34.2500
Right Wing Inspection 1	6.5500	1.54	0.00	17.2500
Right Wing Inspection 2	9.8200	1.58	0.5000	17.7500
Right Wing Lubrication	49.7025	1.31	36.2500	53.7500
Right Wing Non Routine Cards	137.55	1.67	119.75	154.00
Right Wing Rectification	37.0125	1.76	19.2500	54.0000
Right Wing Routine Cards	39.2300	1.31	35.5000	52.5000
Stabilizer Bolts EO	43.3725	1.60	36.5000	54.7500
Station 111 Blankets Installation	16.2000	1.40	0.7500	34.2500
Stow Thrust Reverse Plus Routine	95.0625	3.08	72.5000	137.50
Throttle Cable and Cargo Door Lubrication	9.3000	1.62	0.5000	17.5000
Tire Change	36.4000	0.87	18.7500	52.2500
Vertical and Horizontal Stabilizers Panels Open Up	82.1700	0.12	81.2500	82.7500
VIGV Rigging and Routine	85.3550	2.79	56.2500	122.00
Waste Tanks Cleaning Prep	19.8575	1.08	17.7500	34.5000
Water Tanks Filters Replacement	1.9425	1.02	0.00	16.7500
Window Water Service and Routine	4.8975	1.50	0.00	17.0000
Zonal Inspection	7.0619	1.69	0.00	21.6730
Zone 1 Open Up	33.9400	1.98	23.5000	45.0000
Zone 2 Open Up	38.5050	1.48	26.5000	43.5000
Zone 3 Open Up	41.5850	1.67	33.5000	50.0000

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Other Time	Average	Half Width	Minimum Average	Maximum Average
Aft Cargo Area Final Inspection	1.9882	0.07	1.1111	2.7422
Aft Cargo Pre Inspection	1.9755	0.07	1.1280	2.8494
Air-condition and Wheel Well Inspection	1.0027	0.04	0.5380	1.4454
Air-condition Area Final Inspection	2.0439	0.08	1.0520	2.8893
APU Baroscopic	24.7392	0.62	20.1253	29.9510
APU Inspection	4.0411	0.09	3.0608	4.8919
Area 10 Final Inspection	1.9896	0.09	1.1683	2.9035
Area 10 Inspection 1	1.9848	0.08	1.1469	2.8331
Area 10 Pre Inspection	3.9611	0.17	2.2633	5.7287
Area 7 8 9 10 Avionics Final	29.9160	0.22	28.0381	31.9560
Area 7 Pre Inspection	3.9451	0.08	3.0837	4.9379
Area 8 Pre Inspection	2.0189	0.08	1.0718	2.9267
Area 9 Final Inspection	4.1093	0.17	2.2612	5.7257
Area 9 Inspection 1	1.9814	0.07	1.1122	2.8006
Bulk and OFV Areas Pre Inspection	1.9867	0.08	1.0676	2.9772
Bulk and OFV Final Inspection	1.9863	0.09	1.0794	2.9010
Cabin Lubrication and CIC 2	27.5063	0.30	25.0299	29.9733
Cockpit AV Connection	34.0641	0.22	32.0453	35.9149
Cockpit Pre Inspection	7.5063	0.06	7.0172	7.9844
EE and NLG and Station 111 Pre Inspection	4.9431	0.18	3.2617	6.9410
Engineering Orders 5 EOs	104.96	0.58	100.07	109.90
EO 722047	24.2328	0.53	20.1152	29.9757
EOs and Aft Cargo Inspection	0.9771	0.04	0.5508	1.4210
Final Area 5 Cabin Avionics	32.3249	0.28	30.0227	34.9671
Final Inspection	17.9676	0.35	13.0567	21.9020
FWD Cargo Final Inspection	1.9760	0.08	1.1704	2.8662
FWD Cargo Inspection 1	1.0016	0.04	0.5372	1.4530
FWD Cargo Pre Inspection	1.9348	0.08	1.0376	2.9362
Inspection 2	15.9854	0.14	13.9498	17.7614
Inspection Paper Work	5.0149	0.17	3.2314	6.7729
Left Wing Final Inspection	6.1392	0.16	4.1481	7.6631
Left Wing Inspection 1	2.0461	0.08	1.0757	2.8695
Left Wing Inspection 2	1.0182	0.04	0.5684	1.4348
Pre Inspection	12.1281	0.17	9.8911	14.1601
Pre Inspection Phase	15.1290	0.34	12.1422	17.9062
Pre Inspection Phase 2	14.8714	0.34	12.0237	17.9586
Pre Inspection Phase 3	15.1334	0.36	12.1076	17.9520
Right Wing Final Inspection	5.8821	0.18	4.2602	7.8192
Right Wing Inspection 1	1.9468	0.08	1.1382	2.9330

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Replications: 100 Time Units: Hours

Process

Accumulated Time

Accum Other Time	Average	Half Width	Minimum Average	Maximum Average
Right Wing Inspection 2	2.9798	0.07	2.2441	3.7523
Zonal Inspection	2.0242	0.10	1.0861	2.9895

Other

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Replications: 100 Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
1 2 3 and 4 Fixed Fairings Installation	1.0000	0.00	1.0000	1.0000
1 2 3 and 4 Fixed Fairings Removal	1.0000	0.00	1.0000	1.0000
1 and 2 Turbines Installation	1.0000	0.00	1.0000	1.0000
1 and 2 Turbines Removal	1.0000	0.00	1.0000	1.0000
3 and 4 Turbines Installation	1.0000	0.00	1.0000	1.0000
3 and 4 Turbines Removal	1.0000	0.00	1.0000	1.0000
4 Engines Simulation	0.8000	0.08	0.00	1.0000
5 6 7 and 8 Fixed Fairings Installation	1.0000	0.00	1.0000	1.0000
5 6 7 and 8 Fixed Fairings Removal	1.0000	0.00	1.0000	1.0000
AC EO	1.0000	0.00	1.0000	1.0000
AF Fuel EO Operational Checks Avionics	1.0000	0.00	1.0000	1.0000
Aft Cargo Access Panels Open Up	0.00	0.00	0.00	0.00
Aft Cargo Area Final Inspection	1.0000	0.00	1.0000	1.0000
Aft Cargo Blankets Installation and Close Up	1.0000	0.00	1.0000	1.0000
Aft Cargo Blankets Removal	1.0000	0.00	1.0000	1.0000
Aft Cargo Corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Aft Cargo Door Lubrication	1.0000	0.00	1.0000	1.0000
Aft Cargo Non Routine Cards	1.0000	0.00	1.0000	1.0000
Aft Cargo Pre Inspection	1.0000	0.00	1.0000	1.0000
Aft Cargo Routine Cards	1.0000	0.00	1.0000	1.0000
Air-condition Access Panels Open Up	0.00	0.00	0.00	0.00
Air-condition and Wheel Well Inspection	1.0000	0.00	1.0000	1.0000
Air-condition Area Access Panels Close Up	1.0000	0.00	1.0000	1.0000
Air-condition Area Corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Air-condition Area Final Inspection	1.0000	0.00	1.0000	1.0000
Air-condition Area Non Routine Cards	1.0000	0.00	1.0000	1.0000
APU and Area Non Routine Cards	1.0000	0.00	1.0000	1.0000
APU Baroscopic	1.0000	0.00	1.0000	1.0000
APU Close Up and Rectifications	1.0000	0.00	1.0000	1.0000
APU Inspection	1.0000	0.00	1.0000	1.0000
APU Operational Checks	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
APU Team House Keeping	1.0000	0.00	1.0000	1.0000
APU Test	0.00	0.00	0.00	0.00
Area 10 CIC	1.0000	0.00	1.0000	1.0000
Area 10 Final Inspection	1.0000	0.00	1.0000	1.0000
Area 10 Inspection 1	1.0000	0.00	1.0000	1.0000
Area 10 Leak Checks	1.0000	0.00	1.0000	1.0000
Area 10 Lubrication	1.0000	0.00	1.0000	1.0000
Area 10 Non Routine Cards	1.0000	0.00	1.0000	1.0000
Area 10 OK to Close	1.0000	0.00	1.0000	1.0000
Area 10 Operational Checks	1.0000	0.00	1.0000	1.0000
Area 10 Panels In Place	1.0000	0.00	1.0000	1.0000
Area 10 Panels Security V and H Stabilizers	1.0000	0.00	1.0000	1.0000
Area 10 Pre Inspection	1.0000	0.00	1.0000	1.0000
Area 10 Routine Cards	1.0000	0.00	1.0000	1.0000
Area 10 Stabilizer Jack Screw Motors Servicing	1.0000	0.00	1.0000	1.0000
Area 5 Cabin Non Routine Cards and Operational Checks	1.0000	0.00	1.0000	1.0000
Area 6 Cockpit Operational Checks Avionics	0.00	0.00	0.00	0.00
Area 7 8 9 10 Avionics Final	1.0000	0.00	1.0000	1.0000
Area 7 Pre Inspection	1.0000	0.00	1.0000	1.0000
Area 8 Pre Inspection	1.0000	0.00	1.0000	1.0000
Area 9 Final Inspection	1.0000	0.00	1.0000	1.0000
Area 9 Inspection 1	1.0000	0.00	1.0000	1.0000
Area 9 Non Routine Cards	1.0000	0.00	1.0000	1.0000
Area 9 Routine Cards	1.0000	0.00	1.0000	1.0000
Body and Wing Landing Gears and Doors Lubrication	1.0000	0.00	1.0000	1.0000
Break Assembly Change	1.0000	0.00	1.0000	1.0000
Bulk and OFV Areas Non Routine Cards	1.0000	0.00	1.0000	1.0000
Bulk and OFV Areas Pre Inspection	1.0000	0.00	1.0000	1.0000
Bulk and OFV Areas Routine Cards	1.0000	0.00	1.0000	1.0000
Bulk and OFV CIC and Blankets Installation	1.0000	0.00	1.0000	1.0000
Bulk and OFV Final Inspection	1.0000	0.00	1.0000	1.0000
Bulk and OFV Open Up and Blankets Removal	0.00	0.00	0.00	0.00
Cabin Carpet Replacement and Close Up 1	1.0000	0.00	1.0000	1.0000
Cabin Carpet Replacement and Close Up 2	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
Cabin Carpet Replacement and Close Up 3	1.0000	0.00	1.0000	1.0000
Cabin Filters Replacement and Routine Cards	1.0000	0.00	1.0000	1.0000
Cabin Filters Replacement and Routine Cards 2	1.0000	0.00	1.0000	1.0000
Cabin Filters Replacement and Routine Cards 3	1.0000	0.00	1.0000	1.0000
Cabin Lubrication and CIC 1	1.0000	0.00	1.0000	1.0000
Cabin Lubrication and CIC 2	1.0000	0.00	1.0000	1.0000
Cabin Lubrication and CIC 3	1.0000	0.00	1.0000	1.0000
Canted Pressure Deck Area	1.0000	0.00	1.0000	1.0000
Captain and First Officer Seats Installation	1.0000	0.00	1.0000	1.0000
Captain and First Officer Seats Removal	1.0000	0.00	1.0000	1.0000
Cargo Door Rigging	1.0000	0.00	1.0000	1.0000
CIC Under Body Fairing Structure CIC	1.0000	0.00	1.0000	1.0000
Cockpit AV Connection	1.0000	0.00	1.0000	1.0000
Cockpit Carpet Replacement	1.0000	0.00	1.0000	1.0000
Cockpit Close Up and Final Inspection	1.0000	0.00	1.0000	1.0000
Cockpit Open Up and Disconnection	0.00	0.00	0.00	0.00
Cockpit Pre Inspection	1.0000	0.00	1.0000	1.0000
Cockpit Routine and Non Routine Cards	1.0000	0.00	1.0000	1.0000
Corrosion Inhibiter and Prep Close Up	4.0000	0.00	4.0000	4.0000
Corrosion Inhibiter Applications	1.0000	0.00	1.0000	1.0000
Crew Rest Area	1.0000	0.00	1.0000	1.0000
Door Open Up	0.00	0.00	0.00	0.00
Ducts Reinstallation	1.0000	0.00	1.0000	1.0000
Ducts Removal	1.0000	0.00	1.0000	1.0000
E and E Blankets Installation	1.0000	0.00	1.0000	1.0000
E and E Floor Panels Close Up	1.0000	0.00	1.0000	1.0000
E and E Blanket Removal Floor Panels Open Up	0.00	0.00	0.00	0.00
EE and NLG and Station 111 Pre Inspection	1.0000	0.00	1.0000	1.0000
Electronic Equip and Station 111 CIC	1.0000	0.00	1.0000	1.0000
Engine Baroscopic	4.0000	0.00	4.0000	4.0000
Engine Baroscopic Close Up and Rectification	4.0000	0.00	4.0000	4.0000
Engine Close Up	4.0000	0.00	4.0000	4.0000

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Replications: 100 Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
Engine Health and Functions	1.0000	0.00	1.0000	1.0000
Engine Oil Change and Routine	4.0000	0.00	4.0000	4.0000
Engine Open Up	0.00	0.00	0.00	0.00
Engineering Orders 5 EOs	1.0000	0.00	1.0000	1.0000
EO 5312654 station 2598 Bolts Removal for NDT	1.0000	0.00	1.0000	1.0000
EO 531355	1.0000	0.00	1.0000	1.0000
EO 531433	1.0000	0.00	1.0000	1.0000
EO 541119	1.0000	0.00	1.0000	1.0000
EO 541180	1.0000	0.00	1.0000	1.0000
EO 571334	1.0000	0.00	1.0000	1.0000
EO 722047	1.0000	0.00	1.0000	1.0000
EO 731258	1.0000	0.00	1.0000	1.0000
EO 731292	1.0000	0.00	1.0000	1.0000
EO 781350	0.00	0.00	0.00	0.00
EOs and Aft Cargo Inspection	1.0000	0.00	1.0000	1.0000
Fan Blades and Shaft Lubrication	4.0000	0.00	4.0000	4.0000
FDB EO	1.0000	0.00	1.0000	1.0000
Filter and Oil and Lubrication Plus Routine Cards	1.0000	0.00	1.0000	1.0000
Filter Replacement	1.0000	0.00	1.0000	1.0000
Filters Change and Oil Routine	4.0000	0.00	4.0000	4.0000
Final Area 5 Cabin Avionics	1.0000	0.00	1.0000	1.0000
Final Inspection	4.0000	0.00	4.0000	4.0000
Fire Bottle Extinguishers Replacement	1.0000	0.00	1.0000	1.0000
Forward Cargo Access Panels Open Up	0.00	0.00	0.00	0.00
FWD Body Fairing Open Up	1.0000	0.00	1.0000	1.0000
FWD Body Fairing Panels Close Up	1.0000	0.00	1.0000	1.0000
FWD Cargo Access Panels Close Up	1.0000	0.00	1.0000	1.0000
FWD Cargo Blankets Installation	1.0000	0.00	1.0000	1.0000
FWD Cargo Blankets Removal	1.0000	0.00	1.0000	1.0000
FWD Cargo CIC	1.0000	0.00	1.0000	1.0000
FWD Cargo Final Inspection	1.0000	0.00	1.0000	1.0000
FWD Cargo Inspection 1	1.0000	0.00	1.0000	1.0000
FWD Cargo Non Routine Cards	1.0000	0.00	1.0000	1.0000
FWD Cargo Pre Inspection	1.0000	0.00	1.0000	1.0000
FWD Cargo Routine Cards	1.0000	0.00	1.0000	1.0000
Galley Lift Maintenance	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
Heat Exchanger Reinstallation	1.0000	0.00	1.0000	1.0000
Heat Exchanger Removal	1.0000	0.00	1.0000	1.0000
HVDR EO	1.0000	0.00	1.0000	1.0000
Inspection 2	4.0000	0.00	4.0000	4.0000
Inspection Paper Work	1.0000	0.00	1.0000	1.0000
Integrated Drive Generator and Routine	4.0000	0.00	4.0000	4.0000
Leak Check and Close Up	1.0000	0.00	1.0000	1.0000
Left Wing Access Panels Close Up	1.0000	0.00	1.0000	1.0000
Left Wing Access Panels Open Up	0.00	0.00	0.00	0.00
Left Wing Area Rectification	1.0000	0.00	1.0000	1.0000
Left Wing corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Left Wing Final Inspection	1.0000	0.00	1.0000	1.0000
Left Wing Hydraulic Filters	1.0000	0.00	1.0000	1.0000
Left Wing Inspection 1	1.0000	0.00	1.0000	1.0000
Left Wing Inspection 2	1.0000	0.00	1.0000	1.0000
Left Wing Lubrication	1.0000	0.00	1.0000	1.0000
Left Wing Non Routine Cards	1.0000	0.00	1.0000	1.0000
Left Wing Routine Cards	1.0000	0.00	1.0000	1.0000
Lines Cleaning and Baroscopic	1.0000	0.00	1.0000	1.0000
Lubrication	1.0000	0.00	1.0000	1.0000
Non Routine Cards	1.0000	0.00	1.0000	1.0000
Non Routine Cards 2	1.0000	0.00	1.0000	1.0000
Non Routine Cards 3	1.0000	0.00	1.0000	1.0000
Non Routine Cards and Operational Checks AF Avionics	0.00	0.00	0.00	0.00
Non Routine Cards Rectification	4.0000	0.00	4.0000	4.0000
Nose Landing Gear CIC	1.0000	0.00	1.0000	1.0000
Nose Landing Gear Lubrication	1.0000	0.00	1.0000	1.0000
Number 4 Flap Transmission EO	0.00	0.00	0.00	0.00
Number 5 Flap Transmission EO	1.0000	0.00	1.0000	1.0000
Operational and Functional Checks	4.0000	0.00	4.0000	4.0000
Operational Checks A	1.0000	0.00	1.0000	1.0000
Operational Checks A 2	1.0000	0.00	1.0000	1.0000
Operational Checks A 3	1.0000	0.00	1.0000	1.0000
Operational Checks B	1.0000	0.00	1.0000	1.0000
Operational Checks B 2	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number In	Average	Half Width	Minimum Average	Maximum Average
Operational Checks B 3	1.0000	0.00	1.0000	1.0000
Operational Checks C	1.0000	0.00	1.0000	1.0000
Operational Checks C 2	1.0000	0.00	1.0000	1.0000
Operational Checks C 3	1.0000	0.00	1.0000	1.0000
Oxygen Cylinders Replacement	1.0000	0.00	1.0000	1.0000
Pre Inspection	4.0000	0.00	4.0000	4.0000
Pre Inspection Phase	1.0000	0.00	1.0000	1.0000
Pre Inspection Phase 2	1.0000	0.00	1.0000	1.0000
Pre Inspection Phase 3	1.0000	0.00	1.0000	1.0000
RH Hydraulic Filters	1.0000	0.00	1.0000	1.0000
Right Wing Access Panels Close Up	1.0000	0.00	1.0000	1.0000
Right Wing Access Panels Open Up	0.00	0.00	0.00	0.00
Right Wing corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Right Wing Final Inspection	1.0000	0.00	1.0000	1.0000
Right Wing Inspection 1	1.0000	0.00	1.0000	1.0000
Right Wing Inspection 2	1.0000	0.00	1.0000	1.0000
Right Wing Lubrication	1.0000	0.00	1.0000	1.0000
Right Wing Non Routine Cards	1.0000	0.00	1.0000	1.0000
Right Wing Rectification	1.0000	0.00	1.0000	1.0000
Right Wing Routine Cards	1.0000	0.00	1.0000	1.0000
Stabilizer Bolts EO	1.0000	0.00	1.0000	1.0000
Station 111 Blankets Installation	1.0000	0.00	1.0000	1.0000
Stow Thrust Reverse Plus Routine	4.0000	0.00	4.0000	4.0000
Throttle Cable and Cargo Door Lubrication	1.0000	0.00	1.0000	1.0000
Tire Change	1.0000	0.00	1.0000	1.0000
Vertical and Horizontal Stabilizers Panels Open Up	0.00	0.00	0.00	0.00
VIGV Rigging and Routine	4.0000	0.00	4.0000	4.0000
Waste Tanks Cleaning Prep	1.0000	0.00	1.0000	1.0000
Water Tanks Filters Replacement	1.0000	0.00	1.0000	1.0000
Window Water Service and Routine	1.0000	0.00	1.0000	1.0000
Zonal Inspection	1.0000	0.00	1.0000	1.0000
Zone 1 Open Up	0.00	0.00	0.00	0.00
Zone 2 Open Up	0.00	0.00	0.00	0.00
Zone 3 Open Up	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
1 2 3 and 4 Fixed Fairings Installation	1.0000	0.00	1.0000	1.0000
1 2 3 and 4 Fixed Fairings Removal	1.0000	0.00	1.0000	1.0000
1 and 2 Turbines Installation	1.0000	0.00	1.0000	1.0000
1 and 2 Turbines Removal	1.0000	0.00	1.0000	1.0000
3 and 4 Turbines Installation	1.0000	0.00	1.0000	1.0000
3 and 4 Turbines Removal	1.0000	0.00	1.0000	1.0000
4 Engines Simulation	1.0000	0.00	1.0000	1.0000
5 6 7 and 8 Fixed Fairings Installation	1.0000	0.00	1.0000	1.0000
5 6 7 and 8 Fixed Fairings Removal	1.0000	0.00	1.0000	1.0000
AC EO	1.0000	0.00	1.0000	1.0000
AF Fuel EO Operational Checks Avionics	1.0000	0.00	1.0000	1.0000
Aft Cargo Access Panels Open Up	1.0000	0.00	1.0000	1.0000
Aft Cargo Area Final Inspection	1.0000	0.00	1.0000	1.0000
Aft Cargo Blankets Installation and Close Up	1.0000	0.00	1.0000	1.0000
Aft Cargo Blankets Removal	1.0000	0.00	1.0000	1.0000
Aft Cargo Corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Aft Cargo Door Lubrication	1.0000	0.00	1.0000	1.0000
Aft Cargo Non Routine Cards	1.0000	0.00	1.0000	1.0000
Aft Cargo Pre Inspection	1.0000	0.00	1.0000	1.0000
Aft Cargo Routine Cards	1.0000	0.00	1.0000	1.0000
Air-condition Access Panels Open Up	1.0000	0.00	1.0000	1.0000
Air-condition and Wheel Well Inspection	1.0000	0.00	1.0000	1.0000
Air-condition Area Access Panels Close Up	1.0000	0.00	1.0000	1.0000
Air-condition Area Corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Air-condition Area Final Inspection	1.0000	0.00	1.0000	1.0000
Air-condition Area Non Routine Cards	1.0000	0.00	1.0000	1.0000
APU and Area Non Routine Cards	1.0000	0.00	1.0000	1.0000
APU Baroscopic	1.0000	0.00	1.0000	1.0000
APU Close Up and Rectifications	1.0000	0.00	1.0000	1.0000
APU Inspection	1.0000	0.00	1.0000	1.0000
APU Operational Checks	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
APU Team House Keeping	1.0000	0.00	1.0000	1.0000
APU Test	0.8000	0.08	0.00	1.0000
Area 10 CIC	1.0000	0.00	1.0000	1.0000
Area 10 Final Inspection	1.0000	0.00	1.0000	1.0000
Area 10 Inspection 1	1.0000	0.00	1.0000	1.0000
Area 10 Leak Checks	1.0000	0.00	1.0000	1.0000
Area 10 Lubrication	1.0000	0.00	1.0000	1.0000
Area 10 Non Routine Cards	1.0000	0.00	1.0000	1.0000
Area 10 OK to Close	1.0000	0.00	1.0000	1.0000
Area 10 Operational Checks	1.0000	0.00	1.0000	1.0000
Area 10 Panels In Place	1.0000	0.00	1.0000	1.0000
Area 10 Panels Security V and H Stabilizers	1.0000	0.00	1.0000	1.0000
Area 10 Pre Inspection	1.0000	0.00	1.0000	1.0000
Area 10 Routine Cards	1.0000	0.00	1.0000	1.0000
Area 10 Stabilizer Jack Screw Motors Servicing	1.0000	0.00	1.0000	1.0000
Area 5 Cabin Non Routine Cards and Operational Checks	1.0000	0.00	1.0000	1.0000
Area 6 Cockpit Operational Checks Avionics	1.0000	0.00	1.0000	1.0000
Area 7 8 9 10 Avionics Final	1.0000	0.00	1.0000	1.0000
Area 7 Pre Inspection	1.0000	0.00	1.0000	1.0000
Area 8 Pre Inspection	1.0000	0.00	1.0000	1.0000
Area 9 Final Inspection	1.0000	0.00	1.0000	1.0000
Area 9 Inspection 1	1.0000	0.00	1.0000	1.0000
Area 9 Non Routine Cards	1.0000	0.00	1.0000	1.0000
Area 9 Routine Cards	1.0000	0.00	1.0000	1.0000
Body and Wing Landing Gears and Doors Lubrication	1.0000	0.00	1.0000	1.0000
Break Assembly Change	1.0000	0.00	1.0000	1.0000
Bulk and OFV Areas Non Routine Cards	1.0000	0.00	1.0000	1.0000
Bulk and OFV Areas Pre Inspection	1.0000	0.00	1.0000	1.0000
Bulk and OFV Areas Routine Cards	1.0000	0.00	1.0000	1.0000
Bulk and OFV CIC and Blankets Installation	1.0000	0.00	1.0000	1.0000
Bulk and OFV Final Inspection	1.0000	0.00	1.0000	1.0000
Bulk and OFV Open Up and Blankets Removal	1.0000	0.00	1.0000	1.0000
Cabin Carpet Replacement and Close Up 1	1.0000	0.00	1.0000	1.0000
Cabin Carpet Replacement and Close Up 2	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
Cabin Carpet Replacement and Close Up 3	1.0000	0.00	1.0000	1.0000
Cabin Filters Replacement and Routine Cards	1.0000	0.00	1.0000	1.0000
Cabin Filters Replacement and Routine Cards 2	1.0000	0.00	1.0000	1.0000
Cabin Filters Replacement and Routine Cards 3	1.0000	0.00	1.0000	1.0000
Cabin Lubrication and CIC 1	1.0000	0.00	1.0000	1.0000
Cabin Lubrication and CIC 2	1.0000	0.00	1.0000	1.0000
Cabin Lubrication and CIC 3	1.0000	0.00	1.0000	1.0000
Canted Pressure Deck Area	1.0000	0.00	1.0000	1.0000
Captain and First Officer Seats Installation	1.0000	0.00	1.0000	1.0000
Captain and First Officer Seats Removal	1.0000	0.00	1.0000	1.0000
Cargo Door Rigging	1.0000	0.00	1.0000	1.0000
CIC under Body Fairing Structure CIC	1.0000	0.00	1.0000	1.0000
Cockpit AV Connection	1.0000	0.00	1.0000	1.0000
Cockpit Carpet Replacement	1.0000	0.00	1.0000	1.0000
Cockpit Close Up and Final Inspection	1.0000	0.00	1.0000	1.0000
Cockpit Open Up and Disconnection	1.0000	0.00	1.0000	1.0000
Cockpit Pre Inspection	1.0000	0.00	1.0000	1.0000
Cockpit Routine and Non Routine Cards	1.0000	0.00	1.0000	1.0000
Corrosion Inhibiter and Prep Close Up	4.0000	0.00	4.0000	4.0000
Corrosion Inhibiter Applications	1.0000	0.00	1.0000	1.0000
Crew Rest Area	1.0000	0.00	1.0000	1.0000
Door Open Up	1.0000	0.00	1.0000	1.0000
Ducts Reinstallation	1.0000	0.00	1.0000	1.0000
Ducts Removal	1.0000	0.00	1.0000	1.0000
E and E Blankets Installation	1.0000	0.00	1.0000	1.0000
E and E Floor Panels Close Up	1.0000	0.00	1.0000	1.0000
E and E Blanket Removal Floor Panels Open Up	1.0000	0.00	1.0000	1.0000
EE and NLG and Station 111 Pre Inspection	1.0000	0.00	1.0000	1.0000
Electronic Equip and Station 111 CIC	1.0000	0.00	1.0000	1.0000
Engine Baroscopic	4.0000	0.00	4.0000	4.0000
Engine Baroscopic Close Up and Rectification	4.0000	0.00	4.0000	4.0000
Engine Close Up	4.0000	0.00	4.0000	4.0000

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Replications: 100 Time Units: Hours

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
Engine Health and Functions	1.0000	0.00	1.0000	1.0000
Engine Oil Change and Routine	4.0000	0.00	4.0000	4.0000
Engine Open Up	4.0000	0.00	4.0000	4.0000
Engineering Orders 5 EOs	1.0000	0.00	1.0000	1.0000
EO 5312654 Station 2598 Bolts Removal for NDT	1.0000	0.00	1.0000	1.0000
EO 531355	1.0000	0.00	1.0000	1.0000
EO 531433	1.0000	0.00	1.0000	1.0000
EO 541119	1.0000	0.00	1.0000	1.0000
EO 541180	1.0000	0.00	1.0000	1.0000
EO 571334	1.0000	0.00	1.0000	1.0000
EO 722047	1.0000	0.00	1.0000	1.0000
EO 731258	1.0000	0.00	1.0000	1.0000
EO 731292	1.0000	0.00	1.0000	1.0000
EO 781350	1.0000	0.00	1.0000	1.0000
EOs and Aft Cargo Inspection	1.0000	0.00	1.0000	1.0000
Fan Blades and Shaft Lubrication	4.0000	0.00	4.0000	4.0000
FDB EO	1.0000	0.00	1.0000	1.0000
Filter and Oil and Lubrication Plus Routine Cards	1.0000	0.00	1.0000	1.0000
Filter Replacement	1.0000	0.00	1.0000	1.0000
Filters Change and Oil Routine	4.0000	0.00	4.0000	4.0000
Final Area 5 Cabin Avionics	1.0000	0.00	1.0000	1.0000
Final Inspection	4.0000	0.00	4.0000	4.0000
Fire Bottle Extinguishers Replacement	1.0000	0.00	1.0000	1.0000
Forward Cargo Access Panels Open Up	1.0000	0.00	1.0000	1.0000
FWD Body Fairing Open Up	1.0000	0.00	1.0000	1.0000
FWD Body Fairing Panels Close Up	1.0000	0.00	1.0000	1.0000
FWD Cargo Access Panels Close Up	1.0000	0.00	1.0000	1.0000
FWD Cargo Blankets Installation	1.0000	0.00	1.0000	1.0000
FWD Cargo Blankets Removal	1.0000	0.00	1.0000	1.0000
FWD Cargo CIC	1.0000	0.00	1.0000	1.0000
FWD Cargo Final Inspection	1.0000	0.00	1.0000	1.0000
FWD Cargo Inspection 1	1.0000	0.00	1.0000	1.0000
FWD Cargo Non Routine Cards	1.0000	0.00	1.0000	1.0000
FWD Cargo Pre Inspection	1.0000	0.00	1.0000	1.0000
FWD Cargo Routine Cards	1.0000	0.00	1.0000	1.0000
Galley Lift Maintenance	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
Heat Exchanger Reinstallation	1.0000	0.00	1.0000	1.0000
Heat Exchanger Removal	1.0000	0.00	1.0000	1.0000
HVDR EO	1.0000	0.00	1.0000	1.0000
Inspection 2	4.0000	0.00	4.0000	4.0000
Inspection Paper Work	1.0000	0.00	1.0000	1.0000
Integrated Drive Generator and Routine	4.0000	0.00	4.0000	4.0000
Leak Check and Close Up	1.0000	0.00	1.0000	1.0000
Left Wing Access Panels Close Up	1.0000	0.00	1.0000	1.0000
Left Wing Access Panels Open Up	1.0000	0.00	1.0000	1.0000
Left Wing Area Rectification	1.0000	0.00	1.0000	1.0000
Left Wing corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Left Wing Final Inspection	1.0000	0.00	1.0000	1.0000
Left Wing Hydraulic Filters	1.0000	0.00	1.0000	1.0000
Left Wing Inspection 1	1.0000	0.00	1.0000	1.0000
Left Wing Inspection 2	1.0000	0.00	1.0000	1.0000
Left Wing Lubrication	1.0000	0.00	1.0000	1.0000
Left Wing Non Routine Cards	1.0000	0.00	1.0000	1.0000
Left Wing Routine Cards	1.0000	0.00	1.0000	1.0000
Lines Cleaning and Baroscopic	1.0000	0.00	1.0000	1.0000
Lubrication	1.0000	0.00	1.0000	1.0000
Non Routine Cards	1.0000	0.00	1.0000	1.0000
Non Routine Cards 2	1.0000	0.00	1.0000	1.0000
Non Routine Cards 3	1.0000	0.00	1.0000	1.0000
Non Routine Cards and Operational Checks AF Avionics	1.0000	0.00	1.0000	1.0000
Non Routine Cards Rectification	4.0000	0.00	4.0000	4.0000
Nose Landing Gear CIC	1.0000	0.00	1.0000	1.0000
Nose Landing Gear Lubrication	1.0000	0.00	1.0000	1.0000
Number 4 Flap Transmission EO	1.0000	0.00	1.0000	1.0000
Number 5 Flap Transmission EO	1.0000	0.00	1.0000	1.0000
Operational and Functional Checks	4.0000	0.00	4.0000	4.0000
Operational Checks A	1.0000	0.00	1.0000	1.0000
Operational Checks A 2	1.0000	0.00	1.0000	1.0000
Operational Checks A 3	1.0000	0.00	1.0000	1.0000
Operational Checks B	1.0000	0.00	1.0000	1.0000
Operational Checks B 2	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Process

Other

Number Out	Average	Half Width	Minimum Average	Maximum Average
Operational Checks B 3	1.0000	0.00	1.0000	1.0000
Operational Checks C	1.0000	0.00	1.0000	1.0000
Operational Checks C 2	1.0000	0.00	1.0000	1.0000
Operational Checks C 3	1.0000	0.00	1.0000	1.0000
Oxygen Cylinders Replacement	1.0000	0.00	1.0000	1.0000
Pre Inspection	4.0000	0.00	4.0000	4.0000
Pre Inspection Phase	1.0000	0.00	1.0000	1.0000
Pre Inspection Phase 2	1.0000	0.00	1.0000	1.0000
Pre Inspection Phase 3	1.0000	0.00	1.0000	1.0000
RH Hydraulic Filters	1.0000	0.00	1.0000	1.0000
Right Wing Access Panels Close Up	1.0000	0.00	1.0000	1.0000
Right Wing Access Panels Open Up	1.0000	0.00	1.0000	1.0000
Right Wing corrosion Inhibiter Application	1.0000	0.00	1.0000	1.0000
Right Wing Final Inspection	1.0000	0.00	1.0000	1.0000
Right Wing Inspection 1	1.0000	0.00	1.0000	1.0000
Right Wing Inspection 2	1.0000	0.00	1.0000	1.0000
Right Wing Lubrication	1.0000	0.00	1.0000	1.0000
Right Wing Non Routine Cards	1.0000	0.00	1.0000	1.0000
Right Wing Rectification	1.0000	0.00	1.0000	1.0000
Right Wing Routine Cards	1.0000	0.00	1.0000	1.0000
Stabilizer Bolts EO	1.0000	0.00	1.0000	1.0000
Station 111 Blankets Installation	1.0000	0.00	1.0000	1.0000
Stow Thrust Reverse Plus Routine	4.0000	0.00	4.0000	4.0000
Throttle Cable and Cargo Door Lubrication	1.0000	0.00	1.0000	1.0000
Tire Change	1.0000	0.00	1.0000	1.0000
Vertical and Horizontal Stabilizers Panels Open Up	1.0000	0.00	1.0000	1.0000
VIGV Rigging and Routine	4.0000	0.00	4.0000	4.0000
Waste Tanks Cleaning Prep	1.0000	0.00	1.0000	1.0000
Water Tanks Filters Replacement	1.0000	0.00	1.0000	1.0000
Window Water Service and Routine	1.0000	0.00	1.0000	1.0000
Zonal Inspection	1.0000	0.00	1.0000	1.0000
Zone 1 Open Up	1.0000	0.00	1.0000	1.0000
Zone 2 Open Up	1.0000	0.00	1.0000	1.0000
Zone 3 Open Up	1.0000	0.00	1.0000	1.0000

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Replications: 100 Time Units: Hours

Queue

Time

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
1 2 3 and 4 Fixed Fairings Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
1 2 3 and 4 Fixed Fairings Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
1 and 2 Turbines Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
1 and 2 Turbines Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
3 and 4 Turbines Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
3 and 4 Turbines Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
4 Engines Simulation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
5 6 7 and 8 Fixed Fairings Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
5 6 7 and 8 Fixed Fairings Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
AC EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
AF Fuel EO Operational Checks Avionics.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Access Panels Open Up.Queue	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
Aft Cargo Area Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Blankets Installation and Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Blankets Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Door Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Pre Inspection.Queue	2.0084	1.07	0.00	18.9068	0.00	18.9068
Aft Cargo Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition and Wheel Well Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Airframe Progresssing.Queue	810.42	2.15	785.16	834.70	785.16	834.70
APU and Area Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU Baroscopic.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Close Up and Rectifications.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Operational Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Team House Keeping.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Leak Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 OK to Close.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Operational Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Panels In Place.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Panels Security V and H Stabalizers.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Stabalizer Jack Screw Motors Servicing.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 5 Cabin Non Routine Cards and Operational Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 7 8 9 10 Avionics Final.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 7 Pre Inspection.Queue	0.3592	0.16	0.00	3.2788	0.00	3.2788
Area 8 Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Final Inspection.Queue	0.1908	0.34	0.00	16.7799	0.00	16.7799
Area 9 Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Progressing.Queue	628.72	2.98	591.58	659.55	591.58	659.55
Body and WIng Landing Gears and Doors Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Breake Assembly Change.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Areas Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Areas Pre Inspection.Queue	0.7301	0.61	0.00	17.8934	0.00	17.8934

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Bulk and OFV Areas Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV CIC and Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Open Up and Blankets Removal.Queue	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
Cabin Carpet Replacement and Close Up 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Carpet Replacement and Close Up 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Carpet Replacement and Close Up 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Filters Replacement and Routine Cards 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Filters Replacement and Routine Cards 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Filters Replacement and Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Lubrication and CIC 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Lubrication and CIC 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Lubrication and CIC 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Progressing.Queue	781.49	2.12	752.88	803.91	752.88	803.91
Canted Pressure Deck Area.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Captain and First Officer Seats Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Captain and First Officer Seats Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cargo Door Rigging.Queue	0.00	0.00	0.00	0.00	0.00	0.00
CIC under Body Fairing Structure CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit AV Connection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Carpet Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Close Up and Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Routine and Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Corrosion Inhibiter and Prep Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Corrosion Inhibiter Applications.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Crew Rest Area.Queue	1.3040	0.89	0.00	16.9063	0.00	16.9063

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Door Open Up.Queue	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
Ducts Reinstallation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Ducts Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
E and E Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
E and E Floor Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EE and NLG and Station 111 Pre Inspection.Queue	0.00673453	0.01	0.00	0.6735	0.00	0.6735
Electronic Equip and Station 111 CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Boroscopic Close Up and Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Boroscopic.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Health and Fuunctions.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Oil Change and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engineering Orders 5 EOs.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 5312654 station 2598 Bolts Removal for NDT.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 531355.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 531433.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 541119.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 541180.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 571334.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 722047.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 731258.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 731292.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 781350.Queue	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
EOs and Aft Cargo Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Fan Blades and Shaft Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FDB EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Filter and Oil and Lubrication Plus Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Filter Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Filters Change and Oil Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Final Area 5 Cabin Avionics.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Fire Bottle Extinguishers Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
FWD Body Fairing Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Body Fairing Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Blankets Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Inspection 1.Queue	2.2272	1.12	0.00	22.1114	0.00	22.1114
FWD Cargo Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Gally Lift Maintenance.Queue	0.02279890	0.02	0.00	0.4680	0.00	0.4680
Heat Exchanger Reinstallation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Heat Exchanger Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
HVDR EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Inspection 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Inspection Paper Work.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Inteegrated Drive Generator and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Leak Check and Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Area Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Hydraulic Filters.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Inspection 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Lines Cleaning and Boroscopic.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Non Routine Cards 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Non Routine Cards 3.Queue	1.3040	0.89	0.00	16.9063	0.00	16.9063
Non Routine Cards and Operational Checks AF Avionics.Queue	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
Non Routine Cards Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Non Routine Cards.Queue	0.02279890	0.02	0.00	0.4680	0.00	0.4680
Nose Landing Gear CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Nose Landing Gear Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Number 5 Flap Transmission EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational and Functional Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks A 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks A 3.Queue	1.3040	0.89	0.00	16.9063	0.00	16.9063
Operational Checks A.Queue	0.02279890	0.02	0.00	0.4680	0.00	0.4680
Operational Checks B 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks B 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks B.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks C 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks C 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks C.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Oxygen Cylinders Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Power Plant Progressing.Queue	712.96	2.18	687.96	742.67	687.96	742.67
Pre Inspection Phase 2.Queue	0.03532867	0.02	0.00	0.4914	0.00	0.4914
Pre Inspection Phase 3.Queue	0.03766688	0.02	0.00	0.4929	0.00	0.4929
Pre Inspection Phase.Queue	10.6694	0.55	5.2617	13.1652	5.2617	13.1652
Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
RH Hydraulic Filters.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Access Panels Open Up.Queue	16.2500	0.00	16.2500	16.2500	16.2500	16.2500
Right Wing corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Inspection 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Time

Waiting Time	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Right Wing Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Stabalizer Bolts EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Station 111 Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Stow Thrust Reverse Plus Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Throttle Cable and Cargo Door Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Tire Change.Queue	0.00	0.00	0.00	0.00	0.00	0.00
VIGV Rigging and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Waste Tanks Cleaning Prep.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Water Tanks Filters Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Window Water Service and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Zonal Inspection.Queue	0.9744	0.83	0.00	21.1726	0.00	21.1726
Zone 3 Open Up.Queue	16.0000	0.00	16.0000	16.0000	16.0000	16.0000

Other

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
1 2 3 and 4 Fixed Fairings Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
1 2 3 and 4 Fixed Fairings Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
1 and 2 Turbines Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
1 and 2 Turbines Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
3 and 4 Turbines Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
3 and 4 Turbines Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
4 Engines Simulation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
5 6 7 and 8 Fixed Fairings Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
5 6 7 and 8 Fixed Fairings Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
AC EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
AF Fuel EO Operational Checks Avionics.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Access Panels Open Up.Queue	0.00780502	0.00	0.00757853	0.00805868	0.00	1.0000
Aft Cargo Area Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Blankets Installation and Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Blankets Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Door Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aft Cargo Pre Inspection.Queue	0.00250489	0.00	0.00	0.02365631	0.00	1.0000
Aft Cargo Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Access Panels Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition and Wheel Well Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Aircondition Area Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Airframe Progresssing.Queue	0.9994	0.00	0.9901	1.0000	0.00	1.0000

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU and Area Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Baroscopic.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Close Up and Rectifications.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Operational Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Team House Keeping.Queue	0.00	0.00	0.00	0.00	0.00	0.00
APU Test.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Leak Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 OK to Close.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Operational Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Panels In Place.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Panels Security V and H Stabalizers.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 10 Stabalizer Jack Screw Motors Servicing.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 5 Cabin Non Routine Cards and Operational Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 6 Cockpit Operational Checks Avionics.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 7 8 9 10 Avionics Final.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 7 Pre Inspection.Queue	0.00045107	0.00	0.00	0.00417698	0.00	1.0000
Area 8 Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Final Inspection.Queue	0.00024235	0.00	0.00	0.02134612	0.00	1.0000
Area 9 Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Area 9 Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Avionics Progressing.Queue	0.7727	0.00	0.7245	0.8244	0.00	1.0000
Body and WIng Landing Gears and Doors Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Break Assembly Change.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Areas Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Areas Pre Inspection.Queue	0.00091069	0.00	0.00	0.02234733	0.00	1.0000
Bulk and OFV Areas Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV CIC and Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Bulk and OFV Open Up and Blankets Removal.Queue	0.00780502	0.00	0.00757853	0.00805868	0.00	1.0000
Cabin Carpet Replacement and Close up 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Carpet Replacement and Close Up 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Carpet Replacement and Close up 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Filters Replacement and Routine Cards 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Filters Replacement and Routine Cards 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Filters Replacement and Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Lubrication and CIC 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Lubrication and CIC 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Lubrication and CIC 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cabin Progressing.Queue	0.9635	0.00	0.9253	1.0000	0.00	1.0000
Canted Pressure Deck Area.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Captain and First Officer Seats Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Captain and First Officer Seats Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cargo Door Rigging.Queue	0.00	0.00	0.00	0.00	0.00	0.00
CIC under Body Fairing Structure CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit AV Connection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Carpet Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Close Up and Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Open Up and Disconnection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Cockpit Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Cockpit Routine and Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Corrosion Inhibiter and Prep Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Corrosion Inhibiter Applications.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Crew Rest Area.Queue	0.00163021	0.00	0.00	0.02138074	0.00	1.0000
Door Open Up.Queue	0.00780502	0.00	0.00757853	0.00805868	0.00	1.0000
Ducts Reinstallation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Ducts Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
E and E Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
E and E Floor Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
E and E Blanket Removal Floor Panels Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EE and NLG and Station 111 Pre Inspection.Queue	0.00000839	0.00	0.00	0.00083918	0.00	1.0000
Electronic Equip and Station 111 CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Boroscopic Close Up and Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Boroscopic.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Health and Fuunctions.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Oil Change and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engine Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Engineering Orders 5 EOs.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 5312654 station 2598 Bolts Removal for NDT.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 531355.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 531433.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 541119.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 541180.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 571334.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 722047.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 731258.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 731292.Queue	0.00	0.00	0.00	0.00	0.00	0.00
EO 781350.Queue	0.00780502	0.00	0.00757853	0.00805868	0.00	1.0000
EOs and Aft Cargo Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Fan Blades and Shaft Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FDB EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Filter and Oil and Lubrication Plus Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Filter Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Filters Change and Oil Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Final Area 5 Cabin Avionics.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Fire Bottle Extinguishers Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Forward Cargo Access Panels Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Body Fairing Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Body Fairing Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Blankets Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Inspection 1.Queue	0.00278222	0.00	0.00	0.02768737	0.00	1.0000
FWD Cargo Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
FWD Cargo Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Galley Lift Maintenance.Queue	0.00002846	0.00	0.00	0.00058146	0.00	1.0000
Heat Exchanger Reinstallation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Heat Exchanger Removal.Queue	0.00	0.00	0.00	0.00	0.00	0.00
HVDR EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Inspection 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Inspection Paper Work.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Integrated Drive Generator and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Leak Check and Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Access Panels Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Left Wing Area Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Hydraulic Filters.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Inspection 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Left Wing Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Lines Cleaning and Boroscopic.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Non Routine Cards 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Non Routine Cards 3.Queue	0.00163021	0.00	0.00	0.02138074	0.00	1.0000
Non Routine Cards and Operational Checks AF Avionics.Queue	0.00780502	0.00	0.00757853	0.00805868	0.00	1.0000
Non Routine Cards Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Non Routine Cards.Queue	0.00002846	0.00	0.00	0.00058146	0.00	1.0000
Nose Landing Gear CIC.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Nose Landing Gear Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Number 4 Flap Transmission EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Number 5 Flap Transmission EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational and Functional Checks.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks A 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks A 3.Queue	0.00163021	0.00	0.00	0.02138074	0.00	1.0000
Operational Checks A.Queue	0.00002846	0.00	0.00	0.00058146	0.00	1.0000
Operational Checks B 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks B 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks B.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks C 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks C 3.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Operational Checks C.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Oxygen Cylinders Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Power Plant Progressing.Queue	0.8778	0.00	0.8342	0.9256	0.00	1.0000

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Replications: 100 Time Units: Hours

Queue

Other

Number Waiting	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Pre Inspection Phase 2.Queue	0.00004408	0.00	0.00	0.00061381	0.00	1.0000
Pre Inspection Phase 3.Queue	0.00004701	0.00	0.00	0.00062272	0.00	1.0000
Pre Inspection Phase.Queue	0.01332308	0.00	0.00655880	0.01669076	0.00	1.0000
Pre Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
RH Hydraulic Filters.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Access Panels Close Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Access Panels Open Up.Queue	0.00780502	0.00	0.00757853	0.00805868	0.00	1.0000
Right Wing corrosion Inhibiter Application.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Final Inspection.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Inspection 1.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Inspection 2.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Non Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Rectification.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Right Wing Routine Cards.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Stabilizer Bolts EO.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Station 111 Blankets Installation.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Stow Thrust Reverse Plus Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Throttle Cable and Cargo Door Lubrication.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Tire Change.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Vertical and Horizontal Stabilizers Panels Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
VIGV Rigging and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Waste Tanks Cleaning Prep.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Water Tanks Filters Replacement.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Window Water Service and Routine.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Zonal Inspection.Queue	0.00121057	0.00	0.00	0.02702197	0.00	1.0000
Zone 1 Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Zone 2 Open Up.Queue	0.00	0.00	0.00	0.00	0.00	0.00
Zone 3 Open Up.Queue	0.00749282	0.00	0.00727539	0.00773633	0.00	1.0000

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Replications: 100 Time Units: Hours

Resource

Usage

747

Replications: 100 Time Units: Hours

Resource

Usage

Instantaneous Utilization	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU Inspector 1	0.1563	0.01	0.06422393	0.2626	0.00	1.0000
APU Junior 1	0.3218	0.02	0.1488	0.5152	0.00	1.0000
APU Junior 2	0.5573	0.05	0.2101	0.8732	0.00	1.0000
APU Senior 1	0.3750	0.02	0.1744	0.5317	0.00	1.0000
APU Senior 2	0.5609	0.05	0.2142	0.8881	0.00	1.0000
Avionics Junior 1	0.6304	0.00	0.5855	0.6742	0.00	1.0000
Avionics Junior 2	0.5923	0.01	0.5323	0.6555	0.00	1.0000
Avionics Junior 3	0.6044	0.00	0.5519	0.6443	0.00	1.0000
Avionics Senior 1	0.1886	0.00	0.1752	0.2041	0.00	1.0000
Avionics Senior 2	0.1906	0.00	0.1759	0.2068	0.00	1.0000
Avionics Senior 3	0.1962	0.00	0.1851	0.2088	0.00	1.0000
Cabin Crew 1	0.00207924	0.00	0.00146173	0.00271515	0.00	1.0000
Cabin Crew 2	0.00325944	0.00	0.00245170	0.00379255	0.00	0.5000
Cabin Crew 3	0.00264859	0.00	0.00220606	0.00304733	0.00	0.2000
Cabin Inspector 1	0.01889249	0.00	0.01523416	0.02237964	0.00	1.0000
Cabin Inspector 2	0.01856974	0.00	0.01506315	0.02224212	0.00	1.0000
Cabin Inspector 3	0.01890008	0.00	0.01502704	0.02267093	0.00	1.0000
Cockpit Inspector	0.1359	0.01	0.04713939	0.1870	0.00	1.0000
Crew 1 Team 1	0.04338211	0.00	0.04057788	0.04632629	0.00	0.5000
Crew 1 Team 2	0.06444476	0.00	0.06188615	0.06709317	0.00	0.5000
Crew 1 Team 3	0.04366925	0.00	0.04085809	0.04644304	0.00	0.5000
Crew 2 Team 1	0.04057782	0.00	0.03840695	0.04326319	0.00	0.3333
Crew 2 Team 2	0.06208967	0.00	0.05942463	0.06447102	0.00	0.3333
Crew 2 Team 3	0.04270910	0.00	0.04016349	0.04526665	0.00	0.3333
Crew 3 Team 1	0.03876376	0.00	0.03663855	0.04103856	0.00	0.3333
Crew 3 Team 2	0.05727391	0.00	0.05501201	0.06007304	0.00	0.3333
Crew 3 Team 3	0.03887005	0.00	0.03686885	0.04086331	0.00	0.3333
Engine 1 Inspector	0.01447402	0.00	0.01094439	0.01740208	0.00	1.0000
Engine 1 Junior	0.4015	0.04	0.1952	0.8147	0.00	1.0000
Engine 1 Senior	0.5680	0.04	0.1965	0.8199	0.00	1.0000
Engine 2 Inspector	0.01435672	0.00	0.01157281	0.01743344	0.00	1.0000
Engine 2 Junior	0.2039	0.00	0.1900	0.2170	0.00	1.0000
Engine 2 Senior	0.7575	0.01	0.6901	0.8112	0.00	1.0000
Engine 3 Inspector	0.01428114	0.00	0.01193049	0.01714978	0.00	1.0000
Engine 3 Junior	0.5049	0.04	0.2056	0.8217	0.00	1.0000
Engine 3 Senior	0.5107	0.04	0.2092	0.8249	0.00	1.0000
Engine 4 Inspector	0.01442720	0.00	0.01081709	0.01704294	0.00	1.0000
Engine 4 Junior	0.4959	0.04	0.2014	0.7804	0.00	1.0000
Engine 4 Senior	0.5186	0.04	0.2712	0.8834	0.00	1.0000
Air frame Inspector 1	0.01753994	0.00	0.01366148	0.02077609	0.00	1.0000
Air frame Inspector 2	0.01147255	0.00	0.00878222	0.01425536	0.00	1.0000

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Replications: 100 Time Units: Hours

Resource

Usage

Instantaneous Utilization	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Air frame Inspector 3	0.01744386	0.00	0.01303726	0.02127015	0.00	1.0000
Air frame Inspector 4	0.01236670	0.00	0.00951663	0.01641443	0.00	1.0000
Air frame Inspector 5	0.01601712	0.00	0.01279190	0.01893142	0.00	1.0000
Air frame Inspector 6	0.01113232	0.00	0.00852542	0.01393882	0.00	1.0000
Air frame Junior 1	0.6191	0.05	0.2268	0.9238	0.00	1.0000
Air frame Junior 2	0.3877	0.04	0.1843	0.7889	0.00	1.0000
Air frame Junior 3	0.4687	0.05	0.2325	0.9408	0.00	1.0000
Air frame Junior 4	0.3240	0.03	0.1910	0.7188	0.00	1.0000
Air frame Junior 5	0.4063	0.03	0.1844	0.7120	0.00	1.0000
Air frame Junior 6	0.6780	0.06	0.2525	0.9909	0.00	1.0000
Air frame Junior 7	0.5526	0.06	0.2252	0.9549	0.00	1.0000
Air frame Junior 8	0.6019	0.06	0.2387	0.9623	0.00	1.0000
Air frame Junior 9	0.3783	0.04	0.1949	0.7422	0.00	1.0000
Air frame Senior 1	0.4661	0.05	0.2188	0.9160	0.00	1.0000
Air frame Senior 2	0.5339	0.04	0.1993	0.7873	0.00	1.0000
Air frame Senior 3	0.6569	0.05	0.2401	0.9272	0.00	1.0000
Air frame Senior 4	0.5661	0.03	0.1755	0.7316	0.00	1.0000
Air frame Senior 5	0.4410	0.03	0.1746	0.6585	0.00	1.0000
Air frame Senior 6	0.5394	0.06	0.2541	0.9902	0.00	1.0000
Air frame Senior 7	0.5929	0.06	0.2301	0.9572	0.00	1.0000
Air frame Senior 8	0.5676	0.06	0.2395	0.9645	0.00	1.0000
Air frame Senior 9	0.5745	0.04	0.1987	0.8113	0.00	1.0000
Senior AV Cockpit Technician	0.1173	0.00	0.0964	0.1301	0.00	1.0000
Senior Cockpit Technician	0.2143	0.01	0.1803	0.3106	0.00	1.0000

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Replications: 100 Time Units: Hours

Resource

Usage

Number Busy	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU Inspector 1	0.1563	0.01	0.06422393	0.2626	0.00	1.0000
APU Junior 1	0.3218	0.02	0.1488	0.5152	0.00	1.0000
APU Junior 2	0.5573	0.05	0.2101	0.8732	0.00	1.0000
APU Senior 1	0.3750	0.02	0.1744	0.5317	0.00	1.0000
APU Senior 2	0.5609	0.05	0.2142	0.8881	0.00	1.0000
Avionics Junior 1	0.6304	0.00	0.5855	0.6742	0.00	1.0000
Avionics Junior 2	0.5923	0.01	0.5323	0.6555	0.00	1.0000
Avionics Junior 3	0.6044	0.00	0.5519	0.6443	0.00	1.0000
Avionics Senior 1	0.1886	0.00	0.1752	0.2041	0.00	1.0000
Avionics Senior 2	0.1906	0.00	0.1759	0.2068	0.00	1.0000
Avionics Senior 3	0.1962	0.00	0.1851	0.2088	0.00	1.0000
Cabin Crew 1	0.00931685	0.00	0.00693677	0.01211488	0.00	1.0000
Cabin Crew 2	0.01498083	0.00	0.01242820	0.01754117	0.00	1.0000
Cabin Crew 3	0.01751833	0.00	0.01493064	0.02022570	0.00	1.0000
Cabin Inspector 1	0.01889249	0.00	0.01523416	0.02237964	0.00	1.0000
Cabin Inspector 2	0.01856974	0.00	0.01506315	0.02224212	0.00	1.0000
Cabin Inspector 3	0.01890008	0.00	0.01502704	0.02267093	0.00	1.0000
Cockpit Inspector	0.1359	0.01	0.04713939	0.1870	0.00	1.0000
Crew 1 Team 1	0.1471	0.00	0.1378	0.1570	0.00	1.0000
Crew 1 Team 2	0.2186	0.00	0.2100	0.2278	0.00	1.0000
Crew 1 Team 3	0.1481	0.00	0.1385	0.1575	0.00	1.0000
Crew 2 Team 1	0.1472	0.00	0.1390	0.1568	0.00	1.0000
Crew 2 Team 2	0.2253	0.00	0.2159	0.2341	0.00	1.0000
Crew 2 Team 3	0.1549	0.00	0.1456	0.1645	0.00	1.0000
Crew 3 Team 1	0.1475	0.00	0.1393	0.1561	0.00	1.0000
Crew 3 Team 2	0.2179	0.00	0.2092	0.2284	0.00	1.0000
Crew 3 Team 3	0.1479	0.00	0.1404	0.1554	0.00	1.0000
Engine 1 Inspector	0.01447402	0.00	0.01094439	0.01740208	0.00	1.0000
Engine 1 Junior	0.4015	0.04	0.1952	0.8147	0.00	1.0000
Engine 1 Senior	0.5680	0.04	0.1965	0.8199	0.00	1.0000
Engine 2 Inspector	0.01435672	0.00	0.01157281	0.01743344	0.00	1.0000
Engine 2 Junior	0.2039	0.00	0.1900	0.2170	0.00	1.0000
Engine 2 Senior	0.7575	0.01	0.6901	0.8112	0.00	1.0000
Engine 3 Inspector	0.01428114	0.00	0.01193049	0.01714978	0.00	1.0000
Engine 3 Junior	0.5049	0.04	0.2056	0.8217	0.00	1.0000
Engine 3 Senior	0.5107	0.04	0.2092	0.8249	0.00	1.0000
Engine 4 Inspector	0.01442720	0.00	0.01081709	0.01704294	0.00	1.0000
Engine 4 Junior	0.4959	0.04	0.2014	0.7804	0.00	1.0000
Engine 4 Senior	0.5186	0.04	0.2712	0.8834	0.00	1.0000
Air frame Inspector 1	0.01753994	0.00	0.01366148	0.02077609	0.00	1.0000
Air frame Inspector 2	0.01147255	0.00	0.00878222	0.01425536	0.00	1.0000

Values Across All Replications

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Replications: 100 Time Units: Hours

Resource

Usage

Number Busy	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Air frame Inspector 3	0.01744386	0.00	0.01303726	0.02127015	0.00	1.0000
Air frame Inspector 4	0.01236670	0.00	0.00951663	0.01641443	0.00	1.0000
Air frame Inspector 5	0.01601712	0.00	0.01279190	0.01893142	0.00	1.0000
Air frame Inspector 6	0.01113232	0.00	0.00852542	0.01393882	0.00	1.0000
Air frame Junior 1	0.6191	0.05	0.2268	0.9238	0.00	1.0000
Air frame Junior 2	0.3877	0.04	0.1843	0.7889	0.00	1.0000
Air frame Junior 3	0.4687	0.05	0.2325	0.9408	0.00	1.0000
Air frame Junior 4	0.3240	0.03	0.1910	0.7188	0.00	1.0000
Air frame Junior 5	0.4063	0.03	0.1844	0.7120	0.00	1.0000
Air frame Junior 6	0.6780	0.06	0.2525	0.9909	0.00	1.0000
Air frame Junior 7	0.5526	0.06	0.2252	0.9549	0.00	1.0000
Air frame Junior 8	0.6019	0.06	0.2387	0.9623	0.00	1.0000
Air frame Junior 9	0.3783	0.04	0.1949	0.7422	0.00	1.0000
Air frame Senior 1	0.4661	0.05	0.2188	0.9160	0.00	1.0000
Air frame Senior 2	0.5339	0.04	0.1993	0.7873	0.00	1.0000
Air frame Senior 3	0.6569	0.05	0.2401	0.9272	0.00	1.0000
Air frame Senior 4	0.5661	0.03	0.1755	0.7316	0.00	1.0000
Air frame Senior 5	0.4410	0.03	0.1746	0.6585	0.00	1.0000
Air frame Senior 6	0.5394	0.06	0.2541	0.9902	0.00	1.0000
Air frame Senior 7	0.5929	0.06	0.2301	0.9572	0.00	1.0000
Air frame Senior 8	0.5676	0.06	0.2395	0.9645	0.00	1.0000
Air frame Senior 9	0.5745	0.04	0.1987	0.8113	0.00	1.0000
Senior AV Cockpit Technician	0.1173	0.00	0.0964	0.1301	0.00	1.0000
Senior Cockpit Technician	0.2143	0.01	0.1803	0.3106	0.00	1.0000

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Replications: 100 Time Units: Hours

Resource

Usage

Number Scheduled	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
APU Inspector 1	0.2575	0.00	0.2552	0.2607	0.00	1.0000
APU Junior 1	0.2575	0.00	0.2552	0.2607	0.00	1.0000
APU Junior 2	0.2575	0.00	0.2552	0.2607	0.00	1.0000
APU Senior 1	0.2575	0.00	0.2552	0.2607	0.00	1.0000
APU Senior 2	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Avionics Junior 1	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Avionics Junior 2	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Avionics Junior 3	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Avionics Senior 1	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Avionics Senior 2	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Avionics Senior 3	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Cabin Crew 1	1.6626	0.00	1.6373	1.6814	0.00	9.0000
Cabin Crew 2	1.6776	0.00	1.6584	1.6906	0.00	9.0000
Cabin Crew 3	1.9679	0.00	1.9482	1.9836	0.00	9.0000
Cabin Inspector 1	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Cabin Inspector 2	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Cabin Inspector 3	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Cockpit Inspector	0.2682	0.00	0.2662	0.2716	0.00	1.0000
Crew 1 Team 1	0.9491	0.00	0.9421	0.9604	0.00	4.0000
Crew 1 Team 2	0.9491	0.00	0.9421	0.9604	0.00	4.0000
Crew 1 Team 3	0.9491	0.00	0.9421	0.9604	0.00	4.0000
Crew 2 Team 1	1.0048	0.00	0.9934	1.0125	0.00	4.0000
Crew 2 Team 2	1.0048	0.00	0.9934	1.0125	0.00	4.0000
Crew 2 Team 3	1.0048	0.00	0.9934	1.0125	0.00	4.0000
Crew 3 Team 1	1.0462	0.00	1.0358	1.0560	0.00	4.0000
Crew 3 Team 2	1.0462	0.00	1.0358	1.0560	0.00	4.0000
Crew 3 Team 3	1.0462	0.00	1.0358	1.0560	0.00	4.0000
Engine 1 Inspector	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Engine 1 Junior	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Engine 1 Senior	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Engine 2 Inspector	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Engine 2 Junior	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Engine 2 Senior	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Engine 3 Inspector	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Engine 3 Junior	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Engine 3 Senior	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Engine 4 Inspector	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Engine 4 Junior	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Engine 4 Senior	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Inspector 1	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Inspector 2	0.2673	0.00	0.2646	0.2698	0.00	1.0000

Values Across All Replications

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Replications: 100 Time Units: Hours

Resource

Usage

Number Scheduled	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Air frame Inspector 3	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Inspector 4	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Inspector 5	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Inspector 6	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Junior 1	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Junior 2	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Junior 3	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Junior 4	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Junior 5	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Junior 6	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Junior 7	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Junior 8	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Junior 9	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Senior 1	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Senior 2	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Senior 3	0.2673	0.00	0.2646	0.2698	0.00	1.0000
Air frame Senior 4	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Senior 5	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Senior 6	0.2623	0.00	0.2596	0.2646	0.00	1.0000
Air frame Senior 7	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Senior 8	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Air frame Senior 9	0.2575	0.00	0.2552	0.2607	0.00	1.0000
Senior AV Cockpit Technician	0.2682	0.00	0.2662	0.2716	0.00	1.0000
Senior Cockpit Technician	0.2682	0.00	0.2662	0.2716	0.00	1.0000

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Replications: 100 Time Units: Hours

Resource

Usage

Scheduled Utilization	Average	Half Width	Minimum Average	Maximum Average
APU Inspector 1	0.6069	0.04	0.2495	1.0185
APU Junior 1	1.2496	0.08	0.5738	2.0190
APU Junior 2	2.1642	0.19	0.8111	3.3551
APU Senior 1	1.4565	0.07	0.6751	2.0594
APU Senior 2	2.1784	0.19	0.8302	3.4168
Avionics Junior 1	2.3584	0.01	2.2037	2.5098
Avionics Junior 2	2.2580	0.02	2.0141	2.5040
Avionics Junior 3	2.3473	0.02	2.1398	2.5046
Avionics Senior 1	0.7054	0.00	0.6587	0.7677
Avionics Senior 2	0.7266	0.01	0.6654	0.7941
Avionics Senior 3	0.7619	0.00	0.7176	0.8115
Cabin Crew 1	0.00560487	0.00	0.00416010	0.00736200
Cabin Crew 2	0.00893051	0.00	0.00746681	0.01049496
Cabin Crew 3	0.00890198	0.00	0.00753674	0.01022190
Cabin Inspector 1	0.07067898	0.00	0.05658029	0.08407817
Cabin Inspector 2	0.07079882	0.00	0.05737805	0.08487460
Cabin Inspector 3	0.07340107	0.00	0.05831891	0.08828782
Cockpit Inspector	0.5067	0.03	0.1755	0.6971
Crew 1 Team 1	0.1550	0.00	0.1451	0.1655
Crew 1 Team 2	0.2303	0.00	0.2212	0.2402
Crew 1 Team 3	0.1561	0.00	0.1461	0.1663
Crew 2 Team 1	0.1465	0.00	0.1394	0.1571
Crew 2 Team 2	0.2242	0.00	0.2136	0.2338
Crew 2 Team 3	0.1542	0.00	0.1439	0.1637
Crew 3 Team 1	0.1410	0.00	0.1336	0.1484
Crew 3 Team 2	0.2083	0.00	0.2004	0.2199
Crew 3 Team 3	0.1413	0.00	0.1347	0.1492
Engine 1 Inspector	0.05414616	0.00	0.04109583	0.06504978
Engine 1 Junior	1.5015	0.16	0.7355	3.0260
Engine 1 Senior	2.1253	0.16	0.7342	3.0955
Engine 2 Inspector	0.05370481	0.00	0.04319187	0.06478785
Engine 2 Junior	0.7629	0.00	0.7096	0.8145
Engine 2 Senior	2.8337	0.02	2.5771	3.0289
Engine 3 Inspector	0.05444302	0.00	0.04557372	0.06563693
Engine 3 Junior	1.9246	0.17	0.7791	3.1406
Engine 3 Senior	1.9470	0.17	0.7960	3.1652
Engine 4 Inspector	0.05499806	0.00	0.04095115	0.06453092
Engine 4 Junior	1.8900	0.17	0.7660	2.9843
Engine 4 Senior	1.9776	0.17	1.0397	3.3559
Air frame Inspector 1	0.06561578	0.00	0.05080851	0.07821109
Air frame Inspector 2	0.04291570	0.00	0.03278229	0.05301974

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Replications: 100 Time Units: Hours

Resource

Usage

Scheduled Utilization	Average	Half Width	Minimum Average	Maximum Average
Air frame Inspector 3	0.06649787	0.00	0.04951326	0.08161665
Air frame Inspector 4	0.04714683	0.00	0.03618110	0.06285056
Air frame Inspector 5	0.06220512	0.00	0.04957771	0.07299916
Air frame Inspector 6	0.04323375	0.00	0.03334103	0.05430404
Air frame Junior 1	2.3154	0.20	0.8558	3.4477
Air frame Junior 2	1.4502	0.14	0.6875	2.9443
Air frame Junior 3	1.7534	0.19	0.8635	3.5520
Air frame Junior 4	1.2355	0.13	0.7234	2.7446
Air frame Junior 5	1.5492	0.12	0.6979	2.7049
Air frame Junior 6	2.5855	0.23	0.9554	3.7750
Air frame Junior 7	2.1465	0.25	0.8752	3.7071
Air frame Junior 8	2.3372	0.23	0.9277	3.7484
Air frame Junior 9	1.4692	0.15	0.7567	2.8956
Air frame Senior 1	1.7444	0.20	0.8168	3.4184
Air frame Senior 2	1.9975	0.14	0.7464	2.9685
Air frame Senior 3	2.4576	0.19	0.8927	3.4873
Air frame Senior 4	2.1578	0.13	0.6643	2.7702
Air frame Senior 5	1.6809	0.12	0.6683	2.5127
Air frame Senior 6	2.0558	0.23	0.9658	3.7847
Air frame Senior 7	2.3023	0.24	0.8999	3.7212
Air frame Senior 8	2.2047	0.23	0.9321	3.7447
Air frame Senior 9	2.2310	0.15	0.7740	3.1496
Senior AV Cockpit Technician	0.4373	0.01	0.3584	0.4872
Senior Cockpit Technician	0.7988	0.03	0.6748	1.1540

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Replications: 100 Time Units: Hours

Resource

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
APU Inspector 1	3.0000	0.00	3.0000	3.0000
APU Junior 1	7.0000	0.00	7.0000	7.0000
APU Junior 2	5.0000	0.00	5.0000	5.0000
APU Senior 1	8.0000	0.00	8.0000	8.0000
APU Senior 2	5.0000	0.00	5.0000	5.0000
Avionics Junior 1	2.0000	0.00	2.0000	2.0000
Avionics Junior 2	1.0000	0.00	1.0000	1.0000
Avionics Junior 3	2.0000	0.00	2.0000	2.0000
Avionics Senior 1	2.8000	0.08	2.0000	3.0000
Avionics Senior 2	2.0000	0.00	2.0000	2.0000
Avionics Senior 3	3.0000	0.00	3.0000	3.0000
Cabin Crew 1	0.00	0.00	0.00	0.00
Cabin Crew 2	0.00	0.00	0.00	0.00
Cabin Crew 3	1.0000	0.00	1.0000	1.0000
Cabin Inspector 1	1.0000	0.00	1.0000	1.0000
Cabin Inspector 2	1.0000	0.00	1.0000	1.0000
Cabin Inspector 3	1.0000	0.00	1.0000	1.0000
Cockpit Inspector	2.0000	0.00	2.0000	2.0000
Crew 1 Team 1	2.0000	0.00	2.0000	2.0000
Crew 1 Team 2	2.0000	0.00	2.0000	2.0000
Crew 1 Team 3	4.0000	0.00	4.0000	4.0000
Crew 2 Team 1	2.0000	0.00	2.0000	2.0000
Crew 2 Team 2	2.0000	0.00	2.0000	2.0000
Crew 2 Team 3	4.0000	0.00	4.0000	4.0000
Crew 3 Team 1	2.0000	0.00	2.0000	2.0000
Crew 3 Team 2	2.0000	0.00	2.0000	2.0000
Crew 3 Team 3	4.0000	0.00	4.0000	4.0000
Engine 1 Inspector	3.0000	0.00	3.0000	3.0000
Engine 1 Junior	13.0000	0.00	13.0000	13.0000
Engine 1 Senior	13.0000	0.00	13.0000	13.0000
Engine 2 Inspector	3.0000	0.00	3.0000	3.0000
Engine 2 Junior	13.0000	0.00	13.0000	13.0000
Engine 2 Senior	13.0000	0.00	13.0000	13.0000
Engine 3 Inspector	3.0000	0.00	3.0000	3.0000
Engine 3 Junior	13.0000	0.00	13.0000	13.0000
Engine 3 Senior	13.0000	0.00	13.0000	13.0000
Engine 4 Inspector	3.0000	0.00	3.0000	3.0000
Engine 4 Junior	13.0000	0.00	13.0000	13.0000
Engine 4 Senior	13.0000	0.00	13.0000	13.0000
Air frame Inspector 1	5.0000	0.00	5.0000	5.0000
Air frame Inspector 2	3.0000	0.00	3.0000	3.0000

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Replications: 100 Time Units: Hours

Resource

Usage

Total Number Seized	Average	Half Width	Minimum Average	Maximum Average
Air frame Inspector 3	5.0000	0.00	5.0000	5.0000
Air frame Inspector 4	4.0000	0.00	4.0000	4.0000
Air frame Inspector 5	4.0000	0.00	4.0000	4.0000
Air frame Inspector 6	5.0000	0.00	5.0000	5.0000
Air frame Junior 1	11.0000	0.00	11.0000	11.0000
Air frame Junior 2	10.0000	0.00	10.0000	10.0000
Air frame Junior 3	3.0000	0.00	3.0000	3.0000
Air frame Junior 4	9.0000	0.00	9.0000	9.0000
Air frame Junior 5	8.0000	0.00	8.0000	8.0000
Air frame Junior 6	14.0000	0.00	14.0000	14.0000
Air frame Junior 7	12.0000	0.00	12.0000	12.0000
Air frame Junior 8	11.0000	0.00	11.0000	11.0000
Air frame Junior 9	7.0000	0.00	7.0000	7.0000
Air frame Senior 1	11.0000	0.00	11.0000	11.0000
Air frame Senior 2	9.0000	0.00	9.0000	9.0000
Air frame Senior 3	3.0000	0.00	3.0000	3.0000
Air frame Senior 4	6.0000	0.00	6.0000	6.0000
Air frame Senior 5	8.0000	0.00	8.0000	8.0000
Air frame Senior 6	14.0000	0.00	14.0000	14.0000
Air frame Senior 7	12.0000	0.00	12.0000	12.0000
Air frame Senior 8	11.0000	0.00	11.0000	11.0000
Air frame Senior 9	7.0000	0.00	7.0000	7.0000
Senior AV Cockpit Technician	2.0000	0.00	2.0000	2.0000
Senior Cockpit Technician	7.0000	0.00	7.0000	7.0000

User Specified

Time Persistent

Variable	Average	Half Width	Minimum Average	Maximum Average	Minimum Value	Maximum Value
Department Completion	4.0000	0.01	4.0000	4.0000	4.0000	4.0000
Engine	4.0000	0.00	4.0000	4.0000	4.0000	4.0000
Frame	9.0000	0.00	9.0000	9.0000	9.0000	9.0000
Zone	3.0000	0.00	3.0000	3.0000	3.0000	3.0000