UPES Centre for Continuing Education

"Quality Management System for Aircraft Maintenance Manuals: Challenges & Opportunities"

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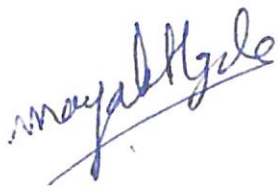
DECLARATION BY THE GUIDE

Declaration by the Guide

This is to certify that **Mr. Gente Pavan Kumar**, a student of **MBA in Aviation Management**, SAP ID – **500071004** of UPES has successfully completed this dissertation report on **"Quality Management System for Aircraft Maintenance Manuals: Challenges & Opportunities"** under my supervision.

Further, I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for the award of any degree. In my opinion, it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the award of the degree of MBA.



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ABSTRACT

Aviation protection depends on minimizing mistakes in all aspects of the system. While the function of flight deck human errors has acquired an awful lot emphasis, currently more attention has been directed towards lowering human errors in renovation and inspection. Avionics maintenance and assessment undertakings are a piece of a mind-boggling association, where individuals play out various commitments in surroundings with time pressures, scanty criticism, and from time to time troublesome encompassing conditions. These situational characteristics, in mixture with widely wide-spread human erring tendencies, bring about numerous kinds of errors. The maximum severe bring about accidents and a lack of life. For example, failure to replace horizontal stabilizer screws on a Continental Express plane resulted in the in-flight modern separation and 14 fatalities. Although accident errors are most important, preservation and inspection errors have other critical effects (e.g., air turn backs, aircraft availability delays, gate returns, airport shift diversions) Which impede airline operations productivity and efficiency and inconvenience the flying public. This paper reviews current tactics for identifying, reporting, and handling human error in aviation protection and inspection.

As a foundation for this discussion, we provide an overview of techniques for investigating human mistakes and an outline of aviation protection and inspection obligations and environmental characteristics. Also, this paper gives several opportunities to improve the quality and ease of use of aircraft maintenance manuals.

Chapter 1: Introduction

1.1 Overview:

Up to this point, little attention has been paid to the way composed methodology that is applied to create and regulate airplanes upkeep specialized records have an impact on the clients of that records. Investigations of maintenance issues have would in the popular spotlight on the sports of the specialist, paintings culture, and work techniques. All the more as of late, endeavors were made to archive the wellspring of renovation mistakes and enhance support techniques. One of the recognized contributing motives for mistakes is the documentation used to direct upkeep undertakings. Therefore, endeavors have been made to set up regulations for the plan of renovation paintings helps. An inquiry that remaining components is the means by which the techniques used by makers to create preservation information may additionally add to consumer blunder.

FAA is promised to decrease airplane incidents to 80 percent mainly to reduce total n umber of aviation accidents. A significant piece of mishap decrease is to diminish the scope of missteps created during the support of the plane. In an assessment of plane redesign botches , two scientists recognized records similar to the absolute best positioned causing reason, which changed into involved in about 38 percent of all support botche. NASA review of safety accident statistics showed that reports were correlated with an ave rage of 50% accidents in the 20th century. Further evaluation of the mistakes attributed to statistics revealed that incorrect facts changed into an aspect in the handiest a small wide variety of those instances, and a lot of those instances were user-initiated problems. The most commonplace problem seemed in instances wherein the information became now not being referred to, misunderstood, or overlooked in prefer of an alternate technique of appearing a protection procedure. Due to the fact that technicians do not use prevention documents adequately. It could be concluded that the hazard should be discussed by training or administrative action nearer to the resources. Though, this could recreate difficulties with the functionality of technical papers if a systematic competence difficulty approach to technical manuals were indicated.

1.2 Background:

The challenges in aviation were the absence of a standardized process for determining manual production by producers. Assessments can include buddy review, grammatical and incorrect spellings and crucial design feedback to assure requirements are met. These methods are key elements of the correction control system. An essential element in the production of a technical performance report is to evaluate the accuracy and error free of the actual intent. The findings of customer statistics show that suppliers in this zone also largely did great work. The overview of feedback not only shows a positive assessment by technicians of the quality and consistency of the records, but the assessments are remarkably similar when evaluated by specific vendors. While the real error rate is hard to determine, workers are not adequately designed to create a negative impression.

Compliance with design and development requirements means that professional materials have a clear look and feel. Development guidelines were described in business rules and regulations are part of an overall business opportunity, like the ATA Configuration for proofreading. Systematic methods to check technological information's precision reduce the number of mistakes (typographical and factual). Compliance with norms can be achieved via inspection throughout the company by more formally than in ISO accreditation. Nonetheless, obedience to business protocols and design standards alone will not guarantee efficient use of the drug.

1.3 Purpose of the Study:

New aircraft's increasing complexity and computerization provides the repair workers with particular challenges, which have to deal with highly automated processes. Advanced aircraft can be defined as' opaque complex systems' in this regard. These processes are distinguished by a sophistication that goes beyond the understanding of the people who hold and run them. Anomalies in servicing are serious safety concerns for the aviation industry. Boeing reported that 3.3 percent of US airline hull failure incidents in the era 1983-1992 had a repair disparity as the accident's' primary cause.

Nevertheless, 12 percent of major accidents were reported to include service as a contributing factor, though not generally the sole factor (Marx and Graeber 1994).

Previously, the UK Civil Aviation Authority announced that there was a servicing disparity in 8 percent of incidents on large aircraft (BAS1 1992). Nevertheless, both of these numbers may be underestimates of the actual occurrence of maintenance-related accidents.

On a routine basis, maintenance workers may deal with environmental conditions such as ice, humidity, fog, darkness, noise, heights, work areas that are difficult to access, precarious working postures, toxic threats, night shift activity and the existence of heavy vehicles and flying aircraft. In some cases, such as during an engine run-up, the noise level is such that staff with ear protection cannot verbally interact.

For the purposes of this paper, the term ' maintenance anomaly' will refer to any incident where maintenance work was conducted in a manner that had the potential to affect an aircraft's safe or economical operation. This will include occasions when anomalous activity was observed and resolved prior to dispatch of the aircraft. Several descriptions of maintenance problems can help illustrate the problem's complex existence.

Big crashes and injuries arising from repair failures on airliners. This study found that, for the last 25 years, 5 percent for all crashes involving are contributing to construction failures were correlational. 45 (10%) of the 481 maintenance crashes for 1999–2015 are deadly for reference look fig. 1. The percentage of servicing incidents in the last 20 years has not fallen. Many deadly deaths occurred at threat of failures of mistake in repair document creates.

Due to the delay in translating the details into technical manuals, updated repair guides are not provided to the airliners within the due date. **Paramount number of terrible events from air transport over many years have been triggered by maintenance mistakes and it's motivated me to make deep dive in the current report.**

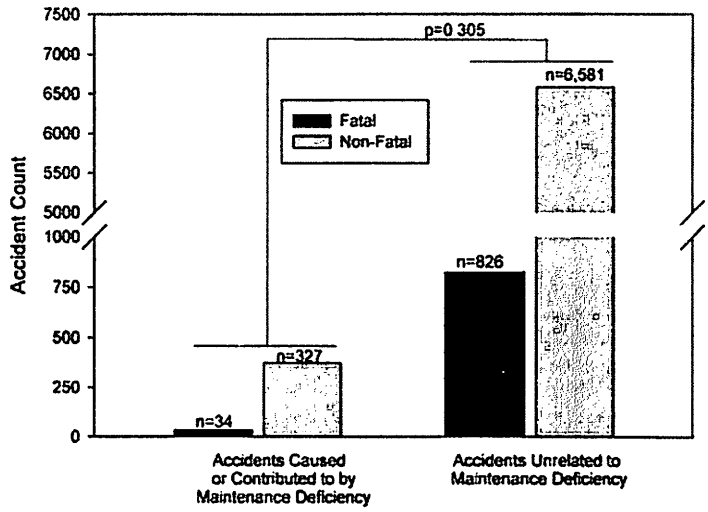


Figure 1: Count of accidents based on the rate of erorrs by manual errors

Chapter 2: Literature Review

One of the issues found in the literature is the absence of a standardized process for producers to determine manual efficiency. Evaluations can include peer review, spelling and spell testing, and essential style tests to ensure compliance with requirements. The errors management method requires these processes. One crucial phase in creating the professional consistency report is to ensure that the concept is simply and accurately delivered. The findings of the consumer statistics show that many of the developers has did a great job in this sector.

The scale and sophistication of a contemporary technological manual necessitate the synthesis of information from multiple outlets, rendering it increasingly difficult to verify the accuracy and clarification of the manuals for material management. Every organisation has created its very original methods and processes to address these problems, but that's a small public industrial conversation documents about either various process used. While producers can refuse to share this information publicly, the potential benefits include lowered manual development costs and increased manual efficiency.

Considering that the purpose of a technical manual is to promote an aircraft's safe and efficient maintenance, it is necessary to constantly determine the degree to which the applicable procedures achieve these goals. The purpose of this attempt is to record how the businesses also dealt of developing solutions to issues and to promote discussion inside the business sector around suppliers, providers and government agencies.

In recent years, the task of developing manuals has become a more critical part of aircraft maintenance, as the demands placed on those manuals are increasing. The continued growth of global air traffic has led to increased production of new aircraft and aging aircraft staying in operation for longer than originally anticipated. While the number of aircraft has risen, the number of repair technicians has not; therefore, aircraft maintenance, in general, is under greater pressure. A 1993 Blue Ribbon Report called "Pilots and Aircraft Maintenance Technicians for the 21st Century: An Evaluation of Supply and Performance" showed that while there were adequate aircraft mechanics at the moment, the expected demand increased at a faster rate than the number of new mechanics. Despite the favorable economic conditions encountered globally in the years

since the publication of this report, the situation has deteriorated faster than anticipated and air traffic continues to increase.

Combined with an aging repair workforce and a worker-friendly job market, the rise of air carrier operations has culminated in a significant shortage of qualified aircraft mechanics. The Labor Department estimates that 140,000 mechanics are employed in the aviation industry today and 40,000 additional mechanics will be expected by 2008. Maintenance facilities are forced to lower hiring requirements for maintenance personnel to fill the positions needed to support larger fleets. American Airlines, for example, has reportedly been forced to lower the standards for experience from 4 to 2 years. At the same time, a general lack of qualified candidates seems to be present.

In 1997, United Airlines introduced a basic skills examination into its repair technicians interview process in response to concerns about the skill level of newly hired mechanics. Such a competence test involves the tasks required by any technician of an aircraft, including installation of rivet and bolt safety wiring. The United Airlines Manager of Maintenance revealed in an interview with USA Today that 1,600 potential employees were questioned between the end of 1999 and mid-2000, and only 45 percent of those were able to pass the basic skills examination. United is one of only five airlines with its recruiting process that includes a capacity check. United Airlines' history could suggest a need for long-term improvements in new mechanics preparation but the short-term fact is that maintenance staff certification appears to be diminishing.

Lesser-trained and less-educated maintenance personnel may rely considerably more heavily on the maintenance manual material. Therefore, they may lack the knowledge that comes with experience to assess when a textbook may be incorrect. In some situations, work has been offloaded to overseas repair facilities for an order to meet demand, which carries with them the additional issue of record translatability. Increasing responsibility and legal demands have also raised the inspection of technical manuals, requiring the introduction of corporate lawyers into the manual development process in some situations. Thanks to these stresses, choices about the quality of comprehension, writing style, consistency and the degree of information to be used when preparing maintenance manuals are even more relevant now than in the past.

The way in which a single producer may manage such judgments regarding products is often a question of proven company history. Manufacturers develop a style of

writing that is propagated from the company's veteran writers to the newly hired writers, and users come to expect a certain style from a particular producer. Design stability may benefit from a generalized similarity through supplier models, but it may not be ideal for the evolving nature of the maintenance workforce.

A Human Factors solution to mitigating repair mistake involves expanding causal blame beyond just the delinquent technician. Where the search for sources of error extends to environmental influences, causal attribution may include latent errors introduced by the maintenance facility's management policy, organizational communication, or corporate culture. Another possibly easily overlooked element in maintenance error is the technological expertise that is used to direct maintenance operations. Potential technological data exposure to repair mistakes is not a fresh issue.

Incumbent knowledge, limited data, ambiguous protocols may contribute towards service failure. The information not only needs to be technically sound; it also needs to be presented in an effective way. A concept more applicable in this situation specific to the computer industry is' usability.' The IEEE describes usability as' the convenience with which a consumer may understand how to function, schedule inputs and perceive device or part outputs. The manuals user experience will also affect the forms and degree to which they will be used by mechanics. In a look at carried out for the Australian Transportation Safety Bureau, 67% mentioned that they were misled by preservation documentation, 47% stated that they had opted to carry out protection procedures in a manner that they considered superior to that described in the manual, and 73% of the mechanics surveyed reported that they had not referred to maintenance documents either occasionally or frequently. Such results raise concerns about the perceived usefulness of manuals and the consistency of the exchange of information between mechanics and the maintenance content authors.

The process of designing and revising repair guides involves the integration of various sources of information across a variety of divisions within the manufacturer's management structure. The first and foremost latest data from the various publications shall be incorporated in the design, work assistance, sales support and manuals writing in order to establish the required technical basis to generate a technologically robust report. It is the ultimate responsibility of professional authors to ensure that they have the current and most accurate information accessible to build technical manuals from.

It is of paramount importance that the information contained in repair manuals is correct and suppliers have introduced several safeguards to protect against the use of

inaccurate materials. To reduce the number of mistakes found in field management guides, paper checklists, peer review, and program design were all introduced. Every supplier once published requires protocols to address problems that consumers experience while using the manuals.

Chapter 3: Research Design and its Methodology

3.1 Gathering of source information:

Active and passive information analyzes is a strategy towards this research. The key information were obtained through the sample checklist with physical copy layout. Supplementary information is collected from different sources on respective web links, Google books and academic publications.

Supplementary information were obtained from accessible history questionnaires of multiple AMTs from multiple jetliners by the ICAO. The details are taken from historical records and from independent academic papers from the ICAO. The design guides includes a few of the sample data to enhance comprehension.

The guide often consults relevant books, journals, and magazines, research papers, written report, posts, blogs, for better reference.

3.2 Design of Survey Method:

In this article, casual or exploratory work was carried out. Exploratory experiments are carried out from the examination of knowledge, from the study of practice. Such work is aimed at developing experience with a phenomenon or gaining new insight into it to devise a more specific question. The approach is about cause-and-effect interactions also to consider the industry's current problems with the correct evidence and to conclude the analysis in the context of opportunities.

A convenient sample is characterized as a non-probability sampling process in which sampling was collected from such a group of people who are easy to contact or meet. It is also referred to as catch sampling or sampling of quality. The sampling method has no other varying requirements except that individuals are available and willing to participate.

The survey focused on the manufacturers ' procedures for developing and revising the technical documentation to be used in the maintenance of their aircraft. A questionnaire is created to assess technical conceptions of servicing documentation to evaluate the impacts of all these processes on data reliability and accessibility. In

addition to general expectations of paper content and usability, respondents were asked to analyze the documents generated by different manufacturers so that variations in customer appraisal could be related specifically to the processes used by a single supplier.

3.2.1 Survey Summary:

The survey solicited from the respondents' details about a number of areas, including the aircraft they are currently working on and their expertise area. Participants were then asked to identify the two aircraft with which they were most acquainted and to assess the number of mistakes, expectations of consistency, reliability, and accessibility of these manuals. First, the respondents were asked to assess how often they have participated in safety-related maintenance activities and to explain the effects of mistakes or contradictory details they have encountered in the guides. Finally, details on requirements for document format and recommendations for developing the manuals were sought.

3.2.2: Distribution of the Survey and AMTs Interview:

The corporation was assigned to carry out and obtain the assessments from the workers. To expand the reach of dissemination, the survey was accessible as a four-page paper document and as a web-based type. A cover statement detailing the intent of the study and the anonymity of the respondents is followed both by document and internet-based polls.

In addition to the questionnaire, one national carrier and two major airline facilities were also inspected at the location. Employees using the guides at these facilities have been consulted to check the reliability and authenticity of survey responses, as well as to provide additional details and interpretation of survey data. There have been interactions from aviation staff, comprising mechanics, managers, developers, vendors even work cards authors.

Meeting members were solicited to recognize regions from quality and shortcoming in the specialized documentation gave by makers. to look into changed producers, to evaluate the potential effect of record quality, and to make

recommendations for any upgrades that could be made to manufacturers. At whatever point potential, interviews were directed in gatherings of two and three members to encourage conversation and to restrict peer impact that may be available in a bigger gathering.

3.3 AMTs Survey Response:

Finished overviews included criticism from experts at both line-and heavy-based support offices. Figure 1 displays the producers of the airplane that specialists keep up, and afterward respective recurrence. Cessna, Airbus, Boeing, McDonnell Douglas were the most much of the time refered to makers. Most of the responses were coming from major airline facilities. To date, it has issued 377 person survey responses and 745 separate aircraft reviews.

Among all voices, most important aircraft operators got here from 287 person survey responses and 500 precise plane assessments. The remaining answers come from repair facilities liable for FAR Part 25 aircraft operated regionally and/or personally. Figure 3 shows the relative percentage of responses, respectively, for big and smaller FAR Part 25 aircraft.

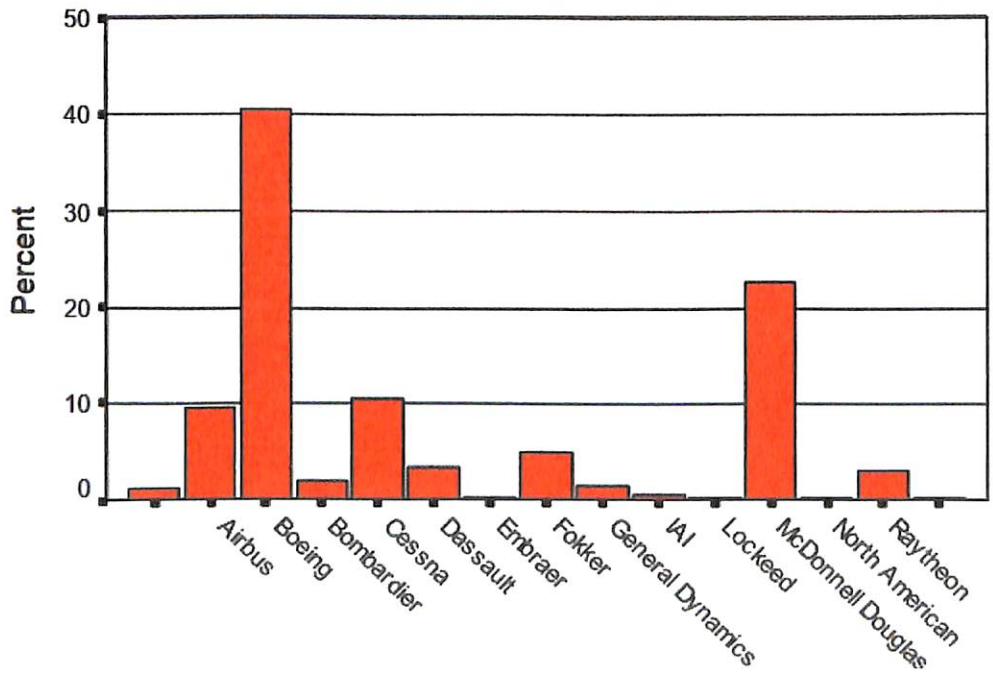


Figure 2. Different airplane manufacturers percentage

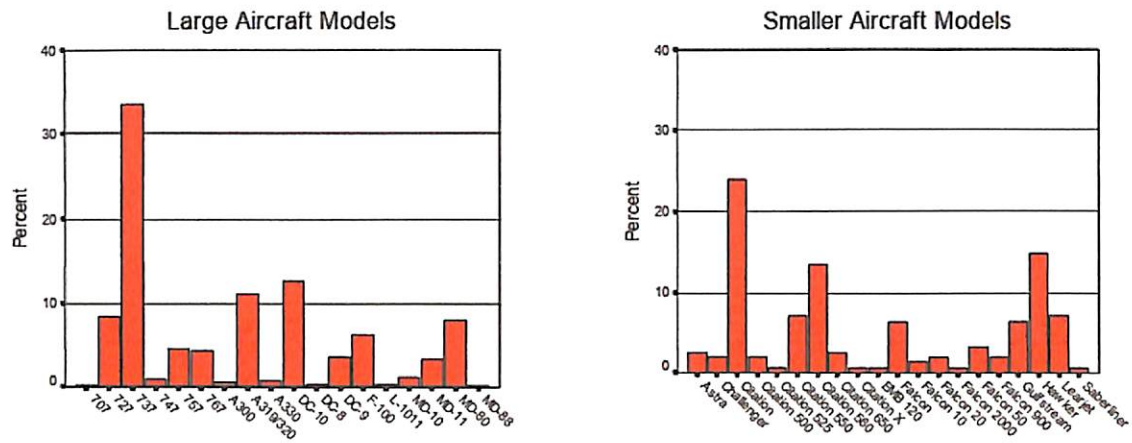


Figure 3. AMTs response of experience in different aircraft

3.3.1 Using Aircraft Maintenance Manuals:

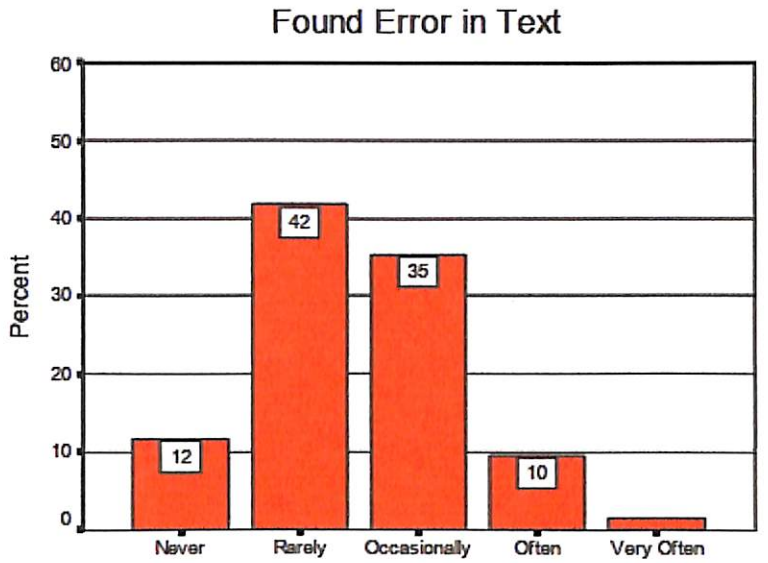
Reactions showed that the Aircraft Maintenance Manual (AMM), Illustrated Parts Catalog, and assignment cards were the most much of the time utilized specialized records. It ought to be recognized that on the grounds that the study test incorporated an enormous cross-segment of support activities, the specialized documentation utilized by a specific expert will contrast contingent upon line and base upkeep, and how much they have practical experience in explicit support assignments

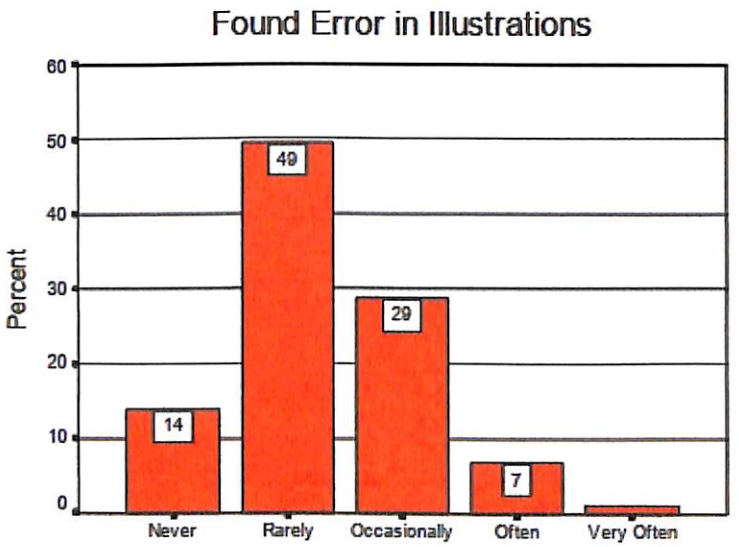
For instance, booked base upkeep will depend all the more vigorously on the utilization of assignment cards, while the erratic idea of line support requires the service manual and parts list to be utilized all the more much of the time. It ought to be stressed that the focal point of this overview and assessment was the AMM and not work task cards. Interested readers can review Drury's and colleagues ' research based on innovative job card architecture and usability problems.

3.3.2 Various human errors in technical authoring:

When manual use levels were identified, technicians were asked to report how often errors were seen in text processes, drawings, and diagrams. One of the bigger objectives of this venture was to decide the level of blunder appearing in specialized manuals. AMTs were approached to rate with five rating scale, "never" to "regularly" at

what frequency they have experienced blunders in the manual content, outlines, and methodology. While abstract, the outcomes refer to figure 4 shows that most respondents announced once in a while or never discovering blunders in manual content of 55 percent, outlines of 68 percent, and charts of 67 percent approximately.





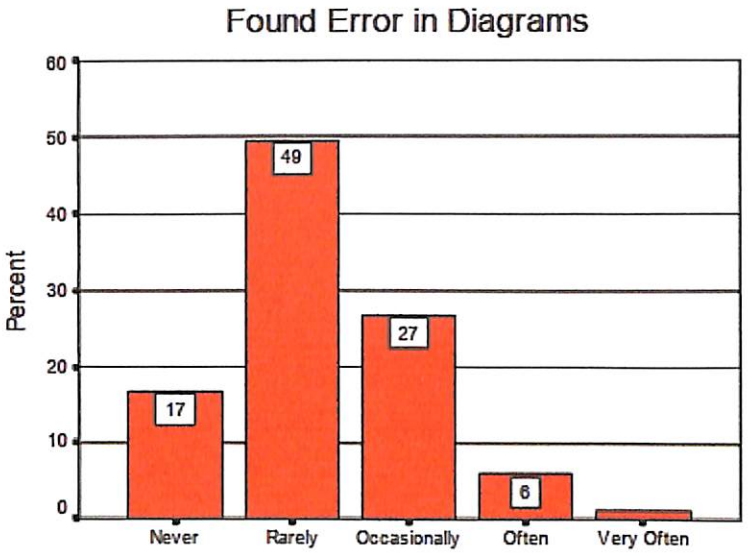
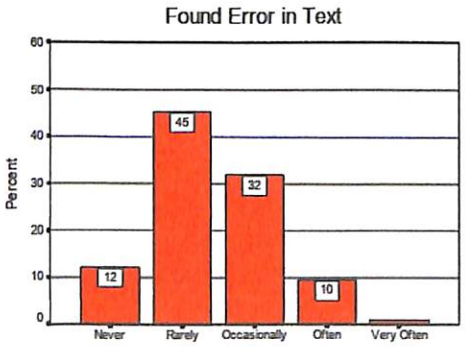


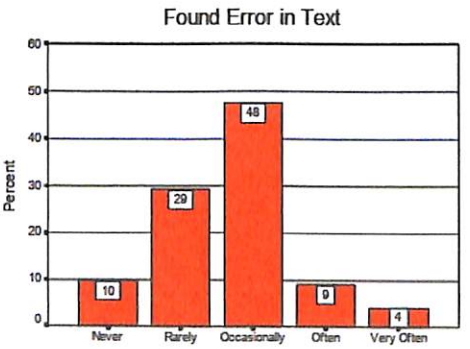
Figure 4: Report of errors for different aircraft

Comparable outcomes are seen when reactions are isolated via airplane size eg, airplane worked by significant carriers versus littler FAR 25 airplane. A measurable examination of enormous and littler airplane uncovers critical contrasts just in client appraisals of the recurrence of content mistakes, with blunder being accounted for all the more much of the time in littler FAR 25 airplane. Figure 5 indicates this relation. A full copy is available for statistical analysis and tests.

Large Aircraft



Smaller Aircraft



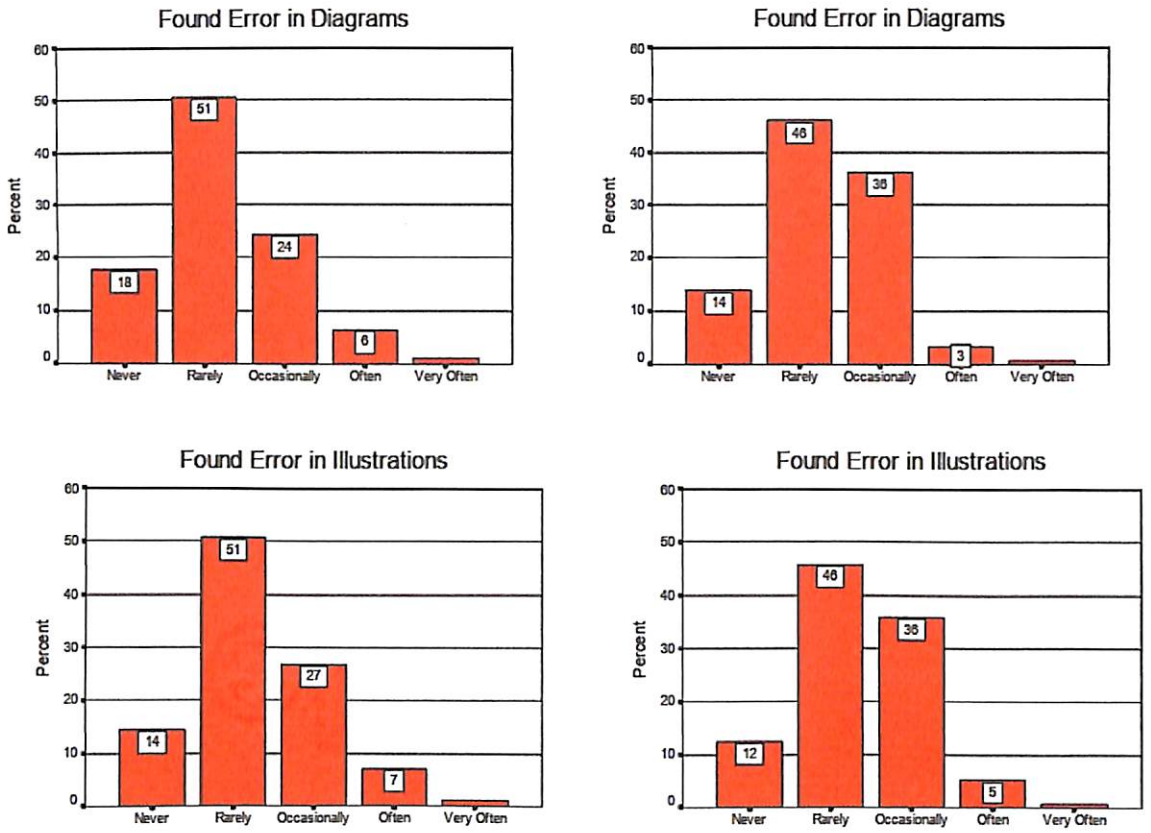


Figure 5: Illustration errors in both small and large airplanes

3.3.3 Quality of Maintenance Manual:

The following query sequence on the survey questioned users regarding general manual efficiency expectations. The respondents were asked to assess the utility of guides, manuals and systems, and the quality of text explanations from all the bad to all decent. Figure 5 shows that fix manuals are amazingly valuable to the activity they do 78% of every great manual or each beneficial thing and that manuals are for the most part of the best quality 54% and great quality outlines 56% and consistency of content 44%.

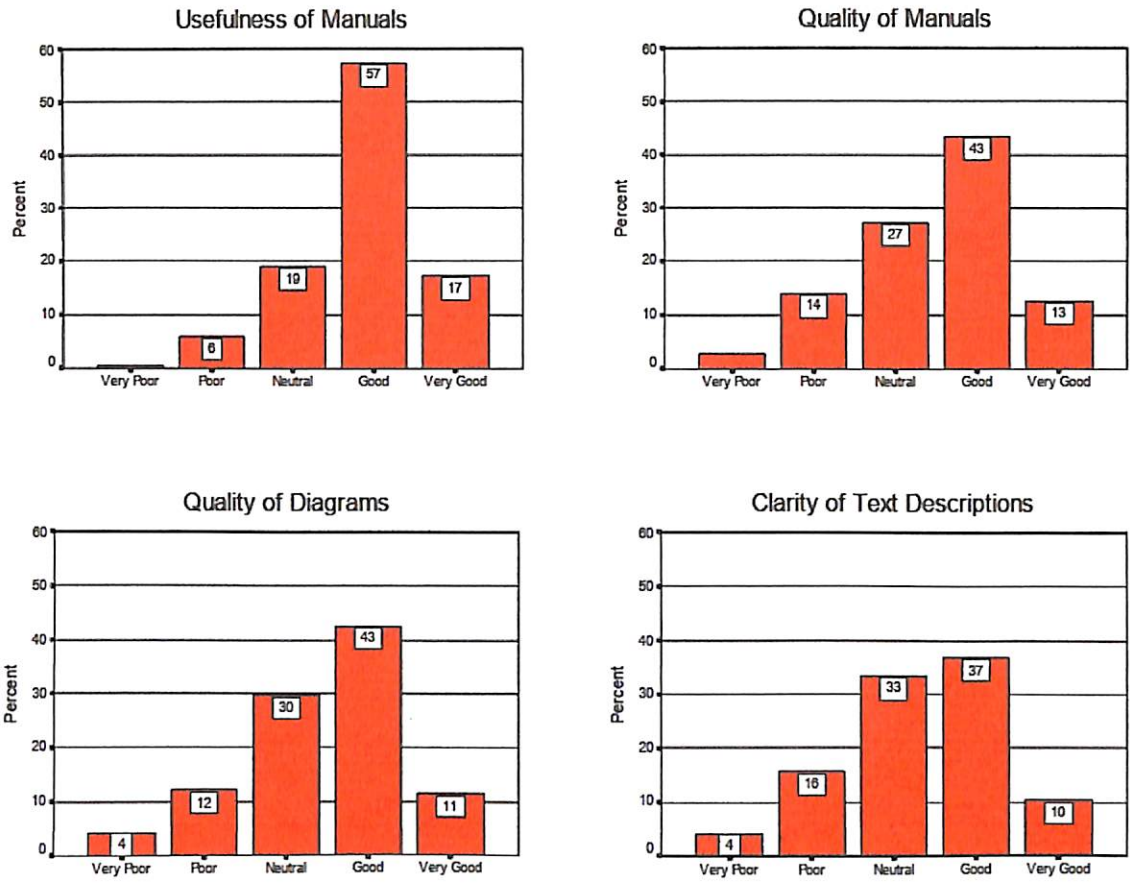


Figure 6: Quality and text clarity of manuals

Notwithstanding qualifications among enormous and littler airplane makers, it is critical to research potential contrasts between producers of comparative airplane. If a supplier is consistently rated better than its rivals, the manual production methods can be superior. The data from the four main aviation manufacturers most frequently mentioned in this survey are highlighted in figure 7.

Close examination of the data indicates that for three of those suppliers the standard of the guides is nearly equal, whereas the fourth is slightly poorer. From these tests, while each supplier uses varying manual production methods, it seems that most manuals result in manuals of similar quality. The more unfortunate appraisals of producer D might be represented by the way that this specific manual was converted into English and is accounted for to be a paper-based adaptation of what was initially planned to be in CD-ROM.

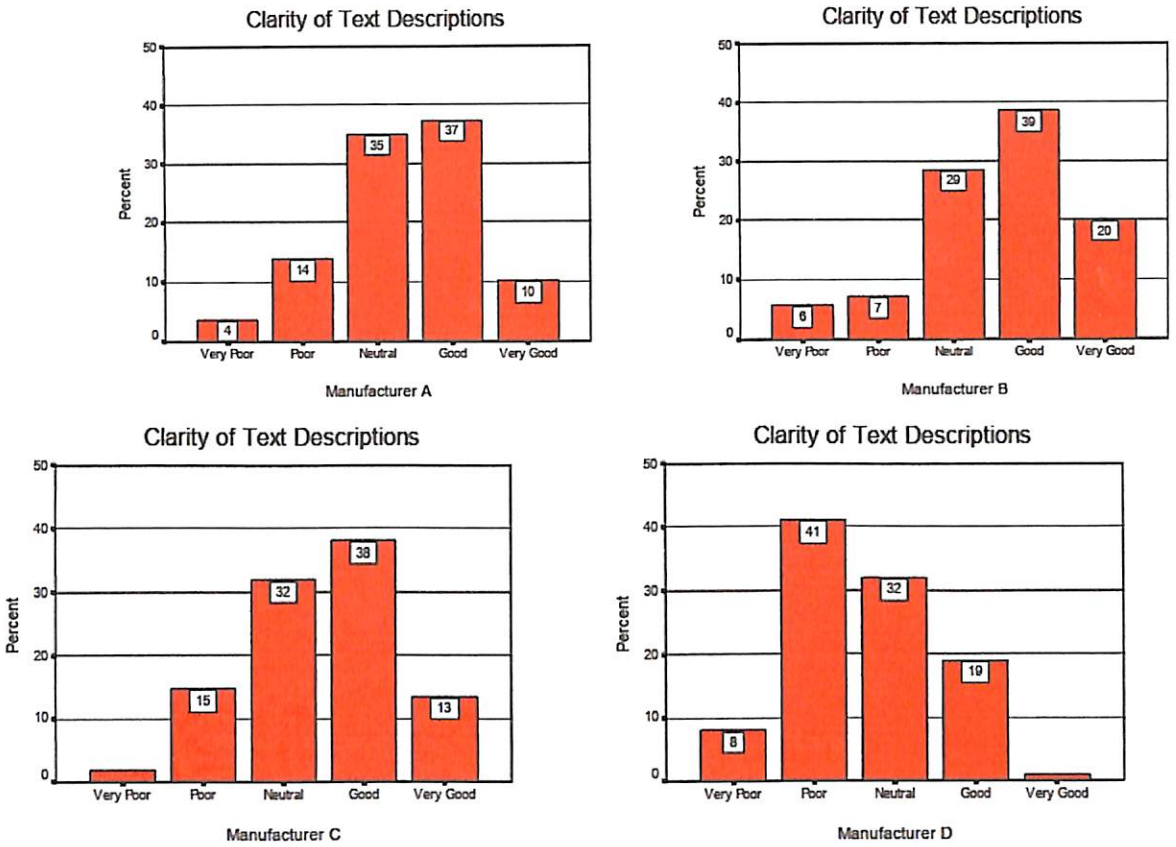


Figure 7. Description of variations in textual interpretation Clarity by producer

3.3.4 AMTs Usage of Maintenance Manual:

The next series of survey questions is planned to examine expectations of manual accessibility among consumers. The usability concerns assessed included manual user-friendliness, manual accuracy and transparency, and breadth of detail. The AMT's response appeared in figures 8 are regularly circulated with the mean focused close to unbiased or moved somewhat toward the positive finish of the scale. Technicians generally think repair guides are easy to learn, quick to use, transparent and reliable.

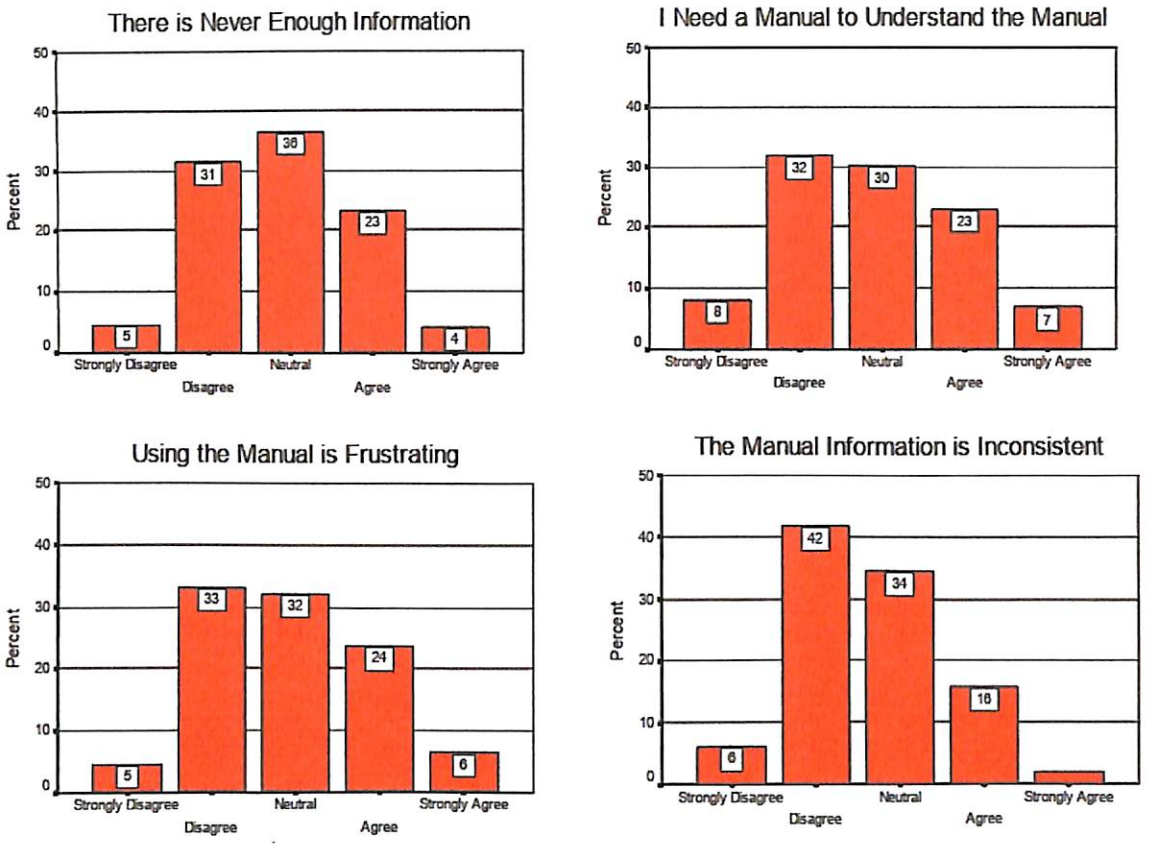
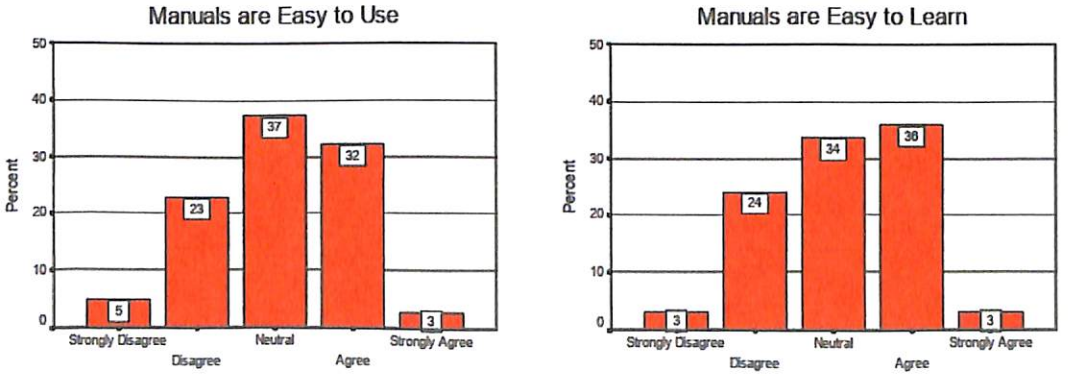


Figure 8. Maintenance manual usability measurement-1

The last two ease of use questions survey how well the depicted techniques coordinate the manner in which specialists really carry out their responsibility. When asked to respond to the statement, the manual describes the best way to proceed, while 47% of technicians say they are not in agreement or strongly disagree. The argument, which the manual writer knows the way I do, culminated in 54% of technicians reacting that they disagreed or strongly disagreed.



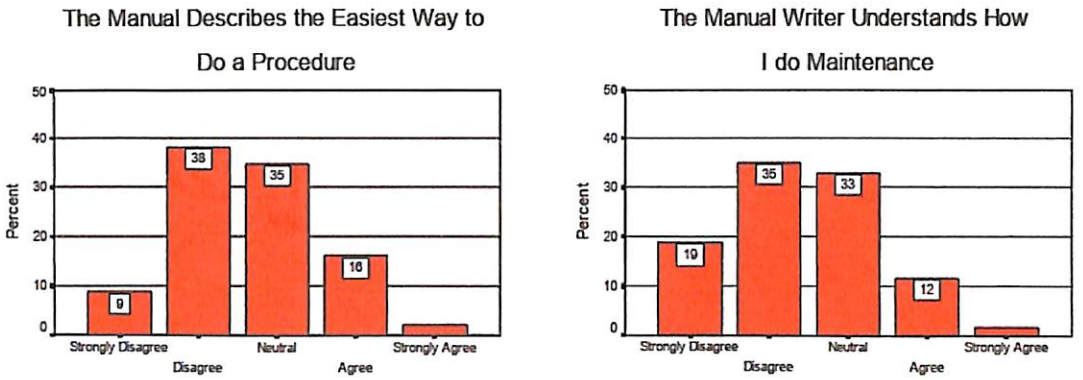
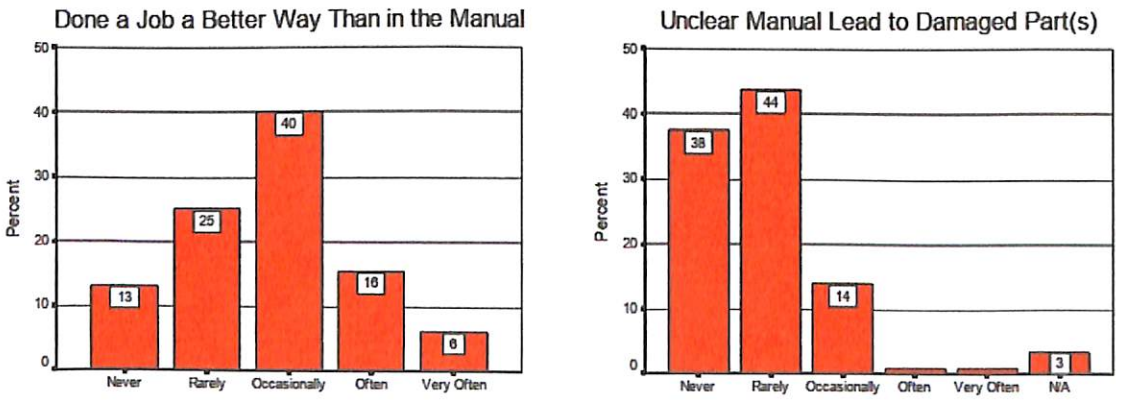


Figure 9. Maintenance manual usability measurement-2

3.3.5: Maintenance Manual Usability Impact:

Figure 10 show the consequences of inquiries intended to evaluate the potential effect of report ease of use. As can be seen in Figure 10, 62 percent of respondents indicated that they had performed treatment in a manner that they considered better than that defined in the textbook. Owing to ambiguous or inaccurate practices, 18 percent of respondents recorded injury to components, 20 percent reported incorrect configuration of a piece, and 25 percent reported incorrect modification or wiring of a device.



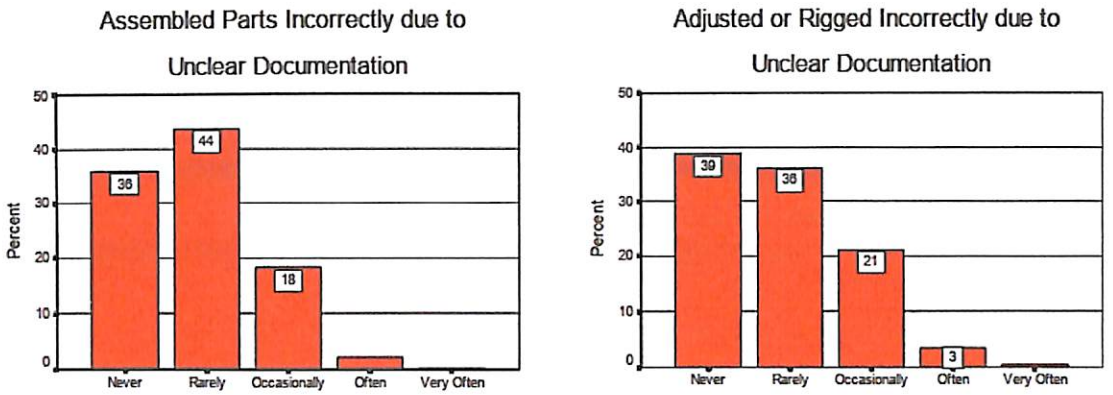


Figure 10. Report of problems using maintenance manuals

Seventy-eight percent of respondents reported contacting another specialist while faced with a complicated process, and 64 percent reported finding their own method of continuing. Just 7 percent detailed that these troubles brought about an airplane being discharged in unairworthiness, yet 38 percent revealed seeing an expert being accused for an accident coming from challenges deciphering the manual.

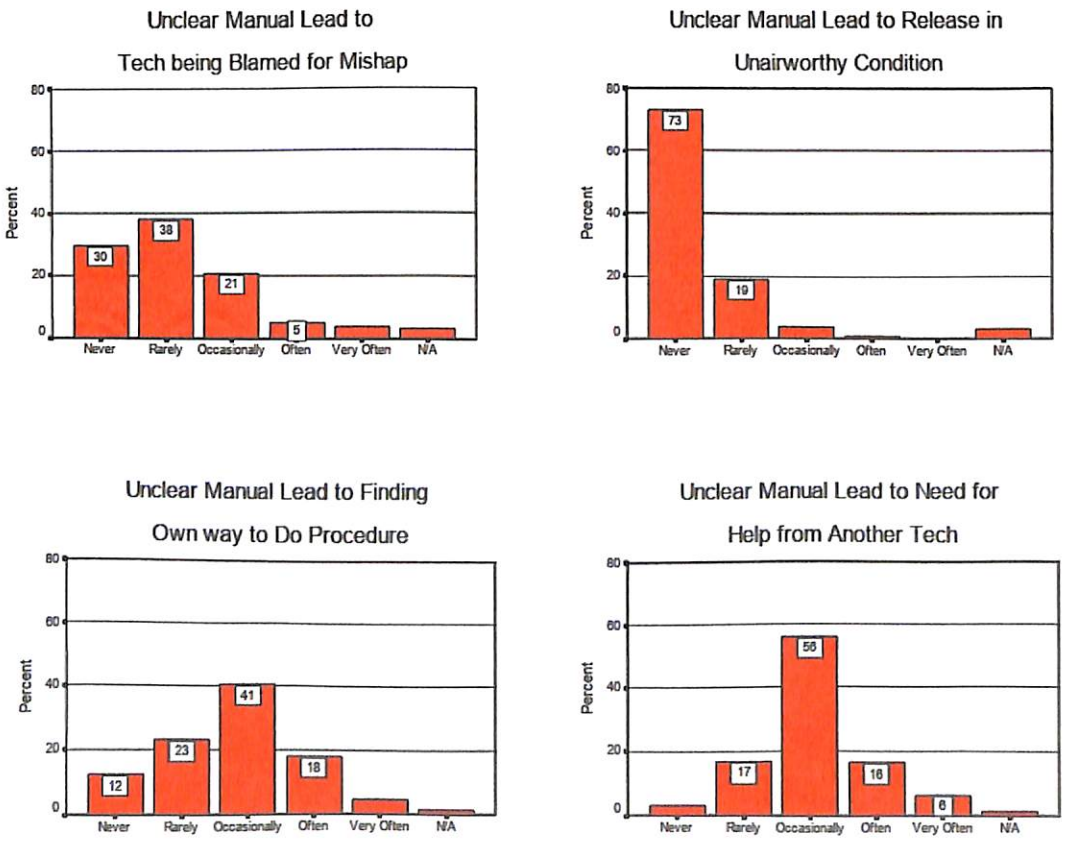


Figure 11. Report of problems using maintenance manuals (Continued)

Chapter 4: Analysis of Challenges Facing by Aircraft Manufacturers

4.1 On-Time Delivery (OTD) of Maintenance Manuals to Customers:

It is the primary duty of the aircraft manufacturer to provide the mutually agreed repair guides with a high-quality level at the specified time. Apparently, though, the airlines do not provide the repair guides on the shipping dates due to multiple problems. That turns out to be one of the manufacturers ' major challenges.

Precise and readily accessible technical publications are essential to support safe and efficient fleet operations. We can create customized technical publications to incorporate changes in aircraft configuration and help identify effective ways to deliver technical publications in a user-friendly format to maintenance and engineering teams. Leverage our established skills in professional authoring and domain knowledge of leading technical standards like S1000D.

Accurate and up-to-date technical documentation is important to enabling fleet and repair activities that are effective and secure for aircraft. Manufacturers provide a broad spectrum of technical data and information management services and technologies to ensure prompt exposure to relevant scientific resources and effective training programs for repair and development staff.

Airliners facing severe problems in the delivery of the maintenance manuals and Airplane parts catalog from the Aircraft manufacturer. Every instance there are so many customer-oriented change requests from airliners. Although job and maintenance task is already incorporated in the aircraft, it needs to be updated in the manual. Now the work is with the aircraft manufacturer, they have to update the required changes in the manual by communicating with the customers.

Nevertheless, manufacturers finding difficulty in updating and delivering manuals on time. Service bulletin means modifications to be done in the aircraft manual while in service. While there are two types of Service Bulletins (SB) one is embodied SB and another is scheduled SB.

If the modifications are already incorporated in aircraft and pending in updating of maintenance manuals it's called Embodied Service bulletin. If the modifications are scheduled to be done on aircraft then those to be updated in the maintenance manual first and it's called Scheduled SB.

4.2 Maintaining Stringent Quality:

On an overview, there is a need to give authoring professionals documentation that not just passes on the specialized data important to keep up an airplane, yet in addition, presents it so that best matches the manner in which experts carry out their responsibility. All makers have frameworks set up to accumulate input from administrators about the precision of manuals, yet assembling information about client view of manual convenience has not customarily gotten as a lot of consideration. This sort of criticism requires progressively nitty-gritty correspondence from the administrator and a more noteworthy responsibility from manufacturers to suspect that input

Most of the existing feedback types and suggestion-reporting approaches are more geared toward the traditional idea that mistakes are restricted to misconceptions. Once manual quality assurance is applied to aspects of paper usability outside knowledge loss, a constructive strategy becomes less successful as consumer quarters are unable to identify usability problems and are even less likely to allow non-technicians to understand these issues.

Clients may not set aside effort to give input, may neglect to verbalize the issue satisfactorily, or the essayist may neglect to welcome the reason or degree of the client's trouble. Survey answers review to the query, How often do you mention errors when you spot them? This demonstrates that technicians actually do not take the time to record mistakes in many situations. Because users provide the last line of defense in maintaining manual quality and accuracy, any failure to disclose a detected mistake may be deemed a system-wide deterioration.

The objective at that point gets one of deciding why clients may neglect to report blunders and how the announcing framework may be improved. As a part of their recommendations, technicians often commented on both on-site interviews and poll reviews that they got no input or did not see any improvements to the manual. If there is a

feeling that no one responds to their suggestions, the technicians may simply stop the support they receive. What stays vague is the place where the breakdown is happening.

Directors may neglect to give data to the authors and specialists inside their administrator, those essayists and architects may neglect to give it to the maker's administration delegate, or the producer may neglect to enough react to the contribution of the administrative agent. A solicitation for change might be denied by and large however the revealing specialist is left oblivious to the explanations behind this choice. When workers feel their concerns have been overlooked, they will have less likelihood of resolving problems in the future.

All together for the revealing procedure to work, a more noteworthy responsibility is required from both the administrator and the maker to guarantee that recognized issues are accounted for in adequate detail, and a subsequent reaction is given to the announcing professional in any event, when no progressions are made.

A few parts of manual ease of use, for example, designing, consistency, and understanding level can be controlled through institutionalization and rules. The requirement for lucidity and constant among all technical manuals has been the inspiration for the ATA rules with respect to the format and association of support documentation. Standards like ATA Spec 100 and ispec 2200 has been a powerful method for setting up a gauge for better manual quality. The example of reactions to overview queries relating to better manual quality, constant values, and convenience propose that the gauges embraced by the ATA have been successful.

The utilization of steady style and designing is one significant part of report ease of use. Be that as it may, inside the system of the ATA determination, the author must settle on choices about subtleties, for example, the requesting of procedural advances, the wording of strategies, the utilization of outlines. Inquiries concerning wording and sentence structure can be tended to with the utilization of confined style guides, yet the one of a kind sort of every upkeep technique restrains the convenience of any agenda or standard strategy for depicting a system.

Authors and specialists must depend on their composing experience and information on the airplane frameworks when choosing how best to portray a

methodology. In like manner, an expert will depend on their upkeep experience and information on airplane frameworks when deciphering and applying support data. Tragically, the experience and information on the author and specialist might be very not quite the same as the experience and information on the professional. This potential befuddle can bring about other ease of use issues in specialized documentation.

At any rate one taking an interest maker has begun to address a portion of these issues by approving upkeep manual systems. Unfortunately, the answers included in the current survey do not include adequate references to credible guides to recognize user experience results. The cognitive processes used with reading and integrating knowledge need to be understood in order to understand how usability issues arise. Two experts give the accompanying diagram see figure 12 and Just of the subjective procedure of perusing to appreciate data. The way toward perusing can be thought of as a stream from the fundamental degree of letter and word recognizable proof to the most developed degree of comprehension. Movement along this continuum from deciphering of words to deduction of aim is a move from content focused, to data and peruser focused procedures. Any composed entry can be assessed for how well it does at any point along this spectrum, however, the criteria for assessment edits in the movement from content to peruser focused levels.

In the early stages of the cognitive model, the student defines verbs, applies rules of grammar, and incorporates phrases to establish a logical understanding of the language. This is a standard driven procedure, in view of the peruser's information on the language. Mistakes recognized during these stages incorporate incorrect spelling, off base utilization of accentuation, and unseemly use of words. These unthinking issues can be wiped out through spelling and syntax checking and utilizing style controls or limited vocabulary.

The effect of errors on reader comprehension at these points can differ according to the extent of the mistake and the reader's experience. Unquestionably, a typographic mistake may bring about a security issue if that blunder were to happen in a section number, a resistance level, a weight level, or torque esteem. Notwithstanding, almost

certainly, typographic and linguistic blunders will be viewed as disturbances as opposed to security issues.

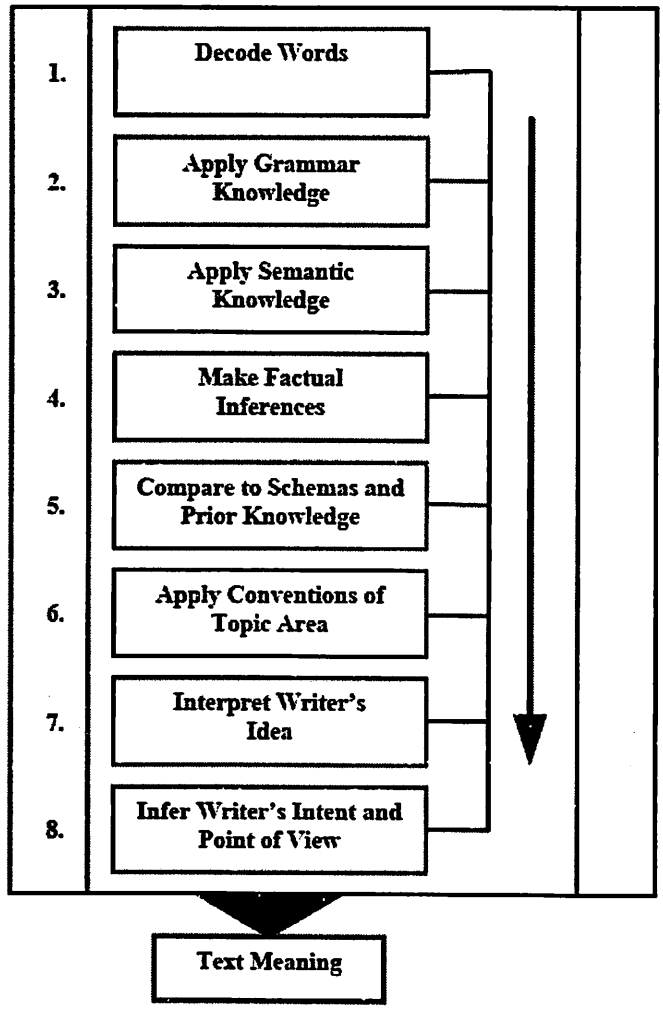


Figure 12. The Reading To Decipher Process

Chapter 5: Interpretation of Opportunities

5.1: Four Levels of Quality Checks:

Each task of the maintenance manual has to undergo four levels of quality checks as per Aerospace Standards (ASD). This improves to find all minute errors and rectify them at that juncture. Four levels of quality include the following

a) Self-Review
b) Peer Review
c) Proof Reading
d) Incoming Inspection

a) **Self-Review:** Self Review should be the first stage of quality check. The technical author will have a deep understanding of overall tasks and the author must be the owner of that task until it's gets delivered to the manufacturer. At this stage, maybe big mistakes or minute mistakes will be removed. If it's rejected in any further stages, the whole task may come as a rework.

b) **Peer Review:** Peer Review is a kind of buddy check from other colleagues. It's mainly for the authors who have less than one year of experience. This review is included to avoid any rejections at the stage of proofreading. It almost involves the same kind of checks as proofreading.

c) **Proof Reading:** Proofreading is the ultimate quality check which involves the deep level checks and verifies the from all perspectives. Proofreader takes all the responsibility for the rejection after the current stage. This level of quality check verifies all task steps and corresponding illustration sets. He/she must write the checklist provided by the aircraft manufacturer. They should fill all the checkpoints and write whether they are Approved or Rejected or Not applicable to the current task. Now, Proofreader submits the task to Incoming inspectors.

d) **Incoming Inspection:** Aircraft manufacturer incoming inspection is the final quality check of all technical authoring phases. Inspectors are the most experienced guys who will have a deep review of authoring and illustrations. These guys are responsible for final delivery to the end customer, nothing but

airliners. After delivery of the task, airliners do the maintenance on the aircraft according to the tasks written by technical authors.

5.1.1: Quality Manager Analytics:

These four quality check parameters must be under the supervision of the quality manager of the technical data business unit. The quality manager must assure the final customer with a high quality of data less prone to errors. He must conduct audits at least once in a quarter of the year. If any rejection comes from incoming inspection, he must do the detailed **Root Cause Analysis** with the respective author and contest with inspectors regarding the issue, if required.

5.2: Implementation of Intelligent Automation (IA) and Artificial Intelligence (AI) for OTD and quality:

We entered an era of Intelligent Automation (IA) as artificial intelligence (AI) gains momentum across enterprises and industries. This is much more than just transferring the tasks from man to machine. The true power of intelligent automation is that traditional methods of operation are fundamentally transformed and what people can achieve together by weaving systems, data and people. Many of the most innovative and transformative technologies are coming from open-source platforms, which ensures that companies desperately need a scalable, effective and safe way to implement best-of-breed AI innovations whenever and wherever they bring maximum value to market.

Intelligent Automation runs with sequential business rules and can-do logical analysis with proper exceptions. Most of the process in the Illustrated Parts Catalogue has a sequential step in without writing any text, unlike AMM. Some tedious processes like downloading source data. Some processes which is straightforward all the time and if there are no process changes. IA will help a lot.

IA makes the authoring with zero error output with 24/7 working access. It improves the On-Time Delivery (OTD) to the airliners and quality of the authoring process. But requires investment in robots, IA developers, Business Analysts (BA), Operations team. Aircraft manufacturer sees the return of investment on IA within one year. Because the IA team takes time to gain maturity in the business process.

Artificial Intelligence (AI) detects the different sets of authoring pattern at least for two months and improves its machine learning process. Suppose the hatching pattern of structural repair manual has different repair damage limits with proper hatching patterns. Authors, illustrators, proofreaders need to observe different hatching patterns and give the limits. With the implementation of AI, it makes the proofreaders and illustrators' life easy for detecting the hatching patters of allowable damaging limits. This is highly sensitive information for aircraft technicians. If this information has any error this may lead to catastrophic incidents.

In a final note, Implementation of Intelligent Automation (IA) and Artificial Intelligence (AI) fastens the delivery i.e., On-Time Delivery improves to the end customers. These latest trending technologies improve and maintain the stringent quality of all the manuals. This decreases the catastrophic incidents of aircraft because of errors in technical maintenance manuals.

Automating mundane tasks will help authors to work on creative and interesting jobs. One must remove the mindset of layoff with the enabling of automation and artificial intelligence. It just helps to replace boring and mundane daily tasks.

5.3: Virtual Reality (VR) and Augmented Reality (AR) adoption for Aircraft Maintenance Technicians (AMTs):

It may be difficult to determine how an aircraft part can be better restored, repaired or replaced in cramped or close conditions, like an avionics cabin or an engine pylon. It's just as easy to fit a pair of virtual reality glasses for digital technologies. The virtual reality (VR) provides real advantages and meaning, allowing scenarios to be replicated and repeated in a stable and expensive world. Digital and improved technology has become more and more interactive and easy to use in recent years and has generated the potential to transform multiple business areas in the whole.

During the design and development phases of an aircraft and during the implementation of modifications or updates. Design engineers need to track and improve the feasibility of the related work. The goal is to ensure high operating trust and to reduce direct airline maintenance costs. This has been usually done using traditional digital technologies such as the DMU (digital mockup) and CATIA (a computer-based modeling

system). The physical examination of complicated objects and processes on the aircraft can be carried out at a later stage in the development, depending on the situation. They have cost, time and engineering experience as an adverse effect in these traditional verification methods.

Airbus ' RHEA (Realistic Human Experience Analysis) rooms have been offering a full-scale, immersive experience focused on the simulated mock-up of the aircraft for many years–where cameras are used to detect sensors mounted on the user's arms and legs, while the helmet shows the body motions accurately. The team has developed now a "portable RHEA" package with a virtual reality helmet, touchpads and 2 infrared cameras that allow uses without leaving their desks operating in a specific interactive environment.

AR device is placing you at the location of an airline mechanic, if there is a problem that prevents you from gaining access or removing a part – the system won't let you do that. The VR-based system has more benefits than portability: knowing how to use it requires only one day. The feedback was amazing, it's a wonderful technology that allows consumers to perform testing and confirmation tasks in just 25 percent of the time needed by conventional CATIA and DMU approaches.

Education and delivery are expected to begin in 2019. They may refine the processes and activities included in the operation bulletins-such as those for pre-designer network configuration evaluations prior to launching retrofits on in-service aircraft. We have engineers in several countries and RHEA's portability and usability help us to install the device anywhere we have citizens, minimizing physical testing on board.

These latest technologies will make aircraft maintenance technicians' life easy by navigating a particular part in a simpler way. It also avoids confusion to find small parts which are placed at multiple locations in aircraft, provided with location unique number.

Chapter 6: Conclusion and its Scope of Future implications

Conclusion:

In contrast, to fasten the delivery to the end customer by increasing the On-Time delivery factor with error-free, aircraft manufacturers can implement Intelligent Automation (IA) and Artificial Intelligence (AI) also to aim at accuracy level. IA setups the robots and has the capability to work for a longer time. But investment needs to be done to set up infrastructure, assign the work to RPA developers, to create a robotic design process by Business Analysts (BA). All repetitive and mundane tasks can be easily eliminated with IA.

Artificial Intelligence (AI) makes deep learning by studying all the different patterns of making technical manuals. AI can be easily scalable to different levels. The maximum level of output can be achieved by IA and AI. These technologies will definitely improve the delivery by fastening the process and make the error-free i.e., so much better quality. Even with four levels of quality check, each task will be aligned and makes error-free.

Virtual Reality (VR) and Augmented reality (AR) are promising technologies that utilize immersive and wearable projection technologies to create innovative applications and implement new ways of viewing documents as digital data and virtual repositories. Nevertheless, other factors such as bulky equipment, the need to place markings on the aircraft, and the need to quickly produce digital content-seem to hamper its successful industrial execution. Aircraft Maintenance Technicians (AMTs) feel more easier when they navigating to a particular component in an aircraft.

Scope of Future implications:

a) Implementation of Intelligent Automation and Artificial Intelligence may be quite challenging in technical authoring, but with proper business rules and known exceptions of all applications is highly possible
b) Improvising the Virtual Reality (VR) concept to aircraft maintenance technicians will really helpful in navigating to the component. Using different application VR needs to be developed.

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All ICAO annexes

All articles of ICAO

APPENDIX

1. AI → Artificial Intelligence
2. AMM → Aircraft Maintenance Manual
3. AMT→ Aircraft Maintenance Technician
4. AR → Augmented reality
5. ATA → Air Transport Association
6. BA → Business Analyst
7. IA → Intelligent Automation
8. ICAO → International Civil Aviation Organization
9. IPC → Illustrated Parts Catalogue
10. OTD → On-Time Delivery
11. VR → Virtual Reality