

# ***Applying International Organization Standardization Guideline for Quality System Management (ISO 9001:2008) in the Aerospace Industry***

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**Abstract** — *The aerospace industry is based on the continuous improvement on processes and product within a high quality. Many companies are working with outsourcing companies to design most of the components that will be used in the final product. These companies should comply with the same quality standards. International Organization Standardization, ISO 9001: 2008 is a standardization system that works with the quality system in the company to achieve a standardized process. This project evaluated each norm that the ISO standard includes and recommended how the system should be implemented to an outsourcing aerospace company and describes some of the result that will be obtained by implementing it.*

**Key Terms** — *Aerospace, ISO 9001:2008, Outsourcing, Standardization.*

## **INTRODUCTION**

Companies are always looking for improvement as part of their plan of increasing the sales return and the quality of the product. In the aerospace is no difference, as part of satisfying the customer need and avoid having products that needs to be returned because the product may have defects or not comply with the standards companies.

Creating a product that meets the requirements, that is economic and will have a long life cycle is a challenge. Customers are looking for a product that meets all the requirements and are low costs. As part of this aerospace companies have decided to use outsourcing companies that are low cost and provide a high quality product. There are companies in India, California, and Puerto Rico. However most of these companies do not have a

program to control the quality management system of the product. It is recommendable that this kind of companies implement a system to control the quality management, one of the reasons is that the highest the quality of the product is the more satisfaction that the customer will have, more work will be sent to the company and less rework has to be performed.

## **RESEARCH DESCRIPTION**

Standardization is what companies are looking for, this way the quality of the product can be always the same and the profit will be improved.

This research is being conducted to demonstrate what the aerospace industry (outsourcing) should take in consideration and what step should take to implement a system that standardize the requirements in the quality system, the International Organization Standardization Guideline for Quality System Management (ISO) 9001. The benefit of implementing this standardization program will be described in this research.

## **RESEARCH OBJECTIVE**

The principal objective is to create a guide with the steps and the requirements that ISO 9001 has established, applied in an outsourcing aerospace company. The expectation for this guide is that can be used in any company that provides outsourcing services in the aerospace field.

## **RESEARCH CONTRIBUTIONS**

This research is intended to guide outsourcing companies to implement the ISO 9001 program. The implementation of this program will create new

opportunities to the company when is applied. The company can extend the service that is provided in the company, since the process is standardize. There are other contributions that can be obtained by implementing the system, when the company decides to implement the quality control program it helps to have more costumers since there are companies that require the ISO system to sign up contracts with the outsourcing company.

## LITERATURE REVIEW

The aerospace industry is an industry that is based on quality. There are many factors that need to be taken into consideration to ensure a high level of quality is met. The aerospace industry has a six sigma level; this means that there is a minimum margin of error.  $6\sigma$  is a statistical term that measures how far a process deviates from perfection [1]. Based on this a company that will provide an outsourcing service for an aerospace industry needs to be at the same level to ensure that even though the product or the service is received by an outsourcing company it will comply with the expected quality standards. That is the main reason that a company that will provide a service in this field should have a quality management system (QMS). QMS is can be defined as “A set of coordinated activities to direct and control an organization in order to continually improve the effectiveness and the efficiency of it performance” [2]. This enables it to achieve the goals and objectives set out in its policy while providing consistency and satisfaction.

An established quality system should meet certain requirements with the purpose of ensuring that it is working correctly. For this reason the International Standard Organization (ISO) has established criteria to certify the QMS. This is known as ISO 9001: 2008.

It is not the intent of this International Standard to imply uniformity in the structure of quality management systems or uniformity of documentation. This means that ISO aims to certify that the quality management system (QMS)

established in the company meets ISO requirements based on business needs. [3]

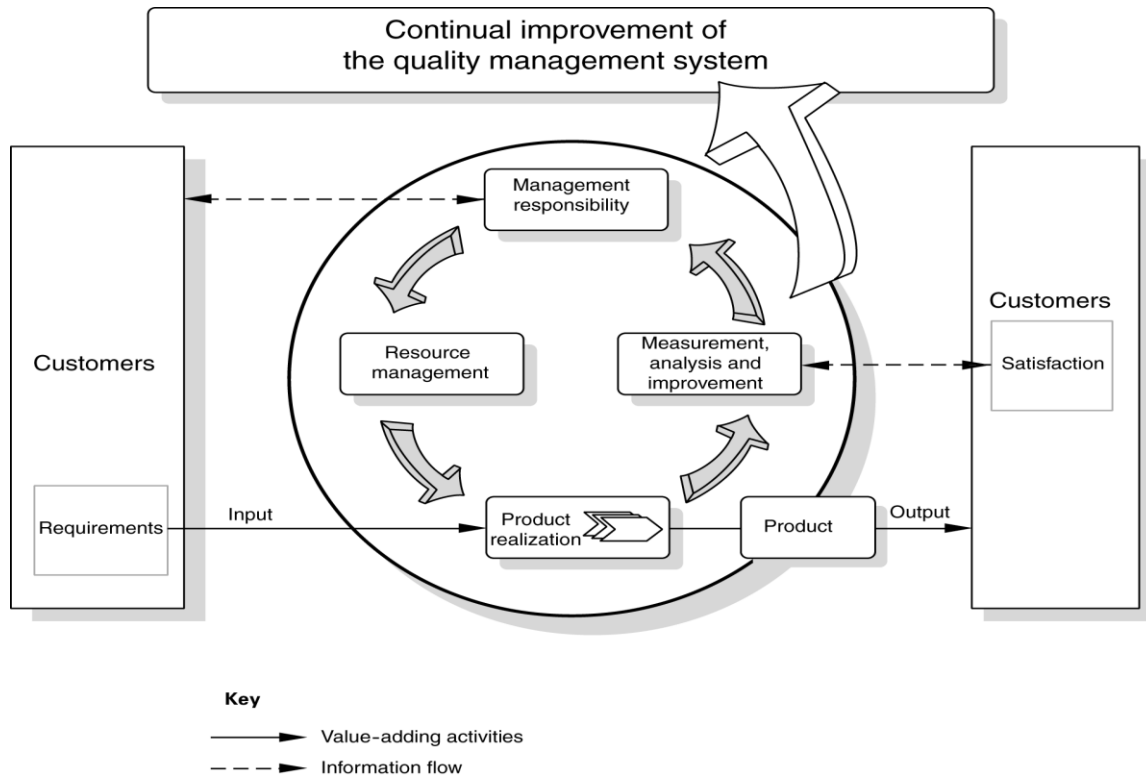
This International Standard promotes the adoption of a process when is developing, implementing and improving the effectiveness of a quality management system, to enhance customer satisfaction by meeting customer requirements. For an organization to function effectively, it has to determine and manage numerous linked activities. An activity or set of activities using resources, and managed in order to enable the transformation of inputs into outputs, can be considered a process. Often the output from one process directly forms the input to the next. The application of a system of processes within an organization, along with the identification and interactions of these processes and their management to produce the desired outcome, can be referred to as the “process approach” [3].

An advantage of the process approach is the ongoing control that it provides over the linkage between the individual processes within the system of processes, as well as over their combination and interaction.

When used within a quality management system, such an approach emphasizes the importance of:

- Understanding and meeting requirements.
- The need to consider processes in terms of added value.
- Obtaining results of process performance and effectiveness.
- Continual improvement of processes based on objective measurement.

The model of a process-based quality management system shown in Figure 1 illustrates the process linkages presented in ISO 9001:2008 Clauses 4 to 8. This illustration shows that customers play a significant role in defining requirements as inputs. Monitoring of customer satisfaction requires the evaluation of information relating to customer perception as to whether the organization has met the customer’s requirements. The model shown in Figure 1 covers all the



**Figure 1**  
**Model of a Process-based Quality Management System**

requirements of this International Standard, but does not show processes at a detailed level [3].

This International Standard specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide products that meet customer and applicable statutory and regulatory requirements and aims to enhance customer satisfaction through the effective application of the system including processes for continual improvement.

The ISO system can be applied to any organization. All requirements of the international standard are generic that way, regardless the type, size, product or service, it can be applied. On occasions there are requirements that cannot be applied due to the nature of the organization and their product, in this particular case this can be considered as exclusion.

Where exclusions are made, claims of conformity to this International Standard are not acceptable unless these exclusions are limited to

requirements within ISO 9001:2008 Clause 7, and such exclusions do not affect the organization's ability or responsibility to provide a product that meets customer and applicable statutory and regulatory requirements [3].

There are documents that are indispensable to have. One of the documents that are indispensable to have is the ISO 9000, Quality management systems – Fundamental and vocabulary. Also all of the terms and definitions given in ISO are also regarded as such.

In order to implement the standardization system the organization should meet certain requirements in the quality system. The organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this International Standard. The organization needs to determine their processes, their sequence and interactions needed for the quality management system and its application. The organization needs to determine

the criteria and methods required to ensure that operation is effective. It also needs to ensure the availability of resources and information required to support the operation and monitoring of these processes. The process needs to be monitored to make sure that everything is working as established. Management needs to create a system to collect and analyze data. Based on the collected data the organization needs to implement action if this is required.

Applying ISO will involve management; this means that management will have certain responsibilities to ensure that the process will work in an efficient way. Management needs to provide the appropriate environment and supply the all of the necessary material. They will need to create a schedule to perform internal audits, receive customer feedback and create plans for the products that do not comply with the customer's requirements.

## **RESEARCH METHODOLOGY**

There are many ways to implement a quality system in a company. In this project the methodology will consist on certain steps that will prepare the company procedures to research the level that an ISO 9001: 2008 standard requires. One of the requirement is to have a defined a quality manual and policy. Other of the requirement is to have a defined organizational chart. In the organization chart in each department, it will be defined the general manager, department managers supervisor and employees. It will help to define and understand how things are going to be reported.

After the organization chart is properly defined, the company needs to create a roadmap. This will be based on the company mission, vision, quality manual and policy. The other company departments will create their own roadmap based on the company roadmap.

To get a real vision about the actual company's quality control and standardization in their processes and procedures the company should perform an internal audit in all departments. The

reason for this is to see which areas should be directly and indirectly impact by the process of implementation of the quality control system. A document form should be created showing all ISO 9001:2008 standards. This form should help the company to state which areas complying or not comply with the requirements. Also, it will communicate which of the non-compliances are minor or mayor offenders. The form will also state which standards are not applicable and why.

After all areas that needs to be improved has been identified to meet the minimum ISO standard the company should establish a corrective and preventing action plan (CAPA). This part of the company's assessment to fix all impacted areas and avoid any future issues. To ensure that all of the proper documentation, records, forms instructions, everything is properly coordinated and everything that ISO 9001:2008 requires, there will be two team that will work for this a Point Team and a Steering Team. The point team will be in charge of documenting the new process, all of the documents, records, forms and work instructions. The key member of the point team will compose the steering team; this team will coordinate efforts of the point teams. These teams will train staff members on how the new process will work. The employees will be trained and informed on how the new process will work to avoid any confusion [4]. In all departments specific peoples will be selected to be train and certified as an ISO internal auditor. The internal auditor will be trained by an ISO certified auditor and will be in charge of auditing the correspondent department and inform the areas that are not complying periodically and create a plan to improve and avoid future issues

After the new processes are complete, Internal Audits and Management Review meetings will be established. The Internal Audits will be performed biweekly; the intention is to evaluate the company and see improvements if any. The Management Reviews will be performed biweekly to evaluate and discuss the data obtained in the previous audit. The process will be put on course and evaluated for one year, this will allow the company to perform

sufficient audits, evaluate the data and implement action plans. All of the records need to be properly documented to prove the improvement and that the system works properly.

The company will evaluate the process after six months. Based on the results the process will be evaluated but by an external company certified by

ISO, the objective is to get recommendations if necessary and get the ISO certification.

Figure 2 shows a Gant Chart representing the task and the time of each, these are the required tasks to obtain the ISO 9001:2008 certification.

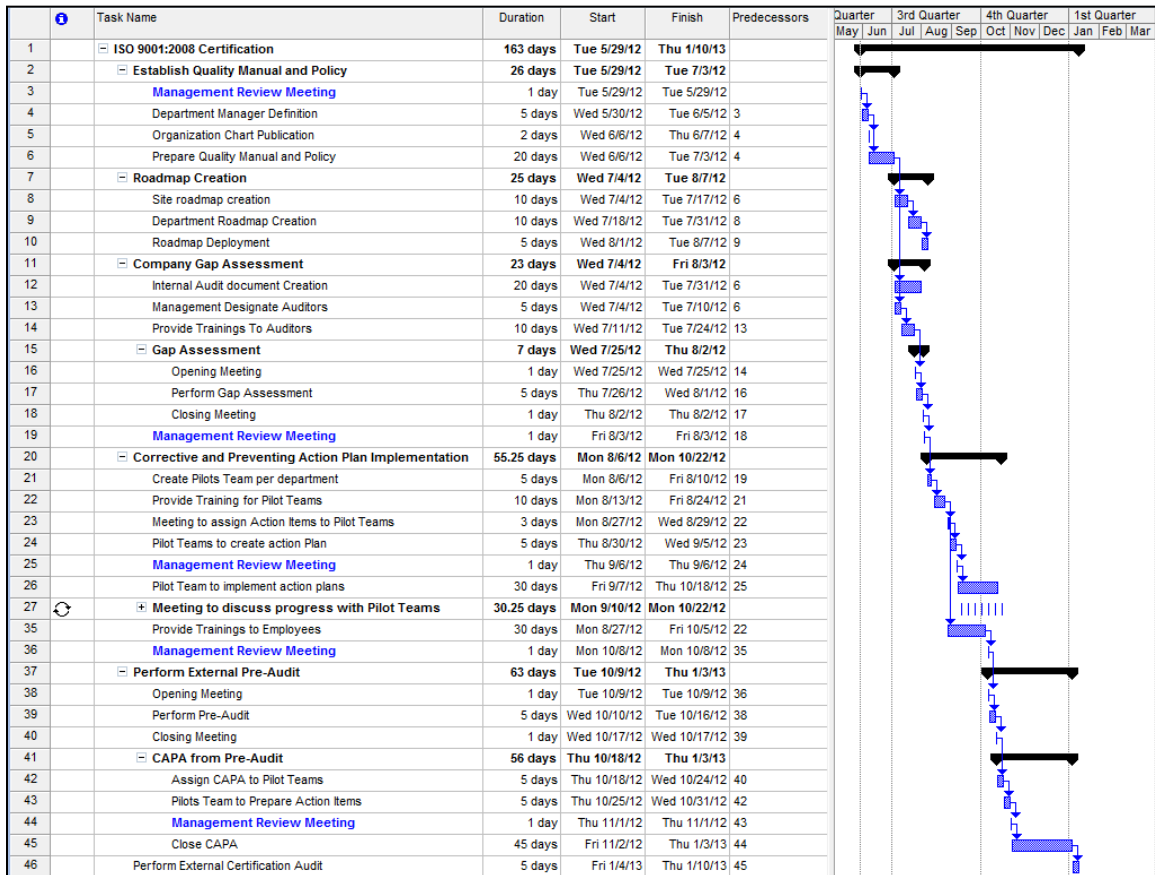


Figure 2  
ISO 9001:2008 Gant Chart

This task time can be modified depending of the departments that the company has. The external certification audit will depend on the gaps that are found in the pre-audit performed by the same external company that will certify the aerospace company.

### RESULTS AND DISCUSSION

As part of the implementation of the ISO 9001:2008 system all of the requirements were evaluated to create a proper guide to follow.

The company should establish a proper quality manual and policy and the manual should comply with all of the ISO requirements. The organization shall establish and maintain a quality manual that specifies the scope, including details and justifications, as well as, documents procedures established for the quality management system or references them and a description of the interaction between all processes of quality management.

In terms of content, as a minimum, the quality manual must include the following:

- The company's quality policy (showing the company's commitment to quality and the critical to quality CTQ).
- An explanation of the company's documentation structure and customer communication.
- Policy statements demonstrating management's intention to comply with ISO 9001 requirements. The policies must cover all areas of the ISO standard and be traceable to them. These policies must include:
  - How management expects company operations to function.
  - Who is responsible to implement these expectations (by function or job title).
  - Where and when the policies are applicable within the organization.
  - What interdependencies exist between functions and the processes.
- References to the "second tier" operating procedures of the company.
- Assignment of one or more "management representatives" for quality in the organization.

A description of the company's organization in the form of an organizational chart, top level of the company only, is recommended. This document would contain no proprietary/confidential information and is available to the customer. The company should make a distinction between the quality manual and the operation procedure. This document is intended to communicate management expectations (in the quality area), demonstrate the compliance with the ISO 9001 requirements and to serve as a measure for compliance. [5]

Based on the quality manual and the quality policy the company needs to create a roadmap. There will be two roadmaps the site wide and the departmental. The departmental is based on the site roadmap and on the department's needs. The roadmap needs to be deployed to the entire staff and have it available for future reference.

To know how the company is currently working, the company needs to create a gap

assessment. The audit document needs to be created based on all ISO 9001:2008 requirements. Management needs to designate and provide trainings to the auditors that will perform the audits. The company needs to schedule meetings to discuss the results. It is expected to receive feedback from the group and create corrective and preventing action plans.

The planned corrective and preventive actions need to coincide with everything obtained from the audits, and be put into action within approximately fifty five days. The number of days can change depending upon the audit results. After the company is sure that all of the actions were covered management needs to perform an internal review and document that all of the actions were closed.

The company needs to submit an external evaluation as a pre-assessment from a company that is certified by ISO 9001:2008; this company will evaluate the company using the ISO requirements. The company that will perform the pre-assessment needs, and create a report with all of the action items. It is necessary to create a corrective action and preventing action plan (CAPA) from the pre-audit to close all the action items.

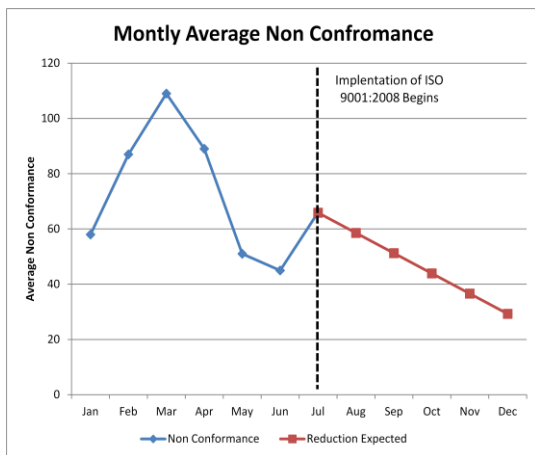
The company will then be submitted to the official assessment. Having everything under the ISO requirement the company will receive the certification which will create new opportunities for the growth of the business. The company will be submitted to reassessment year after year with the purpose of making sure that the company is working properly according to the ISO system.

The importance of implementing a quality system to an aerospace outsourcing company is to make sure to establish a communication with the customer. Having the proper communication with the customer ensure the delivery of the product with high quality and what is expected. In outsourcing aerospace company the product is something that is delivered to the customer within certain specifications. The part should meet all of the requirements established (structural, and safety) to make sure that it will work properly, should fit in the engine with the proper clearance (fit checks)

and meet the manufacturing requirements and also it is imperative to provide the correct model so it can be sent to the supplier that will manufacture the parts. These are the areas that critical for the company and that the quality system will address.

There are many other advantages that the ISO systems will create as a result of implementing it. When the company gets the ISO certification it will open opportunities to promote international trade, increase profit, standardization and many other areas.

In Figure 3 is shown the data obtain from a design department. This data represent the non conformance product after inspection. This data is from January 2011 to June 2012, between this dates the company is running business without ISO 9001:2008. What is expected after implementing the ISO system is to reduce the non conformance in the inspection process by a 60% by the end of the year. The products will continuously improving using the system it is expected to reduce 5 percent from the average, there will be moments that other defects may come up and those will be worked and resolved as well with the system.



**Figure 3**  
**Monthly Average Non Conformance Product**

As part of the continuous improvement of the company a feedback from the customer will be received each three month. Figure 4 demonstrate the data obtain from the same design department from January 2012 to June 2012, from June 2012 to

December 2012 is the result expected after implementing the ISO system. The feedback consists of the satisfaction, delivery and quality of the product. This data will be recollected and analyzed for new areas of improvement. The customer satisfaction, delivery and quality are expected to improve periodically. The feedback analysis can be modified within the necessity of the company.



**Figure 4**  
**Customer Market Feedback Analysis**

## CONCLUSIONS

The result of this project is considered successful. The research was conducted to show what should take in consideration and what step should take to implement International Organization Standardization Guideline for Quality System Management (ISO) 9001:2008 into an outsourcing company that provides services in the aerospace industry.

The document includes the necessary steps to implement the ISO system in the company. In additions it provides the benefits that the company will receive implementing this. It shows that the use of ISO will open new opportunities on the market and the areas that it will address such as delivery and meeting the requirements. The document demonstrates what is expected to see after the company implements the system based on data

collected and how it will impact customer satisfaction, quality and the delivery of the product.

### **LIMITATIONS**

This project was created as a guideline; due to limited time the execution could not be implemented. The document should be presented to the company and must be evaluated by supervisors and managers. After approval incorporate into the company.

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