UNIVERSITAS INDONESIA

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NADCAP ACCREDITATION IMPLEMENTATION AND QUALITY IMPROVEMENT

TESIS

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FAKULTAS TEKNIK
PROGRAM STUDI TEKNIK SIPIL
DEPOK
JULI 2012

UNIVERSITAS INDONESIA

IMPLEMENTASI AKREDITASI NADCAP DAN PENINGKATAN MUTU

TESIS

Diajukan sebagai salah satu syarat untuk memperoleh gelar Magister Teknik

ARPANDI
1006787924

FAKULTAS TEKNIK
PROGRAM STUDI TEKNIK SIPIL
KEKHUSUSAN TRANSPORTASI
DEPOK
JULI 2012

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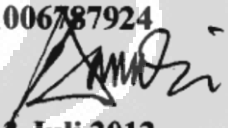
Tanda Tangan	**:** 
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KATA PENGANTAR

Puji syukur saya panjatkan kepada Tuhan Yang Maha Esa, karena atas berkat dan rahmat-Nya, saya dapat menyelesaikan Tesis ini. Penulisan Tesis ini dilakukan dalam rangka memenuhi salah satu syarat syarat untuk memperoleh gelar Magister Teknik Jurusan Teknik Sipil pada Fakultas Teknik Universitas Indonesia. Penulis menyadari bahwa, tanpa bantuan dan bimbingan dari berbagai pihak, dari masa perkuliahan sampai pada penyusunan Proposal Tesis ini, sangatlah sulit bagi saya untuk menyelesaikan Tesis ini. Oleh karena itu, saya mengucapkan terima kasih kepada:

1. Prof. Abderafi Charki selaku dosen pembimbing yang telah menyediakan waktu, tenaga, dan pikiran untuk mengarahkan saya dalam penyusunan tesisi ini;
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Akhir kata, saya berharap Tuhan Yang Maha Esa berkenan membalas segala kebaikan semua pihak yang telah membantu. Semoga Tesis ini membawa manfaat bagi pengembangan ilmu.

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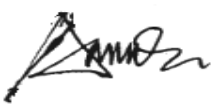

(Arpandi)

ABSTRAK

Nama : Arpandi
Program Studi : Teknik Sipil
Judul : Implementasi Akreditasi NADCAP dan Peningkatan Mutu

Untuk mengetahui secara langsung beberapa aspek penerapan NADCAP akreditasi dan Peningkatan Mutu. Dasar Penelaahan atas informasi yang dikumpulkan dengan kuesioner survei, tinjauan komprehensif NADCAP Akreditasi dan Peningkatan Mutu. Dari hasil survei kita bisa memberikan gambaran singkat mengenai isu-isu terkait dalam penerapan Akreditasi NADCAP. Secara umum kita dapat melihat penerapan akreditasi NADCAP dominan diterapkan di berbagai bidang Chemical Processing (CP), Nondestructive Testing (NDT) dan Heat Treating (HT). Responden percaya bahwa penerapan Akreditasi NADCAP brkontribusi keselamatan kedirgantaraan dengan persentase 72%. Aplikasi utama dari akreditasi NADCAP karena pelanggan membutuhkan (*costumer require*). Kendala utama dalam penerapan akreditasi NADCAP adalah Interpretasi Standar Sulit (*Difficult Interpretation Standard*) . Sebagian besar responden berpendapat bahwa pengaruh NADCAP Akreditasi signifikan terhadap peningkatan Kualitas. Dari hasil survei kita dapat mengetahui pengaruh NADCAP Akreditasi terutama pada kualitas.

Kata kunci:
NADCAP, Akreditasi, , Peningkatan, kualitas

ABSTRACT

Name : Arpandi
Study Program : Civil Engineering
Title :NADCAP Accreditation Implementation And Quality Improvement.

To find out directly some aspects of the application of NADCAP accreditation and Quality Improvement . The Review base on information collected by survey questioner , a comprehensive review NADCAP Accreditation and Quality Improvement. From the survey results can we give a brief overview of related issues in the application of NACAP Accreditation . In general we can see the application of the NADCAP accreditation dominantly applied in many fields of Chemical Processing (CP), Non Destructive Testing (NDT) and Heat Treating (HT) . Respondents believed that the application of NADCAP Accreditation aerospace safety contribute a percentage of 72%. The main applications of the NADCAP accreditation due to costumer require. Major obstacle in the application of the NADCAP accreditation is Difficult Interpretation Standard. Most respondents argued that the NADCAP Accreditation significant influence on the increase in Quality. From the survey results we can determine the effect of NADCAP Accreditation particularly on quality .

Key words:
NADCAP, Accreditation, Improvement, Quality

DAFTAR ISI

DAFTAR TABEL

DAFTAR GAMBAR

CHAPTER 1
INTRODUCTION

1.1 Background

Currently manufacture aerospace industry is growing giving rise to relationship between manufacture supplier and primes contractors . The global aerospace and defense manufacturing industry is worth $170 billion, according to the Society of Manufacturing Engineers. The industry involves the manufacture of defense goods, including information systems, watercraft, aircraft and weaponry (www.reportlinker.com). In order for the resulting product as expected and in accordance with existing standards imposed NADCAP (*National Aerospace and Defense Contractors Accreditation)* . NADCAP is a global standards program for aerospace, engineering, defense and related industries, Nadcap focuses on process performance as well as AS9100 (aerospace standard) the Standards for Quality Management.

NADCAP program is a part of PRI (Performance Review Institute) which was created in 1990 by the Society of Automotive Engineers and is headquartered in Warrendale, Pennsylvania (USA) . NADCAP's membership of "prime contractors" convene to coordinate industry-wide standards for special processes and products. Through the Performance Review Institute, NADCAP provides independent certification of manufacturing processes for the industry. PRI's mission is to "provide international, unbiased, independent manufacturing process and product assessments and certification services for the purpose of adding value, reducing total cost, and facilitating relationships between primes and suppliers (wikipedia.org).

NADCAP Accreditation has a good purpose for aerospace industry and defense equipment which aims to maximize efficiency and minimize the production process and financing so it can be improves the quality of product. This study aims to understand the reasons implementation of NADCAP standard and effect NADCAP Accreditation towards improving the quality and implementation reasons NADCAP Accreditation.

1.2 Problem Statement

Many aerospace suppliers and defense equipment companies have been implemented NADCAP Accreditation, associated case autor would like to know and analyze :

1. What the reason for the implementation of NADCAP Accreditation?
2. Are NADCAP Accreditation gives a significant effect on quality improvment?

1.3 Objective and Scope

The Objective of this study is to find out directly some aspects of the application of a significant impact on the company suppliers NADCAP accreditation in manufacturing aircraft components. The author want to explore in more depth as the reasons companies are looking for NADCAP accreditation .

1.4 Authenticity Research

In conducting this research, the author presents of the results of a survey conducted itself. If using the research results that have been made by others, will include a reference source. The few references which is used in this study as follows :

1. Josep G. Pinto , . 2011, Nadcap Program Introduction , Performance Review Instituute.
2. Juran Institute, 1999, Juran's Quality Handbook, Fifth edition, McGraw-Hill Companies, Inc.
3. Garvin, D., 2000, A Learning in Action : A Guide to putting the Learning Organization to work . Harvard Bussines Work..

1.5 Systematical Of Writing

In writing the report, necessary to the arrangement or matters to be discussed in it. Systematical is inserted in order the things discussed in this report clearly outlined and directed, in preparing this report the author performed a systematic discussion into 5 chapters, each chapter is further divided in sub-section as described below :

Chapter 1 Introduction

Chapter I deals with the background NADCAP, research Statement, research objectives and scope, Systematical Of writing.

Chapter 2 Literature Review

Chapter 2 focus on the literature review associated with the references used in this study. in this second chapter describes a lot of explanation about NADCAP, associated standards and theories related to the purpose of study.

Chapter 3 Research Methodology

Chapter 3 is an explanation of the process and what activities are performed, in chapter 3 includes a model of research, research methods and data collection methods in data processing for analysis

Chapter 4 Data Analysis

Chapter is Analyzing the results of data collection conducted by the research methodology conducted.

Chapter 5 Conclusion

Contains the conclusions obtained from this research.

CHAPTER 2
LITERATURE REVIEW

2.1 NADCAP

According to (Blonded, 2011) NADCAP special process of *Aerospace Quality Systems*, the leading worldwide cooperative program of major companies designed to manage a cost-effective consensus approach to special processes & products and provide continual improvement within the aerospace & automotive industries. "The NADCAP vision is to "develop a world-class special processor supply-base for the global aerospace industry using a *cost-effective* industry managed accreditation process". Without successful teamwork built on mutually trusting relationships, the Nadcap program simply would not have the fuel to make its vision a reality. Here's to coming together, sharing together, working together, and succeeding together .

Nadcap Structure Organization structure is very simple, which comprises four levels of importance , as seen in Figure 2.1.

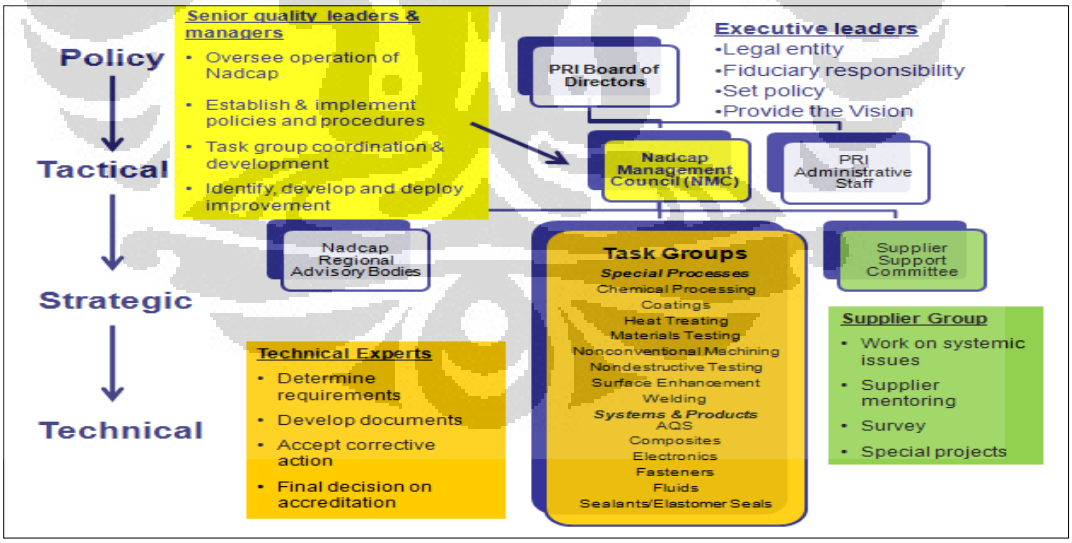

Figure 2.1 Organization Structure

Source : Nadcap Supplier Introduction & Tutoria 23 February 2010

2.1.1 PRI (Performance Review Institute)

PRI (Performance Review Institute) is a global provider of customer focused solutions designed to improve process and product quality by adding value, reducing total cost and promoting collaboration among stakeholders in industries where safety and quality are shared goals. Created in 1990 by SAE Inc., PRI is a not-for-profit organization. It exists to advance the interests of the mobility and related industries through development of performance standards and administration of quality assurance, accreditation, and certification programs as well as related activities for the benefit of industry, government, and the general public (www.pri-network.org).

NADCAP program was created in 1990 by the Society of Automotive Engineers and is headquartered in Warrendale, Pennsylvania (USA). NADCAP's membership of "prime contractors" convene to coordinate industry-wide standards for special processes and products. Through the Performance Review Institute, Nadcap provides independent certification of manufacturing processes for the industry. PRI's mission is to "provide international, unbiased, independent manufacturing process and product assessments and certification services for the purpose of adding value, reducing total cost, and facilitating relationships between primes and suppliers." Branch offices of NADCAP are located in London, Beijing, and Nagoya (en.wikipedia.org).

Table . 2.1 The Nadcap Prime Contractors include

• Airbus • Alenia Aeronautica • Astrium • Avio • BAE Systems • Ball Aerospace • Bell Helicopter • Boeing • Bombardier • Cessna Aircraft • DCMA • EADS CASA • Eurocopter • GE Aviation • General Dynamics • General Services Administration (GSA)	• Goodrich • Hamilton Sundstrand • Hawker Beechcraft • Héroux-Devtek • Honeywell Aerospace • Honeywell • Industria de Turbo Propulsores • Israel Aerospace Industries • Latecoere • Liebherr Aerospace • Lockheed Martin • MD Helicopters • MTU Aero Engines • Northrop Grumman • Parker Aerospace	• PFW Aerospace • Pratt & Whitney • Raytheon • Rockwell Collins • Rolls-Royce • Safran • Sikorsky Aircraft • Sonaca • Spirit AeroSystems • Textron Systems • Thales • U.S. Airforce • United Space Alliance • Volvo Aero • Vought Aircraft

source : Airbus EASA Workshop – May 10, 2011

2.1.2 AS9100 The Standard for Aerospace

AS9100 is the quality management standard specifically written for the aerospace industry. It had long been considered by some entities, such as the Federal Aviation Administration (FAA), that the ISO 9000 series of standards were inadequate in terms of ensuring quality and safety in the "high risk" aerospace industry. AS9000 was first published in August 1997 and was written with input from a number of large aerospace prime contractors including Lockheed Martin, Northrop Grumman and GE Aircraft Engines and was written against the clauses of ISO 9001:1994. In late 1999, the first revision of AS9100 was published by The Society of Automotive Engineers (SAE International) with

input from the American Aerospace Quality Group (AAQG) and support from the International Aerospace Quality Group (IAQG) and the Society of British Aerospace Companies (SBAC). The current version of AS9100 aligns the standard with ISO 9001:2008 and has extra requirements regarding Regulatory Compliance and the following aerospace-sector specific requirements (www.isoqar.com) :

- Configuration management
- Design phase, design verification, validation and testing processes
- Reliability, maintainability and safety
- Approval and review of subcontractor performance
- Verification of purchased product
- Product identification throughout the product's life cycle
- Product documentation
- Control of production process changes
- Control of production equipment, tools and numerical control machine programmes
- Control of work performed outside the supplier's facilities
- Special processes
- Inspection and testing procedures
- Methods, resources and recording
- Corrective action
- Expansion of the internal audit requirements in ISO 9001: 2000
- First article inspection
- Servicing, including collecting and analysing data, delivery, investigation and reporting and control of technical documentation
- Review of disposition of non conforming product

As a result, ISO 9001:2000 is totally encompassed within AS9100 with these additional requirements applied specifically addressing aviation safety concerns. It is also the only standard which considers the role of the Regulatory Authorities and so many of the "add-ins" are directly traceable to FAA Regulations FAR Part 21 (Certification Procedures for Products and Parts), Part

39 (Airworthiness Directives) and Part 45 (Identification and Registration Marking).

However it must be remembered that AS9100 remains complementary to contractual and applicable law and regulations. Any business implementing an AS9100 compliant quality system must ensure the additional requirements of their customers, regulatory agencies (FAA, JAA etc) and local, state and national laws are referenced within the systems documentation. There is now a family of the AS9100 Standards applicable to different areas of the aerospace industry which includes the following (www.isoqar.com) :

- AS 9101 - Quality System Assessment (the checklist corresponding to AS9100 rev B)
- AS 9102 - Aerospace First Article Inspection Requirements
- AS 9104 - Standard for overall control of Aerospace Scheme
- AS 9110 - Requirements for Maintenance Organisations
- AS 9120 - Requirements for Stockists and Distributors

The Benefits of Implementing AS9100

Implementing AS9100 will motivate staff by defining their key roles and responsibilities. Cost savings can be made through improved efficiency and productivity as product or service deficiencies will be highlighted. From this, improvements can be developed, resulting in less waste, inappropriate or rejected work and fewer complaints. Customers will notice that orders are met consistently, on time and to the correct specification. This can open up the market place to increased opportunities. An additional benefit due to the standardised processes and procedures is the reduction in multiple expectations due to the consistency in verification (www.isoqar.com) .

How to Implement AS9100

- Identify the requirements of AS9100 and how they apply to the business involved.

- Establish quality objectives and how they fit in to the operation of the business.
- Produce a documented quality policy indicating how these requirements are satisfied.
- Communicate them throughout the organisation.
- Evaluate the quality policy, its stated objectives and then prioritise requirements to ensure they are met.
- Identify the boundaries of the management system and produce documented procedures as required.
- Ensure these procedures are suitable and adhered to.
- Once developed, undertake internal audits to ensure the system carries on working.

Why Seek Certification to AS9100

- Registration to AS9100 by an accredited registrar shows commitment to quality and customers and a willingness to work towards improving efficiency.
- It demonstrates the existence of an effective quality management system that satisfies the rigours of an independent, external audit and addresses the additional safety, reliability and quality concerns specific to the aerospace industry.
- An AS9100 certificate enhances company image in the eyes of customers, employees and shareholders alike.
- It gives a competitive edge to an organisation's marketing.
  (www.isoqar.com)

2.2. Roadmap for NADCAP accreditation

According to (Wiliam, 2011) Accreditation requires a complete understanding of the AC7108D checklist, which is the bible of suppliers, auditors and chemical processing staff engineers at the Performance Review Institute (PRI), and the task group of primes and suppliers who administer the checklist.

- Step 1

  Your company must have an acceptable quality system in place or verifiable at your initial audit. This system is administered by the PRI, which acts as registrar for the system. Usually the architecture of a "quality system" has several tiers that support the complete process control. The first tier is the quality manual (AC7004 or AS9100). It serves as your mission statement or "statement of core philosophy." Below this core document is the procedures manual. The third tier should be specific work instructions which describe in detail how each procedure is actually performed. The fourth tier should be the forms that verify compliance with any procedures or work instructions requiring sign-off or verification of compliance with the work instructions, procedure or logs used to verify data. The AC7108D checklist uses the word "procedure" nearly 100 times, which should alert you to the need to have robust, revision-controlled procedures in every phase of your operations. Accreditation is difficult because Nadcap imposes plant-wide process control of everything happening in your plant through the checklist. But before commencing on the checklist journey, the author recommends registering with PRI. With full access to the eAuditnet website, one can access a wealth of resources. Print out copies of the AC7108D checklist for your Nadcap team. Bring people into the process from all parts or your organization. Involve employees early and thoroughly. Don't make the mistake of allowing people to regard the Nadcap audit as something residing in the domain of the quality department and not the concern of others.

- Step 2

  Section 2 of the checklist, "Instructions to Supplier to be Audited," imposes a requirement that the supplier conduct a self-audit. While this is described as a critical first step, the supplier and his Nadcap team need to have studied the checklist and need to understand the myriad requirements before conducting the self-audit. Do the self-audit honestly and with a critical eye to whether you can answer "yes" to the checklist questions. Your auditor is going to dig in to areas of doubt. The rest of section 2 is self-explanatory, but do not ignore anything.

- Step 3

  Section 3 of the checklist focuses on the "General Quality System" and covers everything from process integrity through shipping and receiving to internal quality audits. It begins with questions about process integrity and immediately incorporates Appendix A by reference. Be sure to study Appendix A and its requirements for continuous improvement as managed by a "Control Plan." The view is that if the supplier is not improving, then the opposite is probably taking place. The subsections of Section 3 cover much of what goes on in the chemical processing plant—the physical activity that is subject to "procedures" and "process control." You will want to create systems of procedures and forms that give your company control and verification of compliance with all of these sections. Finally, Section 3 addresses internal quality audits. Essentially, we come full circle in Sections 2 and 3 concerning the importance of internal audits/self-audits. Effective self-audits will identify objective evidence to show compliance with a checklist question or will honestly identify a shortcoming that needs to be corrected.

- Step 4

  Section 4 of the AC7108/D checklist deals with periodic testing, lot testing and solution analysis. These disciplines, often set out in industry specifications, establish methods to measure the results of a process and control the chemistry used in the process.

- Step 5

  Section 5 deals with process equipment control and maintenance. There are several sections which may not apply and can be marked NA, depending on what your processes are. Be sure to check closely. After you have completed your journey through the first five sections of the checklist, have a thorough understanding of the requirements and have achieved compliance with the requirements of these sections, turn your attention to job audits. Download "The Chemical Processing Auditor's Handbook" and review it to get an understanding of the manner and method of the Nadcap auditor.

- Step 6

  Section 6 is the part of the checklist auditors use to determine compliance with specifications and the checklist when processing jobs. This is where the rubber meets the road. Perform your job audits using the Section 6 form, but also use the remainder of the checklist. At the end of the job audit, verify compliance with specifications completely—all elements of the specification. When you have findings, which you should, generate corrective actions for the findings. This allows for documentation of what has been done through the appropriate use of continuous improvement methodologies. Be sure to follow up on the corrective actions to be sure they were effective and retain evidence of having done them. When you have your real audit, don't be surprised when there are findings, and don't engage in arguments with the auditor. The auditors are trained to be objective and to look for objective evidence upon which they can answer "yes" to the checklist. If the evidence is inadequate (existence, compliance, adequacy) then the answer will be "no." Auditors see black and white. We can see the process flow as figure 2.2 below.

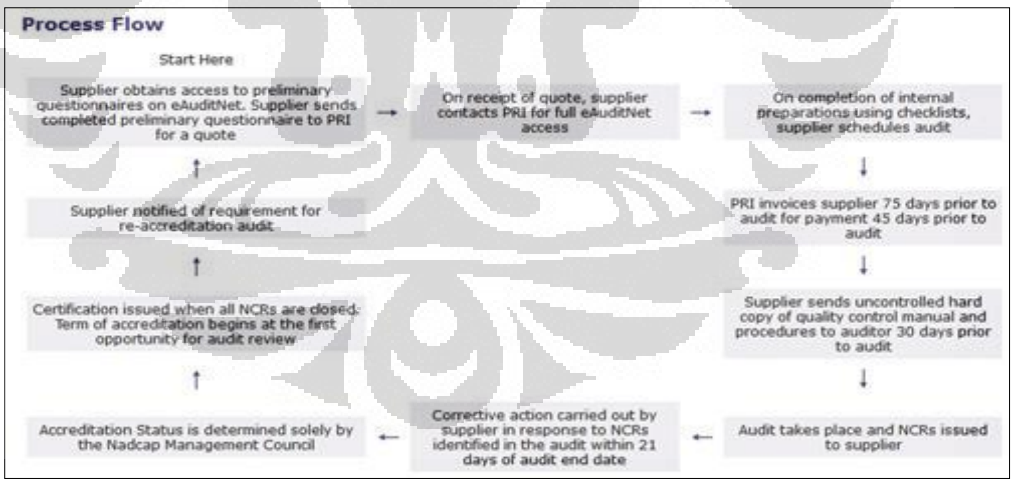

Figure 2.2 Process Flow NADCAP Accreditation

Source : www.pfonline.com

According to (Josept, 2011) NADCAP procedure hierarchy there are six stages starting with the Aerospace Standard which documents the requirements for implementing Nadcap industry consensus-based accreditation programs

(AS7003), Document stating the quality policy and describing the quality system of the organization (Quality Manual), Documents detailing the specific procedures by which Nadcap operates NOP (Nadcap Operating Procedure), Documents describing the scope and general operating procedures for each specific PRI/Nadcap commodity program, Documents detailing specific procedures by which PRI/Nadcap Staff operates NIP (Nadcap Internal Procedure), Defines the role and responsibilities for Nadcap Auditors, and provides technical and administrative clarifications to facilities and standardizes the audit process (Audit Handbook). As in figure 2.3 below :

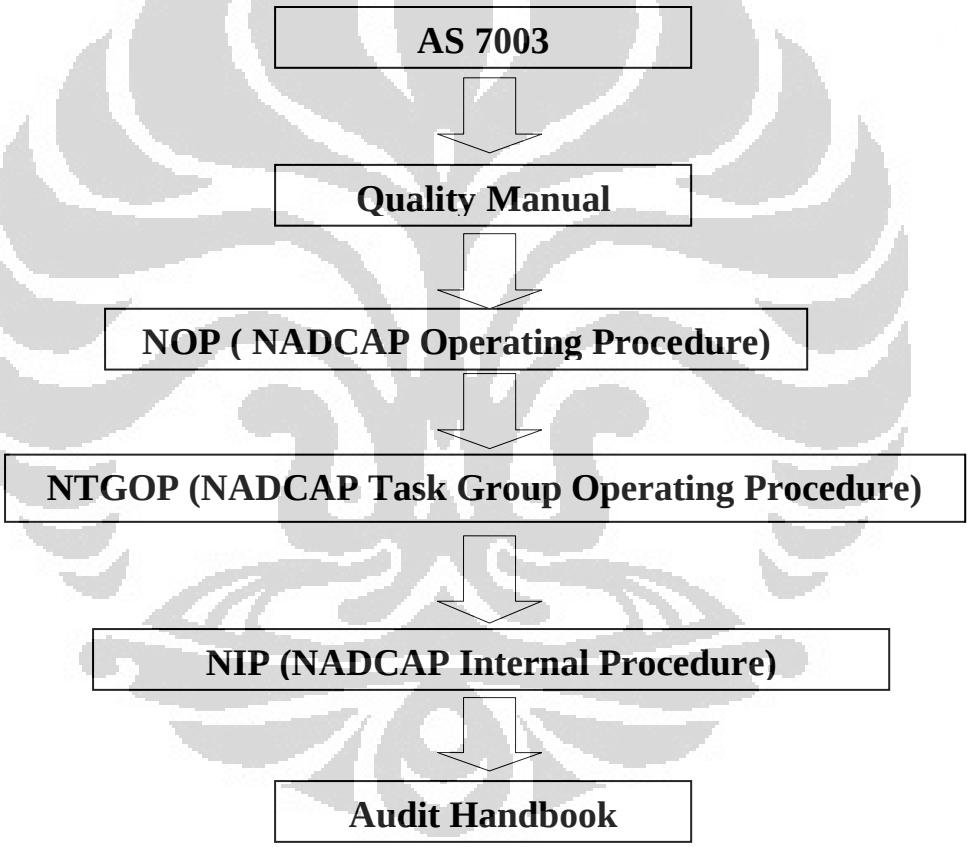

Figure 2.3 Nadcap Procedure Hierarchy

Source : Joseph G.Pinto, Performance Review Institute

2.3 NADCAP Accreditation and ISO / CEI 17025

Nadcap has established an accreditation program that includes Aerospace Quality Systems. The Aerospace Quality Systems Task Group recognizes the industry developed Aerospace Quality Systems standard AS/EN/JISQ9100 and

AS/EN9110. In addition, Nadcap recognizes ISO 17025 for testing laboratories, including nondestructive testing laboratories. The ISO 17025 scope of accreditation must cover the Nadcap scope of accreditation and be from an approved NACLA / ILAC accreditation body (pri-network.com).

Suppliers who have an AS/EN/JISQ9100 or AS/EN9110 registration / certification from an IAQG approved Registration / Certification body, as listed on the IAQG Oasis website, or an ISO 17025 accreditation approved by NACLA / ILAC do not require an additional quality systems audit through Nadcap. (See NOP-002) At the time of the audit, when a supplier does not hold a current approved quality system in accordance with NOP-002, an assessment to the Nadcap AC7004 is required (pri-network.com).

2.3.1 History and status of ISO 17025:2005

According to (UNIDO, 2009) before publish ISO 17025:1999 there was no internationally accepted standard for laboratory quality systems that could provide a globally accepted basis for accreditation. Accreditation was based on national standards. However, there was a considerable level of uniformity between the requirements expressed in these various standards due to the existence of ISO Guide 25, a document drawn up by the ISO Council Committee on Conformity Assessment (CASCO) in response to a request by the International Laboratory Accreditation Cooperation (ILAC) held in Auckland, New Zealand, in October 1988. The declared purpose of ISO Guide 25, taken from its foreword, is to establish the principle that "third party certification systems [for laboratories] should, to the extent possible, be based on internationally agreed standards and procedures". ISO guides are intended to be used by local standards institutions when preparing their own national standards. By this means, it is hoped to achieve a high degree of compatibility between standards prepared in different countries "so as to facilitate bilateral and multilateral agreements". (Quotations from the foreword to ISO Guide 25, 3rd Edition.) The document now known as ISO 17025 began life as a revision of the third edition of ISO Guide 25, but during the revision process it was decided to convert the guide to a standard, so providing a truly global basis for accreditation. It was also decided to introduce as much compatibility as possible between ISO 17025 and the generic quality management

system standard ISO 9001, which was also under revision at the same time. The objective appears to have been to create a logical connection between ISO 9001 and ISO 17025 such that the former would be seen as a master standard with ISO 17025 being a specific application of that standard to testing and calibration laboratories. ISO 17025: 1999 was accepted by ISO subscribing countries in late 1999 and came into effective use during the first quarter of 2000 after its adoption as a national standard by most countries around the world. The new version of ISO 9001, the 2000 edition, was accepted at a later date. The exercise intended to harmonise ISO 17025 and ISO 9001 was, in the event, regarded as imperfect, especially in that ISO 9001 placed great emphasis on continual improvement in the quality system. Although this was included in ISO 17025, its importance as a part of the standard was not strongly emphasised. Hence a revision of ISO 17025 was undertaken and this led to ISO 17025:2005 which was adopted as an ISO standard in late May of 2005. There are no fundamental differences between ISO 17025:1999 and ISO 17025:2005 and nothing which impinges essentially on the technical requirements. The main differences can be summed up as follows:

- Insistence on a demonstrated commitment to continually improve the quality management system and identified mechanisms for achieving this.
- Greater emphasis of the need to communicate with customers and, especially, to actively solicit feedback on service quality and ensure the resulting information is used as the basis of action to improve the management system.
- Greater emphasis of the need to use information from quality control data to evaluate the performance of the quality system and to identify opportunities for improvement.

The transitional period between ISO 17025:1999 and ISO 17025:2005 lasted two years, with the two standards running together. In May 2007 ISO 17025:1999 became defunct and existing laboratories who had not been assessed against the 2005 version ceased to be accredited.

2.3.2 International recognition of accreditation

According to (UNIDO, 2009). Accreditation of laboratories is generally performed by national accreditation bodies. The primary function of such bodies

is, of course, to provide assessment of laboratories in their respective countries against ISO 17025. However, they will also often respond to requests to carry out assessments in other countries, especially if the requesting laboratory is in a country without its own national accreditation body. Where there is a national accreditation body in the country and a laboratory seeks to use a body from another country, the incoming accreditation body will normally, as a matter of courtesy, seek approval from the resident body before operating in the country.

A laboratory may prefer to use an accreditation body other than its domestic organization when the latter has either no international recognition or where it lacks recognition in parts of the world relevant to the laboratory's operations.

International recognition of accreditations awarded by national bodies is based on the conclusion of Mutual Recognition Agreements (MRAs) between national bodies. The mechanism is that the bodies seeking to agree to recognise each other's accreditations will audit each other's operations against ISO 17011: Conformity assessment—General requirements for accreditation bodies accrediting conformity assessment bodies. This is the international standard to which assessment bodies are expected to adhere.

MRAs may be multi-lateral (i.e. involving more than two bodies) but even so they can be rather cumbersome and it can take many years for a new national body to establish significant international recognition. However, this rather cumbersome process is being rapidly streamlined by means of regional laboratory accreditation conferences linked through ILAC (see section 1.1). The regional body applies rules for membership, including compliance with ISO 17011, and audits national bodies for compliance. Mutual recognition is then organised between the regional bodies, so simplifying the whole system and shortening the timescale.

Key regional groupings are the Asia Pacific Accreditation Cooperation (APLAC), the European Cooperation for Accreditation of Laboratories (EAL) and the Southern Africa Development Community in Accreditation (SADCA). This regionalization of international recognition is developing rapidly but has not been fully established, and it is still possible to find accreditation bodies who are

members of regional groups who prefer to pick and choose which of the other members they will recognize.

In this context of national accreditation bodies and mutual recognition it has to be noted that not all countries choose to establish their own domestic accreditation service. In the case of smaller countries with only limited numbers of laboratories, this may make little economic sense. In such instances the country uses other national bodies, either on the basis of an agreement with a particular body to provide the service to the country or on an *ad hoc* basis where each laboratory chooses its own accreditation service. Currently attempts are being made to develop arrangements where several countries club together to have a single regional accreditation body. It seems likely that initiatives of this type will bear fruit in southern Africa.

The recent World Trade Organization initiatives to deal with technical barriers to trade have sought to address the question of global acceptance of test data as part of quality issues in international trade. The agreement can be summarized as a recognition that, when deciding whether data from a particular laboratory is acceptable, a key criterion should be compliance of the laboratory with ISO 17025. This has been widely interpreted as meaning that countries all need to establish a national ISO 17025 accreditation body for laboratories. However, in this context, the following points need to be noted :

- Accreditation must have credibility, which means, in practice, that the accreditation body must apply ISO 17025 rigorously and itself operate to ISO 17011. Simply having an accreditation body is not, in itself, a solution.
- The credibility of the accreditation body on an international scale needs MRAs, especially with countries which are recipients of trade goods needing testing support.
- The credibility of individual laboratories can be established by their direct assessment by either customers or accreditation bodies from trading partners. A national accreditation body is not essential .

2.3.3 Selection of a suitable accreditation body by laboratories

According to (UNIDO, 2009) as should be clear from the foregoing discussion, the key issue in selecting an accreditation body is to ensure that it has recognition in the context in which the laboratory's data needs to be used. Where a laboratory operates purely in a domestic market and where the data is used only within the country, for example for local food safety or environmental protection, then a national accreditation body, even one with no international recognition, will normally be entirely suitable. However, if the laboratory is servicing exporters who need to present its data internationally, it is critical that the accreditation body is recognized by importing countries. Hence the laboratory needs to establish the range of MRAs held by the accreditation body and especially which other countries, other than the home country of the accreditation body, will recognise accreditation awarded by it.

2.3.4 Scope of accreditation

According to (UNIDO, 2009) although ISO 17025 is written as though all the methods used by a laboratory are covered by the standard and hence included in any accreditation against the standard, this is rarely the case. In practice, any particular laboratory will have only some of its methods accredited and perhaps not even the majority. In spite of this, an accreditation body will often make a formal statement to the effect that it expects to see a comprehensively operating quality system. In reality, however, any assessment will focus on the scope of methods and on the equipment used to deliver them and take little interest outside this scope. In this sense the term 'accredited laboratory' is inaccurate.

We should rather talk of a laboratory accredited for a specific list of methods. The laboratory will need to select methods to offer as part of the scope when it makes its application for accreditation. The following criteria should be born in mind:-

- Methods which are performed infrequently, for example less than 12 times per annum, are difficult to accredit since it is impossible to demonstrate a track record of performance. If such methods have to be included in the accreditation, a large level of quality control will be required by the assessors.

- Methods with little objective content are unlikely to be able to be accredited since consistency in application cannot be guaranteed.
- Commercial laboratories should select methods on a purely commercial basis. If there is no commercial advantage in accreditation of the method, then the cost an effort may not provide a return.
- In many countries data generated for environmental, food safety or legal reasons must be covered by accreditation to be acceptable.

Overall, the laboratory should select a scope of methods which includes those it performs routinely and those where either commercial or legal issues make accreditation advantageous. Accreditation bodies differ in precisely how they define scope and some will allow a more generic definition in some areas of activity. In such instances they will assess the laboratory for a particular application of a method plus a procedure to be followed when extending the method to other areas. For example, a laboratory may have accreditation for trace metals in certain types of foods with a procedure for how the recovery checks will be done and evaluated if the method is applied to a hitherto untried matrix.

2.3.5 Relationship between ISO 17025 and ISO 9001

According to (UNIDO, 2009) ISO 9001 is the general standard which specifies the requirements for a quality management system. Laboratories which meet the requirements of ISO 17025 also operate in accordance with the requirements of ISO 9001 that are relevant to calibration and testing activities.

What this means in practice is that an organization which holds ISO 9001 certification may use a laboratory accredited against ISO 17025 as a supplier of test data without the need to carry out its own audit of the laboratory's quality system. The question often arises of whether laboratories should be accredited/certified to ISO 9001 or to ISO 17025. In general it is agreed that the appropriate accreditation for commercial testing and calibration laboratories is to ISO 17025. As a result of agreements with laboratory accreditation bodies many ISO 9001 certification bodies will not allow their certification to be cited by commercial testing or calibration laboratories in support of their services.

What this means in reality is that if you are an ISO 9001 certified organization with an in house laboratory which forms part of your quality control system, the

laboratory will be included in the ISO 9001 external audit. However, if you then want to sell the services of that laboratory to outsiders as a testing service you cannot advertise it as an ISO 9001 accredited/certified laboratory. You would need to obtain accreditation to ISO 17025. It is not uncommon, however, for organizations with laboratories used purely for internal quality control purposes to seek to accredit the laboratory to ISO 17025. This is generally done to enhance the laboratory's, and hence the overall quality control system's, credibility or as part of the application of an ISO 9001-compliant system.

ISO 9001 external auditors will not usually do a detailed audit of such an internal laboratory if it holds a current ISO 17025 compliant accreditation. The quality system in the laboratory is largely taken for granted for ISO 9001 purposes. Since laboratory accreditation procedures leading to ISO 17025 accreditation are explicitly designed for laboratories, they can be easier to interpret for the laboratory as opposed to the rather more diffuse requirements of ISO 9001, which are designed for a more general context. The other advantage of accrediting an internal quality control laboratory is that it will generally reduce the number of audits by customers and this is often a key reason for seeking accreditation. Frequent audits by a range of customers can be disruptive to operations.

There are certainly a number of significant omissions from ISO 9001 as compared to ISO 17025 although, as already discussed, there is a general ISO move to bring the standards closer together. The additional requirements in ISO 17025, as opposed to ISO 9001, include participation in proficiency testing, adherence to documented, validated, methodology and specification of technical competence, especially on the part of senior laboratory personnel. There is also a difference in the method of scrutiny of laboratories under ISO 9001 as compared to ISO 17025 assessment.

ISO 17025 assessment bodies will always use technical assessors who are specialists and who carry out a peer review of the methods being used by the laboratory and the way in which those methods are applied. An ISO 9001 external audit to determine suitability for certification does not include this peer review of

technical aspects and the auditors are not required to be technical specialists. They confine their attention to the quality management system.

From the point of view of a laboratory's clients, laboratories meeting the requirements of ISO 17025 fulfil all the relevant requirements of ISO 9001 when acting as subcontractors. The practical effect of this is that if an organisation which is certified to ISO 9001 is using an ISO 17025 accredited laboratory as a sub-contractor, it can treat it as an ISO 9001 certified sub-contractor for any work within the laboratory's scope of ISO 17025 accreditation. There will, for example, be no necessity to carry out quality audits of the sub-contractor .

2.3.6. What does ISO/IEC 17025 Cover

According to (Khan & Rahman, 2009) ISO 17025 covers every aspect of laboratory management. It involves everyone in the laboratory, including the laboratory manager, assistant laboratory manager, or quality manager. The standard also involves all laboratory staff whose functions relate to the quality of laboratory data generated. A laboratory's fulfilment of the requirements of ISO/IEC 17025:2005 means that the laboratory meets both the technical competence requirements and management system requirements necessary for it to consistently deliver technically valid test results and calibrations. The standard was revised in 2005, the purpose of which was to align it with ISO 9001:2000. Unlike before, the two standards are now considered to be compatible rather than fully aligned. The revision makes it clear that meeting the requirements of ISO/IEC 17025 does not automatically mean that the requirements of ISO 9001 are met. The standard does however recognize that, by being accredited to ISO/IEC 17025, a laboratory will meet the principles of ISO-9001. Consequently, laboratories may choose to be accredited to ISO/IEC 17025, or be certified to ISO 9001, or both, but the processes of accreditation and certification would be two separate actions.

2.3.7. The Need for Competent Laboratories

According to (Khan & Rahman, 2009) The lack of acceptance of laboratory test data across national borders has been identified as a significant barrier to trade. The World Trade Organization has adopted two major new

agreements to ensure that technical requirements do not restrict trade: The agreement on Technical Barriers to Trade (TBT); and the Agreement on Sanitary and Phytosanitary Measures (SPS). Asia Pacific Economic Cooperation (APEC) has given priority to conformity assessment issues. The Declaration on APEC Standards and Conformance Framework and Osaka Action Agenda confirm the intention of members to achieve mutual recognition of conformity assessment among the eighteen APEC economies in both the regulated and voluntary sectors. Activities are being coordinated through the APEC sub-committee on Standards and Conformance with direct involvement from the "specialist regional bodies", including the Asia Pacific laboratory Accreditation Cooperation (APLAC). Other regional trade groupings are also enhancing cooperation in standards and conforming in order to facilitate trade.

Regional and international mutual recognition agreements are in place to facilitate acceptance of conformity assessment results, which include test results. These include the International laboratory Accreditation Cooperation (ILAC) and the APLAC.

These agreements and policies aim to avoid expensive testing. If they are to be effective, regulators and customers must be able to rely on test conducted in other countries. They need to know the status and competence of the testing laboratories supplying the data and to have independent assurance that the test results are valid.

When testing laboratory implements an internationally accepted standard for good laboratory practices such as the ISO/IEC 17025 standard, the laboratory demonstrates that it has the competence to perform the tests and the test results produced are valid. Test reports/data generated by these laboratories provide Government bodies and regulators with the confidence in order to make their decisions based on sound technical judgments. These decisions relate to industry efficiency and technological development, enforcement of regulations for safety, health, environment protection and assure consumer interests are protected. ISO/IEC 17025 is a specification for calibration and testing laboratories, applicable to any type of organization regardless of size, location or the range of

services they provide. The majority of information is contained in 2 of its sections:

- Management requirements and
- Technical requirements

Management requirements include:

- Organization and management
- Quality system
- Document control
- Review of request
- Subcontracting of tests and calibrations
- Purchasing services and supplies
- Service to the client
- Complaints
- Control of non-conformity testing
- Corrective action
- Preventive action
- Records
- Internal audits
- Management reviews

Technical requirements include:

- General
- Personnel
- Accommodation and environmental conditions
- Test and calibration methods including sampling (This includes requirements for method validation (laboratory developed, non-standardized, standardized but used outside of their intended range) and measurement uncertainty)
- Equipment
- Measurement traceability
- Sampling

- Handling and transportation of test and calibration items
- Assuring the quality of test and calibration results
- Reporting the results

2.4 NADCAP Special Processes

The Nadcap program has established an accreditation that includes the following commodities (www.pri-network.org) :

1. Aerospace Quality Systems Task Group

   Nadcap has established an accreditation program that includes Aerospace Quality Systems. The Aerospace Quality Systems Task Group recognizes the industry developed Aerospace Quality Systems standard AS/EN/JISQ9100 and AS/EN9110. In addition, Nadcap recognizes ISO 17025 for testing laboratories, including nondestructive testing laboratories. The ISO 17025 scope of accreditation must cover the Nadcap scope of accreditation and be from an approved NACLA / ILAC accreditation body. Suppliers who have an AS/EN/JISQ9100 or AS/EN9110 registration / certification from an IAQG approved Registration / Certification body, as listed on the IAQG Oasis website, or an ISO 17025 accreditation approved by NACLA / ILAC do not require an additional quality systems audit through Nadcap. (See NOP-002) At the time of the audit, when a supplier does not hold a current approved quality system in accordance with NOP-002, an assessment to the Nadcap AC7004 is required (www.pri-network.org).

2. Chemical Processing

   Nadcap has established an accreditation program that includes Chemical Processing. The Chemical Processing Task Group conducts audits to demonstrate compliance to SAE AC7108 (www.pri-network.org), which includes the following :

   - Anodizing
   - Chemical Cleaning
   - Chemical Milling
   - Conversion / Phosphate Coatings

- Paint / Dry Film Coatings
- Plating
- Stripping
- Surface Treatment / Passivation
- Etching (Nital / Pre-Penetrant / Temper / Macrostructure / Blue Etch Anodize)

3. Coatings

   Nadcap has established an accreditation program that includes Coatings. The Coatings Task Group conducts audits to demonstrate compliance to AC7109 (www.pri-network.org), which includes the following:

   - Thermal Spray
   - Diffusion Coatings
   - Vapor Deposition
   - Coating Evaluation Laboratory
   - Stripping of Coatings
   - Heat Treating of Coated Parts
   - Dry Film Lubrication of Coated Parts
   - Plating of Coated Parts

4. Conventional Machining

   Nadcap has established an accreditation program that includes Conventional Machining as a Special Process. The CMSP Task Group conducts audits to demonstrate compliance to the AC7126 series of checklists (www.pri-network.org), which includes the following:

   - Holemaking
   - Broaching
   - Milling
   - Turning
   - Grinding, including grinding of coatings or after heat treatment
   - Edge Treatment, including automated, hand bench, and mass finishing

5. Elastomer Seals

   Nadcap has established an accreditation program that includes Elastomer Seals. The Elastomer Seals Task Group conducts audits to demonstrate compliance to AC7115 series of checklists (www.pri-network.org).

6. Electronics

   Nadcap has established an accreditation program that includes Electronics. The Electronics Task Group (ETG) conducts audits to demonstrate compliance to the following:

   - AC7119 Printed Circuit Boards
   - AC7119/1 Rigid Printed Boards
   - AC7119/2 Flexible and Rigid-Flexible Printed Boards
   - AC7119/3 - High Density Interconnect Printed Boards
   - AC7120 Printed Circuit Assemblies
   - AC7121 Cable and Harness

   (www.pri-network.org)

7. Fluid Distribution Systems

   Nadcap has established an accreditation program that includes Fluids Distributions Standards. The Fluids Distribution Standards Task Group conducts product audits to demonstrate compliance to SAE AS7112 (www.pri-network.org), which includes the following:

   - Couplings Fittings & Other Machined Components Hose Assembley
   - Hose Manufacturing

8. Heat Treating

   Nadcap has established an accreditation that includes Heat Treating. The Heat Treating Task Group has developed the audit checklist AC7102 (www.pri-network.org), which includes the following :

   Metal Systems :

   - Carbon & Alloy Steel
   - pH Steel Cast Iron

- Heat Resisting Alloys
- Tool Steel
- Aluminium Alloys
- Other Nonferrous Metals
- Stainless Steel
- Titanium Alloys

Heat Treating Processes

- Normalizing
- Solution Heat Treating
- Nitriding
- Annealing
- Aging
- Stress Relieving
- Hardening & Tempering
- Carburizing

Heat Treating Equipment

- Furnace
- Atmospheric Control
- Pyrometry
- Instrumentation

Brazing

- Vacuum Brazing
- Induction Brazing

Hot Forming

9. Materials Testing Laboratories

   Nadcap has established an accreditation program that includes Materials Testing Laboratories. The Materials Testing Laboratory Task Group conducts audits to demonstrate compliance to Nadcap AC7101 (www.pri-network.org), which includes the following:

   - Chemical Analysis Corrosion Differential Thermal Analysis (DTA) Hardness

- Brinell, Rockwell, Vickers, Macrohardness
- ISO / IEC 17025 Requirements Mechanical Testing
- Tensile Testing, Stress Rupture, Creep, Fatigue, Cyclic Rupture, Fracture Toughness, Crack Propogation, Bend, Impact
- Metallography (Micro & Macro) Microhardness
- Vickers, Knoop
- Mechanical Test Specimen Preparation Heat Treating of Specimens

10. Non-Destructive Testing

    Nadcap has established an accreditation program that includes Non-Destructive Testing. The Non-Destructive Testing Task Group conducts audits based on the AC7114 series of checklists (www.pri-network.org), which includes the following:

    - Liquid Penetrant Testing
    - Magnetic Particle Testing
    - Ultrasonic Testing
    - Radiographic Testing

11. Nonconventional Machining and Surface Enhancement

    Nadcap has established an accreditation program that includes Nonconventional Machining and Surface Enhancement (NMSE). The NMSE Task Group conducts audits based on the AC7116 checklist for nonconventional machining and the AC7117 checklist for shot peening, which include the following (www.pri-network.org) :

    Nonconventional Machining

    - Electrochemical Machining (ECM)
    - Electrochemical Grinding (ECG)
    - Electrical Discharge Machining (EDM) Fast Hole, Sinker, Wire
    - Laser Beam Machining (LBM) Cutting, Drilling, Marking

    Surface Enhancement

- Shot Peening Automated
- Computer Controlled
- Flapper, Manual
- Peen Forming

12. Sealants

    Nadcap has established an accreditation program that includes Sealants On-Site Surveillance. The Sealants On-Site Surveillance Task Group conducts audits to demonstrate compliance to SAE AS7200/1 (on-site inspection of aerospace sealant manufacturers) and SAE AS7202 (www.pri-network.org), which includes the following :

    - Adhesion Promoters Coatings & Coating Processes Peel Panels,
    - Shear Specimens,
    - Tensile Bars Polyurethanes Silicones & Flurosilicones
    - Two Part Polysilfide Sealants

13. Nadcap has established an accreditation that includes Welding. The Welding Task Group has developed process specific requirements based on the AC7110 series of checklists (www.pri-network.org), which includes the following:

    - Torch / Induction Brazing
    - Flash Welding
    - Electron Beam Welding
    - Resistance Welding
    - Fusion Welding
    - Laser Welding
    - Friction / Inertia Welding
    - Diffusion Welding
    - Percussion Stud Welding

2.5 NUCAP

Nadcap Users Compliance and Audit Program (NUCAP) provides Nadcap Users a uniform method for certification of captive special processes in accordance with industry standards and requirements. NUCAP Approval indicates Nadcap compliance (and not an accreditation by Nadcap) which may be accepted by Nadcap User Members as equivalent to Nadcap Accreditation (www.pri-network.com).

Eligibility:

1. NUCAP Applicant must be a Nadcap Subscriber
   - Nadcap Subscriber-members are those aerospace or defense contractor Subscriber companies who are Nadcap Subscribers and Production or Design Approval holders (such as TSO, TC or PC holders) from regulatory agency approval.
   - Subscribers work to their own special process specifications and have internal engineering organizations to provide technical directions and support.
2. Functional Quality System equivalent AS/EN/JISQ/9100, with an effective corrective action system and closure and corrective action through Subscriber oversight system (internal).

Objectives:

1. To develop industry standard for special process audit program that assures Nadcap compliance.
2. Provide a mechanism for independent, objective and consistent analysis of process audit data.
3. Evaluate User's Internal Auditors and audit process to meet NUCAP Requirements per Program Document 3001.

2.6 Quality Management For Reliability Product and Teknis

2.6.1 Introduction

An organization will benefit from establishing an effective quality management system (QMS). The cornerstone of a quality organization is the

concept of the customer and supplier working together for their mutual benefit. For this to become effective, the customer-supplier interfaces must extend into, and outside of, the organization, beyond the immediate customers and suppliers. A QMS can be defined as: *"A set of co ordinated activities to direct and control an organization in order to continually improve the effectiveness and efficiency of its performance."* These activities interact and are affected by being in the system, so the isolation and study of each one in detail will not necessarily lead to an understanding of the system as a whole. The main thrust of a QMS is in defining the processes, which will result in the production of quality products and services, rather than in detecting defective products or services after they have been produced (www.businessballs.com).

2.6.2 The benefits of a QMS

A fully documented QMS will ensure that two important requirements are met (www.businessballs.com) :

- The customers' requirements – confidence in the ability of the organization to deliver the desired product and service consistently meeting their needs and expectations.
- The organization's requirements – both internally and externally, and at an optimum cost with efficient

use of the available resources – materials, human, technology and information. These requirements can only be truly met if objective evidence is provided, in the form of information and data, to support the system activities, from the ultimate supplier to the ultimate customer. A QMS enables an organization to achieve the goals and objectives set out in its policy and strategy. It provides consistency and satisfaction in terms of methods, materials, equipment, etc, and interacts with all activities of the organization, beginning with the identification of customer requirements and ending with their satisfaction, at every transaction interface. It can be envisaged as a "wedge" that both holds the gains achieved along the quality journey, and prevents good practices from slipping:

Management systems are needed in all areas of activity, whether large or small businesses, manufacturing, service or public sector. A good QMS will:

- Set direction and meet customers' expectations
- Improve process control
- Reduce wastage
- Lower costs
- Increase market share
- Facilitate training
- Involve staff
- Raise morale

In a survey conducted by the Defense Evaluation Research Agency (DERA), ca.96% of respondents said they believed their system contributed to meeting the business goals. However, ca.72% responded that their organization did not measure this contribution (www.businessballs.com).

2.6.3 International Organization for Standardization (ISO)

ISO is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is carried out through ISO technical committees, in liaison with international organizations, governmental and non-governmental bodies. ISO's most recent family of standards for quality management systems are currently in their final draft (FDIS) form, and comprises:

- ISO/FDIS 9000:2000 - Quality management systems – Fundamentals and vocabulary.
- ISO/FDIS 9001:2000 - Quality management systems – Requirements.
- ISO/FDIS 9004:2000 – Guidelines for performance improvement.

It is expected that they will be issued as an ISO in December 2000 or January 2001. If these vary from the FDIS version, changes will be made to this website. They are built around business processes, with a strong emphasis on improvement and a focus on meeting the needs of customers. The new standards originated from a regular six year review and are intended to be generic and adaptable to all kinds of organizations. The ISO 9002 and ISO 9003 are to be discontinued (but can still be used by those organizations certified against them

during the three year transition period), and ISO 9001and ISO 9004 are designed to be used together, but can be used independently. The ISO Series can form the means by which a holistic management system can be implemented, into which quality, health and safety and environmental responsibility can be integrated, with the audits carried out either separately or in combination. The ISO Standard is also now more closely aligned with the requirements of the EFQM Excellence (www.businessballs.com)

2.7 Basic Concept of Quality, Quality Dimension and Parameters

Quality has a broad definition under different aspect . Crosby (1996) has defined quality as conformance to requirement and specification and suggest that to measure quality in order to manage quality effectively. Juran (1999) sated that quality is fitness for use. He emphasized that requirement and specification translate fitness for use as a quality measurement and he relegated design responsibility to inspection department. According to, quality means a degree of excellence, Hoyle (1998) in ISO 9000 quality System Handbook 3rd edition conformance with requirement, the totality of characteristic of an entity that bears its ability to satisfy sated or implied needs, Fitness for use. Clients demands should be prioritized and contractor have to build the structure within the cost and time frame given by the clients. The quality of work also must be freed from any defect, imperfections and satisfy clients need expectation.

Agreeing to other researches Garvin (2000) defines five different perspective of quality. The first perspective is from transcendental perspective is from transcendental perspective where Pirsing (1974) stated that although quality cannot be defined, one knows what it is. From this perspective, quality is synonym to excellence, universally renowned, resistance to fashion and state. Most often quality cannot be defined but we learn to recognize is through experience. Secondly, from the product's perspective, Cason (2003) stated the qualitative differences reported to quantitative difference of some desired components or attributes. In this context, the qualitative differences are given by the quantitative difference between the characteristic of product. Thirdly, from the user's perspective where quality consist of the capacity to fulfill demand. Juran

(1998) stated that the quality represents the capacity of the product to be used (fitness for use) and the quality of the product depends on the manner it satisfies the request of the user. Fourthly from the producer's perspective where Markham (2000) stated that quality means conformity to request. In this case, quality represent the extent to which a certain product is conformant to a project or stipulation or demand. Lastly , from perspective , according to Nersein (2000), quality represent the level of excellent at the affordable cost. Further explain a product can be considered high quality if the product provides performance or conformity at an affordable or acceptable price or cost. The Conclusion is by integrating all the perspective, the aim still to satisfy the client's demands.

2.7.1 Quality Dimension

The assessment of the impacts of NADCAP Accreditation on quality was based on Garvin's (2000) has proposed dimension of the product quality namely performance, characteristic, feasibility, conformity, durability serviceability, aesthetics and perceived quality. Each of the dimension are independent where a product that is considered to be high value from the point of view of one dimension could be low when different dimension is considered . Table 2.2 Shows the Quality Dimension based on (Garvin)

Besterfield (2000) has divided quality into nine different dimension. These dimension are depending on another. For example, a product or service is good in one dimension and maybe average or poor in other dimension. It is rare to find a product or service that can meet all dimension. Table 2.3 shows nine different quality dimension and terms.

Table 2.2 Quality Dimension (Garvin, 2000)

Dimension	Terms
Performance	Primary Product/Service characteristic. Such as time cost and workmanship aspect (value / satisfaction, financial)
Features	Secondary characteristic, added consideration, such as creativity in design, attractiveness (sense of aesthetics)
Conformance	Meeting specification or industry standard, workmanship and client requirement in contract (meet specifications)
Reliability	Consistency of performance over time, average time for the unit to fail (quality consistency)
Durability	Useful life period, less maintenance or repair (core material & process quality control)
Service	Resolution of problem and complaint, ease of repair (Customer Service)
Aesthetic	Sensory characteristic in design, such as exterior finishes (Design Innovation)
Perceived Quality	Past performance and other intangible, such as being ranked first in the tendering process (Product & Service Satisfaction)

Table 2.3 : Nine Different Quality Dimension (Besterfield , 2001)

Dimension	Terms
Performance	Primary Product/Service characteristic. Such as time , design quality , Strength structure, nature and quality of raw material
Characteristic	Secondary characteristic, elements to complete the basic functioning of the product, Such as accessibility, Utility
Feasibility	Reflect the probability of product to go out of order within a specified time span
Conformity	The degree of which the design of a product and its operational characteristic are concordant with pre established standars.
Durability	The Function time of product before its physical deterioration (Gavin, 2000), less repair or maintenance
Serviceceability	Speed, Courtesy, competence and easiness to resolve problem and complaint, ease of repair
Response	Human to human interface, such as efficiency during meeting , fast decision making, effective human resource management
Aesthetic	Sensory characteristic in design, such as being ranked first in the tendering process.
Reputation	Past performance and other intangibles, such as being ranked first in the tendering process

2.7.2 Quality Parameters

Difference in can be denoted by grade or class or also can be result of poor attention to client need (Hoyle, 1998). Quality consist of tree parameters namely quality of design, quality of conformance and quality of use. Quality design means the design reflects a product or service that satisfied customer needs. All the necessary characteristic need to be designed into a product or service at the

outset. Quality of conformance means the product or service conforms to design standard. The designer has translating the client need and now depends on the processor to realize the design into an user product. Quality of use means the user is able to secure continuity of use from the product or service where the product need to have low cost of ownership, be safe and reliable and maintainable in use.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

Development of aerospace manufacturing industry continues to grow rapidly encourage for standards governing the existence of a manufacturing process that the resulting product quality standards of each company**.** Nadcap's membership of "prime contractors" convene to coordinate industry-wide standards for special processes and products. Through the Performance Review Institute, Nadcap provides independent certification of manufacturing processes for the industry. In the chapter will be described on the planning of research to be used in this study consists of research frameworks, strategies, research process, data collection, methods of analysis.

3.2 Framework of Thinking

Framework of thinking is a miniature of the research process as a whole. Where is the frame of mind is necessary, because it can give you a direction or path that will be done in the study, making it easier to understand the purpose of the study. Besides, with the right frame of mind then there will be a question to be answered through research undertaken (research). The author describes the analysis based on the application of the NADCAP Accreditation with three key stages are Pre-implementation, Implementation Processe, During Implementation with some aspect related Cost, Time, People/Personal, Regulation/Policy, Documentation, Procedure, Costumer, Product, Organization, Service . The frame of mind and study questions as below.

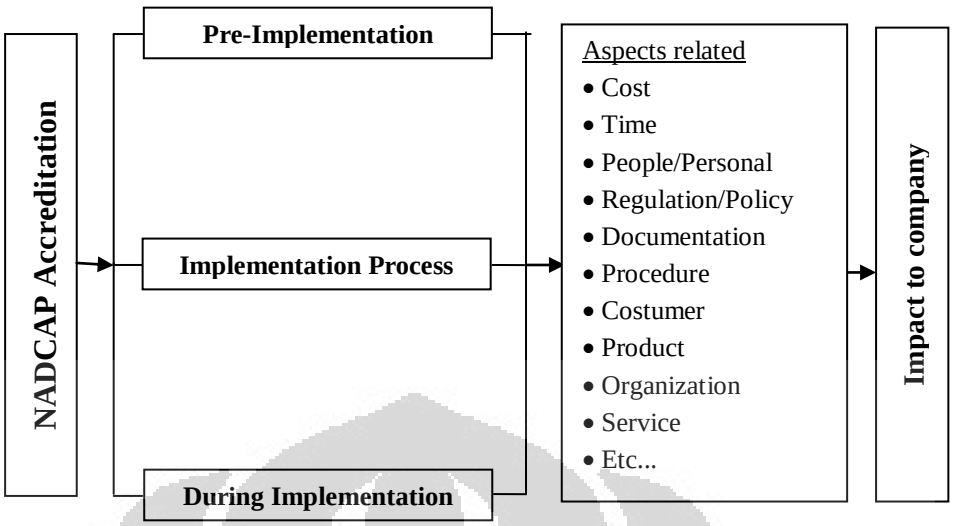

Figure 3.1 . Framework of thinking

3.3 The design of Research

According to (Isaac & Michael, 1997, p. 136) "to answer questions that have been raised, to solve problems that have been posed or observed, to assess needs and set goals, to determine whether or not specific objectives have been met, to establish baselines against which future comparisons can be made, to analyze trends across time, and generally, to describe what exists, in what amount, and in what context

This studies using survey method with Questioner the structured portion of the interviews utilized a questionnaire that was developed based on a comprehensive review of the literature. This study conducted based on following step as shown in figure 3.1. Firs step of study literature review about NADCAP Accreditation second step define goals and objectives third develop instrument the fourth step Conduct Pilot Test the fifth step Conduct Research /Survey sixth step Analyze Data and the final step Prepare Report.

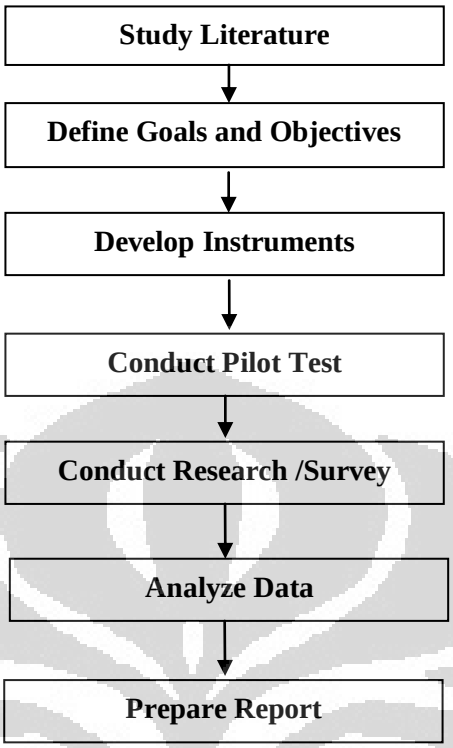

Figure : 3.2 Step Research Study

3.4. Place and Time Research

The research was conducted at several companies that already have NADCAP Accreditation in several countries around the world. This study begins from March 2012 until June 2012.

3.5. Type Of Research

Under this method the study is a survey research. Survey Research is research that takes a sample from a population using a questionnaire as a data collection tool (Singarimbun, 1995).

According to (Jhon Hendry, 2009) The questionnaire is a list of questions that will be used by researchers to obtain data from the source directly through a process of communication or by asking questions. In this research Form of questions posed to respondents is closed which have been given the answer choices.

This survey Research aims to determine some aspects associated with application of the NADCAP Accreditation. This survey Research aims to explain the causal relationships and testing hypotheses influence the implementation of some aspects of the NADCAP Accreditation in accordance with the objectives of the study. Based on the nature, this research is descriptive explanatory that describe and explain the effect of application of the NADCAP accreditation through a hypothesis which is done through data collection in the field. Descriptive research studying the problems of society in certain situations, including the relationship, the activities, attitudes and perceptions as well as an ongoing process and the influence of a phenomenon (Nasir, 1999).

3.6. Data Collection Techniques

Data collection techniques performed in the following way :

1. Questionnaire, the authors proposed a statement to the respondent.
2. Documentation, namely the collection of data is already available about the related to research such as NADCAP documents, websites and other sources.
3. The use of email in the spread of the questionnaire, because of the company are far apart and the lack of information.

3.7. Types and Sources of Data

The data used in this study are:

1. Primary data, the data obtained by researchers directly through interviews use questionnaires to the respondents.
2. Secondary data, i.e. data obtained from indirect sources and other data relevant to the analysis in this study.

3.8. Sample and Population

According to (Priscilla A. Glasow, 2005) determination of sample size depends on five factors :

- Desired degree of precision
- Statistical power required

- Ability of the researcher to gain access to the study subjects
- Degree to which the population can be stratified
- Selection of the relevant units of analysis

The research was conducted at several companies that have implemented NADCAP accreditation is obtained from the website largely aerospacesuppliers.com. Many companies that have implemented NADCAP accreditation to become a member and published through aerospacesuppliers.com.

3.9. Model and Technic Analysis

Descriptive analysis is a method of analysis used in order to obtain an in-depth and objective of the research object. data processing is done simply by using the excel program with Average Index in order to determine the rating of the respond and then analyzed descriptive in accordance with the aims and objectives of the study. In an effort to help explain the results of this analysis are presented in tabulated form, the image in accordance with the results obtained.

CHAPTER 4
SURVEY ANALYSIS AND RESULTS

4.1 Introduction

In this survey the author via e-mail sent 100 questionnaires obtained from the company's website, some companies can not provide answers to a variety of reasons, or because the recipient has not applied NADCAP Accreditation. Twenty-two valid responses received to the overall response rate of 22% .

For the purpose of better understanding the associated NADCAP accreditation authors developed the questions based on the existing literature related issues in particular the application of standard. The authors would like to dig deeper by developing appropriate and relevant questions NADCAP accreditation, amounting to seven important questions with type question *closed-ended* and *Likert* (question number seven), as follows :

1. Scope of Accreditation
2. What effect has NADCAP had on driving lean manufacturing at your Company?
3. How Long Your Company Accreditated NADCAP?
4. Do you believe that NADCAP contributes to the overall aerospace industry' s safety
5. Reasons for Seeking NADCAP
6. Obstacles Encountered During NADCAP Certification Process
7. Impacts of NADCAP Accreditation on Quality

4.2 Result Survey

4.2.1 Scope of Accreditation

In this survey the first question the author would like to know some of the accreditation scope owned by some the companies surveyed. From the survey results obtained as follow

Table 4.1. Scope Accreditation

Scope of Accreditation	Percentage
Chemical Processing (CP)	26%
Coatings (CT)	5%
Composites	-
Conventional Machining (CM)	3%
Elastomer Seals (SEAL)	-
Sealants (SLT)	3%
Surface Enhancement (SE)	-
Electronics (ETG)	5%
Fluid Distribution Components	3%
Heat Treating (HT)	16%
Materials Testing Laboratory (MTL)	8%
Non-Metallic Materials Testing (NMMT)	-
Non Destructive Testing (NDT)	18%
Nonconventional Machining (NM)	5%
Welding (WLD)	8%

From the results of a survey by the author based on questionnaire responses received. Chemical Processing (CP) 26 % , Nondestructive Testing (NDT) 18%, Heat Treating (HT) 16 %, Materials Testing Laboratory (MTL) , Welding (WLD) 8%, Coatings (CT) 5%, Electronics (ETG) 5% , Nonconventional Machining (NM) 5%, Conventional Machining (CM) 3% and Sealants (SLT) 3% complete results can be seen in table Appendix B1.

4.2.2. Effect NADCAP had on driving lean manufacturing

On the second question the authors would like determine the impact of the implementation of lean manufacturing NADCAP to driving on the companies that have implemented the NADCAP Accreditation, complete results can be seen in table Appendix B2.

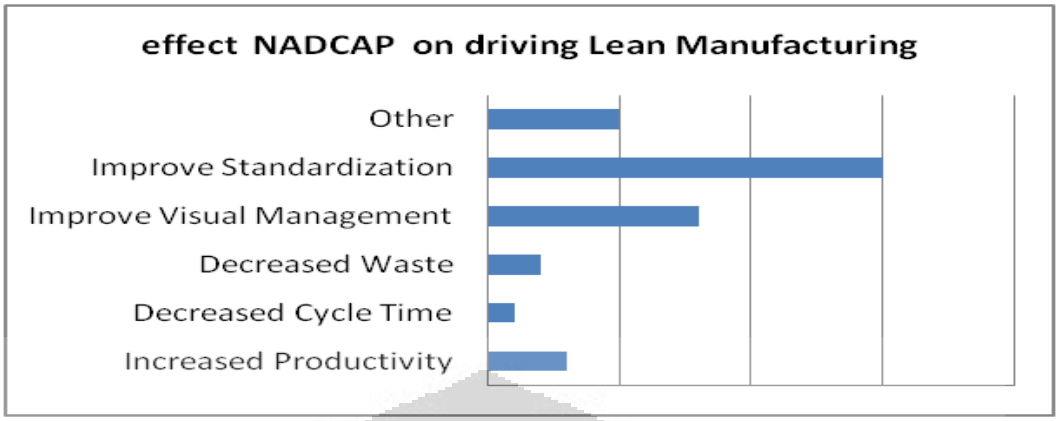

Figure 4.1 Effect NADCAP on driving Lean Manufacturing

NADCAP Accreditation is based on the degree of influence on driving lean by level were as follows :

1. Improve Standardization (44%)
2. Improve Visual Management (23%)
3. Effect on other aspects (15%)
4. Increased Productivity (9%)
5. Decrease waste (6%)
6. Decrease Cycle time (3%)

4.2.3 How Long Accreditated NADCAP

On the third question is very simple questions that the author wants to know was how long the companies surveyed implement NADCAP accreditation.

Table 4.2. How long Company Accreditated NADCAP

Year	Percentage
1 Year	4%
2 Year	9%
3 Year	14%
4 Year	0%
Most 5 Year	73 %

Obtained from the survey shows that firms in the survey 73% had more than 5 years running NADCAP Accreditation (examples SN, FTL, AMF, CMF has involved more than 25 years in the metal industry and aviation industry) . There is a survey of the new company to implement NADCAP Accreditation for 1 year the company's PS, although it has been a long established are encouraged by market demand for quality improvement in the field of Quality System Aerospace. Two new companies have NADCAP Accreditation for 2 years is the TDP and the GF, the company has a long established application of the NADCAP Accreditation is possible because of consumer demands Similarly, for a company that has had three years of the NADCAP company LY, TM and WG, complete results can be seen in table Appendix B3.

4.2.4. NADCAP contributes to the overall aerospace industry ‘s safety

On the fourth question is a question the author would like to know the opinion of the company that uses aerospace NADCAP accreditation for safety.

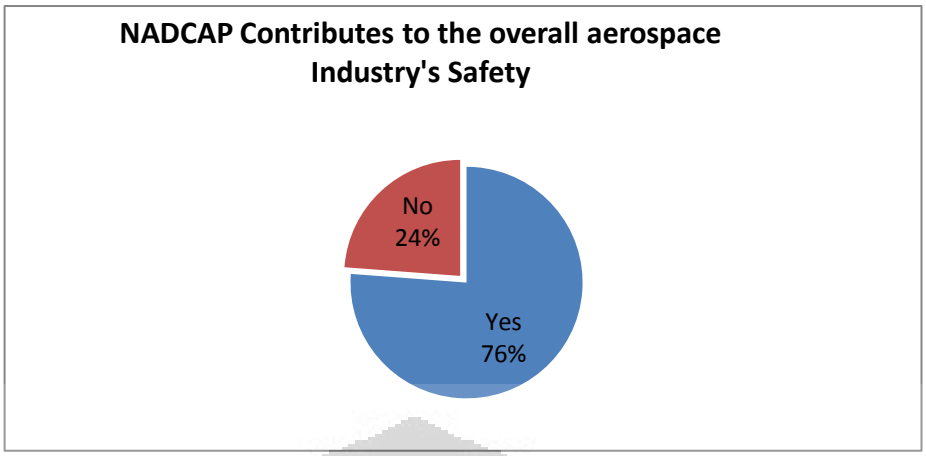

Figure 4.2 Graphic Contributes to the overall aerospace Industry's Safety

From the survey results obtained if we describe the percentage into 72% of respondents answered Yes and 28% said no If we compare the previous survey ever conducted by the PRI in June 2010 with percentage 69% of respondents answered Yes and 31% No Complete results can be seen in Appendix B4. It means the NADCAP Accreditation contributes to the safety aspects of Aerospace. According to Arshad Hafeez, Executive Director of Global Business Operations & Corporate Strategies at PRI commented It is encouraging to see that the benefits of Nadcap accreditation are recognized around the world by people working in the aerospace industry (pri-network.org).

4,2.5. Reasons for Seeking NADCAP

On the fifth question is the question the author would like to know the reason of the companies that implement NADCAP accreditation is a very important question related the form the fundamental aspects Complete results can be seen in Appendix B5.

Table 4.3. 1st Reasons For Seeking NADCAP

1st Reasons For Seeking NADCAP	Percentage
Costumer Require	45%
Improve Service Quality	14%
Company Philosophy	14%
Improve Public Image	4%
Responsiveness	5%
Not Answer	14%

We can see 45 % the first reason is because the implementation of the NADCAP Accreditation Require Costumer is based on the answers of the respondent Firm PS, MF, SN, SPC, BZ, TDP, GF, AST, JH and CMF. 14% gave the reason the first application of NADCAP for improve Quality and Service Company represented the company philosophy LY, WD, FTL, AC, CM, and WG. 5% of the first reasons to implement NADCAP to Improve Public Image and Responsiveness. 14% did not answer the questionnaire may be due to errors of understanding or other factors.

Table 4.4. 2nd Reasons For Seeking NADCAP

2nd Reasons For Seeking NADCAP	Percentage
Improve Product Quality	4%
Improve Public Image	4%
Company Philosophy	14%
Not Answer	41%
Improve Service Quality	9%
Competitive Pressure	14%
Responsiveness	5%

The second reason the application NADCAP we can see from the table above 4% to Improve Product Quality is based on the answers, the company PS, LY and WG. 14% for the second reason for Company Philosophy The Company is represented by WD, GF, and SCL. 41% of companies do not give answers but most of the companies that provide answers to the first reason is mostly because Costumer Require. 9% is a second reason to Improve Service Quality company that provides firm FTL and AR. 14% for the second reason for Competitive

Pressure is represented by a firm answer AMT, AC and AST. 5% is a second reason for the company represented Responsiveness CM.

Table 4.5. 3rd Reasons For Seeking NADCAP

3rd Reasons For Seeking NADCAP	Percentage
Increase Internal Audit	4%
Costumer Require	4%
Competitive Pressure	14%
Not Answer	41%
Improve Product Quality	23%
Improve Public Image	9%
Cost Reduction	5%

The third reason 4% of respondents gave answers and Costumer Increase Require Internal Audit answer from the company PS and LY. The third reason 14% of companies give a reason for Competitive pressure is represented its response FTL and CM. 41% did not provide an answer column entries in the third reason, but they give an answer on the field, and mainly the first reason Costumer Require reason. 23% gave answers to Improve Product Quality, represented the company answers GF, AMT, AC, AST and WG. 9% of respondents provide answers to Improve Public Image represented the company answers DPS and SCL. 5% gave a third reason for Cost Reduction.

Table 4.6. 4th Reasons For Seeking NADCAP

4th Reasons For Seeking NADCAP	Percentage
Improve Service Quality	9%
Improve Product Quality	14%
Increase Internal Audit	4%
Not Answer	50%
Responsiveness	4%
Cost Reduction	4%
Company Philosophy	5%
Improve Public Image	5%
Competitive Pressure	5%

50% for the fourth reason the company did not provide answers but most have provided the first reason as we have seen since Costumer require. 9% gave an answer to Improve Service Quality according to firm answers PS and AST.

14% gave a reason to Improve Product Quality, according to its response firm LY, FTL and DPS. 4% for a reason to Increase Internal Audit and Cost Reduction its response represented firm AR and AMT. 5% each give a reason Company Philosophy, Improve Public Image and Competitive Pressure according to firm answer to AC, CM and WG.

Table 4.7. 5th Reasons For Seeking NADCAP

5th Reasons For Seeking NADCAP	Percentage
Company Philosophy	14%
Costumer Require	41%
Not Answer	41%
Improve Product Quality	4%

14% of respondents gave five reasons for Company Philosophy according to firm answer PS, LY and AST. 41% gave reasons for Customer Require fifth according to the firm answer to WD, FTL, DPS, AR, AMT, AC, CM, WG and SCL. 41% did not answer, the same as the previous reasons. 4% of respondents replied to the reasons Improve Quality product according to the firm TM.

4.2.6. Obstacles Encountered During NADCAP Certification Process

On the sixth question is a question the author would like to know Obstacles Encountered During NADCAP Certification Process Complete results can be seen in Appendix B6.

Table 4.8. 1st Obstacle Encountered During NADCAP Certification Process

1st	Percentage
Inadequate NADCAP Training	14%
Difficult Interpretation Standard	27%
System Change	14%
Time Implementation	9%
Implementation Cost/Limitation Cost	9%
Not Answer	18%
Over Documentation	4%
Poor Documentation	5%

Perceived barriers were while implementing NADCAP accreditation based on the survey's results to first obstacle, 27% of the barriers firm difficult Interpretation Standard according to firm LY, BZ, AST, JH, CMF and SCL. 18% of respondents not provide an answer. 14% obstacles NADCAP Inadequate

Training and System Change, according to the firm answer PS, WD, FTL and DPS. 9% obstacles Time Implementation and implementation cost / Cost Limitation according to the firms SN, GF, SPC and CM. 5% of respondents answered obstacles Over Documentation and 4% obstacles because of Poor Documentation according to the firm AR and AMT.

Table 4.9. 2nd Obstacle Encountered During NADCAP Certification Process

2nd	Percentage
Implementation Cost/Limitation Cost	9%
Inadequate NADCAP Training	4%
System Change	9%
Time Implementation	14%
Not Answer	27%
Over Documentation	18%
Internal Resistance	5%
Difficult Interpretation Standard	14%

Perceived barriers were while implementing NADCAP accreditation based on the survey's results to second obstacle, 9% obstacles for Implementation Cost / Cost Limitation according to the firm PS and SCL. 4% obstacles for Inadequate NADCAP Training according to the firm LY. 9% obstacles for System Change according to firm WD and CMF. 14% obstacles for Implementation Time according to the firm MF, DPS and AST. 27% did not answer the possibility of charging an understanding of the survey form. 27% obstacles due to Over Documentation according to firm SPC, BZ and CM. 5% obstacles due to Internal Resistance according to firm FTL. 14% obstacles due to Difficult Interpretation Standard according to firm AR, AMT and AC.

Table 4.10. 3rd Obstacle Encountered During NADCAP Certification Process

3rd	Percentage
Difficult Interpretation Standard	18%
System Change	9%
Time Implementation	9%
Implementation Cost/Limitation Cost	14%
Not Answer	27%
Poor Documentation	4%
Inadequate NADCAP Training	5%
Over Documentation	9%
Internal Resistance	5%

Perceived barriers were while implementing NADCAP accreditation based on the survey's results to third obstacle, 18% obstacles for Difficult Interpretation Standard according to the firm PS, TDP, CM and WG. 9% obstacles for System Change according to firm LY and AC. 9% obstacles for Time Implementation according to firm WD and CMF. 14% obstacles for Implementation Cost/Limitation Cost according to firm MF, AR and AST. 27% did not answer. 4% obstacles for Poor Documentation according to firm SPC. 5% obstacles for Inadequate NADCAP Training according to firm TDP. 9% obstacles for Over Documentation according to firm DPS and AMT. 5% obstacles for Internal Resistance according to firm SCL.

Table 4.11. 4th Obstacle Encountered During NADCAP Certification Process

4th	Percentage
System Change	9%
Over Documentation	14%
Implementation Cost/Limitation Cost	14%
Poor Documentation	4%
Not Answer	32%
Inadequate NADCAP Training	18%
Difficult Interpretation Standard	4%
Time Implementation	5%

Perceived barriers were while implementing NADCAP accreditation based on the survey's results to fourth obstacle. 9% obstacles for System Change according to firm PS and AR. 14% obstacles for Over Documentation according to firm LY, TDP and AST. 14% obstacles for Implementation Cost/Limitation Cost according to firm WD, CMF and WG. 4% obstacles for Poor Documentation Cost

according to firm MF. 32% did not answer. 18% obstacles for Inadequate NADCAP training according to firm SPC, FTL, AMT and CM. 4% obstacles for Difficult Interpretation Standard according to firm DPS. 5% obstacles for Time Implementation according to firm AC.

Table 4.12. Obstacle Encountered During NADCAP Certification Process

5th	Percentage
Poor Documentation	4%
Implementation Cost/Limitation Cost	23%
Over Documentation	9%
Internal Resistance	9%
Not Answer	32%
Difficult Interpretation Standard	4%
Time Implementation	9%
Top Management Involvement	5%
Inadequate NADCAP Training	5%

Perceived barriers were while implementing NADCAP accreditation based on the survey's results to fifth obstacle. 4 % obstacles for Poor Documentation according to firm PS. 23% obstacles for Implementation Cost/Limitation Cost according to firm SPC, FTL, AMT and CM. 9% obstacles for Over Documentation according to firm WD and SPC. 9% obstacles for Internal Resistance according to firm MF and AST. 32% did not answer. 4% obstacles for Difficult Interpretation standard according to firm TDP. 9% obstacles for Time Implementation according to firm AR and CM. 5% obstacles for Top Management Involvement according to firm CMF . 5% obstacles for Inadequate NADCAP Training according to firm WG.

4.2.7. Impacts of NADCAP Accreditation on Quality

In the seventh question is a question the author would like to know the impact of implementation of the Quality NADCAP accreditation for companies that have implemented the NADCAP accreditation, The assessment of the impacts of NADCAP Accreditation on quality was based on Garvin's (2000) has proposed dimension of the product quality namely performance, characteristic, feasibility, conformity, durability serviceability, aesthetics and perceived quality. Each of the dimension are independent where a product that is considered to be

high value from the point of view of one dimension could be low when different dimension is considered . Table 4.14 Shows the Quality Dimension based on (Garvin).

Table 4.13. the eight dimension of the product quality

Dimension	Terms
Performance	Primary Product/Service characteristic. Such as time cost and workmanship aspect (value / satisfaction, financial)
Features	Secondary characteristic, added consideration, such as creativity in design, attractiveness (sense of aesthetics)
Conformance	Meeting specification or industry standard, workmanship and client requirement in contract (meet specifications)
Reliability	Consistency of performance over time, average time for the unit to fail (quality consistency)
Durability	Useful life period, less maintenance or repair (core material & process quality control)
Service	Resolution of problem and complaint, ease of repair (Customer Service)
Aesthetic	Sensory characteristic in design, such as exterior finishes (Design Innovation)
Perceived Quality	Past performance and other intangible, such as being ranked first in the tendering process (Product & Service Satisfaction)

Theory Approach Vs the purpose of research

In the survey authors would like to know effect of NADCAP Accreditation for quality improvement by changing the dimension Aesthetic with the Personal Competence. The author feels very important aspect of personal competence in the NADCAP accreditation,

Table 4.14. Dimension Quality theory Garvin (2000) Vs Questioner Survey

Dimension	Survey NADCAP Accreditation
Performance	Performance
Features	Features
Conformance	Conformance
Reliability	Reliability
Durability	Durability
Service	Service
Aesthetic	Personal Competence
Perceived Quality	Perceived Quality

Table 4.15 . Question Number Seventh

Question		V+	S+	None	S-	V-
Impacts of NADCAP Accreditation on Quality	**Performance**					
	Features					
	Reliability					
	Conformance					
	Durability					
	Serviceability					
	Personal Competence					
	Perceived quality					
	Note : please put a cross (X) in the column ***V+ = very positive score (5)*** ***S+ = somewhat positive score (4)*** ***None = no impact score (3)*** ***S- = somewhat negative score (2)*** ***V- = very negative score (1)***					

We can determine the average index value of each variable with a simple formula, and then from the results obtained to determine the rankings , result survey can be seen completely in appendix table B7 .

Average index

$$\bar{X} = \frac{\sum Xi}{N}$$

(4.1)

Definition:

$\bar{X}$ = Mean

$\sum Xi$ = amount of each data

N = amount of data

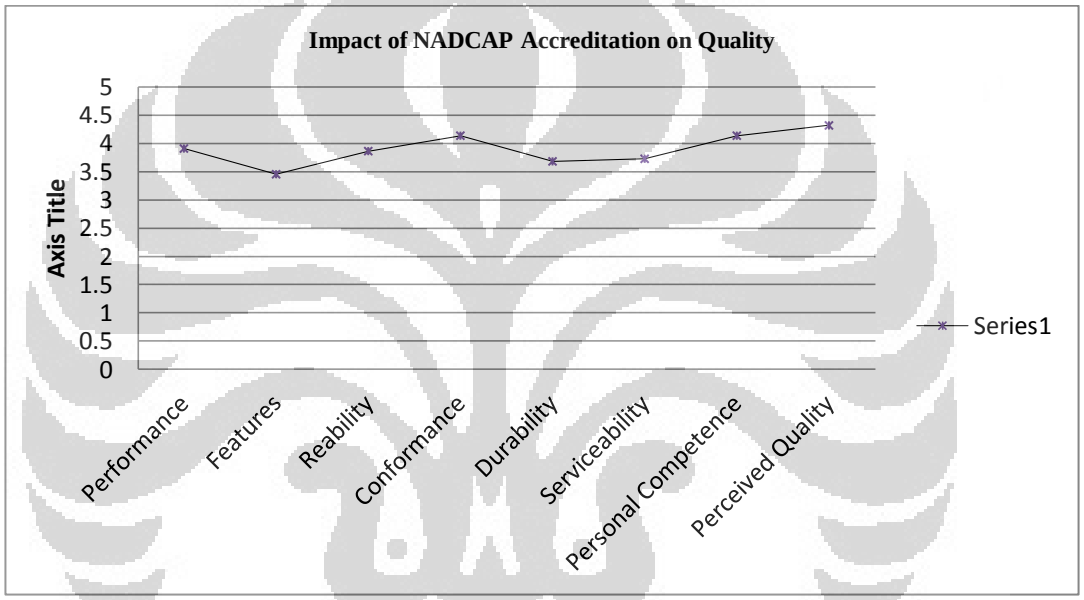

Figure 4.3. Impact of NADCAP Accreditation on Quality

Impact of NADCAP Accreditation on Quality by level were as follows :

1. Perceived Quality
2. Personal Competence
3. Conformance
4. Performance
5. Reability
6. Serviceability
7. Durability
8. Feature

4.3. General Analysis

4.3.1. NADCAP And Related Standards

From the literature NADCAP Accreditation is also generally associated with other standards such as :

- AS 9100 Quality management system
- ISO 9001:2008
- ISO 17025
- SAE AS 7101 General Requirements For Materials Test Laboratory Accreditation Program.

ISO 9001: 2008 is the basis of the development of AS 9100 and ISO 17025 which was developed based on the complexity and the requirement that it be required, With so many inter-related standards is causing problems terms of effectiveness must be proven as discussed previously in the literature study.

4.3.2. NADCAP Domain Scope

From the survey results can we give a brief overview of related issues in the application of NACAP Accreditation . In general we can see the application of the NADCAP accreditation dominantly applied in many fields of Chemical Processing (CP), Non Destructive Testing (NDT) and Heat Treating (HT) fifteenth scope of the whole..

4.3.3. NADCAP Implementation domain reason

The main applications of the NADCAP accreditation due to costumer require This is we can understand because essentially all of the company have a business purpose (demand).

4.3.4. NADCAP Major Obstacle During Implementation

From the survey results obtained, the application NADCAP Accreditation has some obstacles, Major obstacle in the application of the NADCAP accreditation is Difficult Interpretation Standard, can be seen completely in appendix table B6.

4.3. 5. NADCAP And Quality

In this study NADCAP are considered a product where the product is used by the aerospace and defense industry supplier, In conducting this research with the NADCAP Accreditation is based on dimensional approach to Quality ,does

NADCAP member contributed to the increase in Quality for aerospace and defense industry? Most respondents argued that the NADCAP Accreditation significant influence on the increase in Quality as can be seen in sub section 4.2.

CHAPTER 5
CONCLUSION

The main goal of this study was to determine the effect of application of the NADCAP Accreditation, to the companies. For this purpose , based on existing theory author is trying to develop questions that are then carried out a survey to the company which already have NADCAP Accreditation. From the results of the survey questionnaire received 22 responses from respondents who then performed a descriptive analysis.

From the survey results there are several conclusions that could be taken :

1. Respondents believed that the application of NADCAP Accreditation aerospace safety contribute a percentage of 72%.
2. NADCAP Accreditation associated with the application of lean process management, based on Survey result the degree of influence on driving lean by level were as follows :
    - Improve Standardization (44%)
    - Improve Visual Management (23%)
    - Effect on other aspects (15%)
    - Increased Productivity (9%)
    - Decrease waste (6%)
    - Decrease Cycle time (3%)
3. We could find out the five biggest reasons for each company in the application of the NADCAP Accreditation in accordance with table 4.3-4.7 and see page 48-50.
4. We could find out the five biggest obstacles in the implementation of NADCAP Accreditation in accordance with the table 4.8-4.13 see page 51-53.
5. From the survey results we can determine the effect of NADCAP Accreditation for Quality.

NADCAP Quality Dimension Level base on result Survey

5.1. Quality Dimension Level By Survey Result

Quality Dimension
Perceived Quality (1)
Personal Competence (2)
Conformance (3)
Performance (4)
Reability (5)
Serviceability (6)
Durability (7)
Feature (8)

There are many deficiencies that the authors feels in this study, the lack of answers from respondents also lack the journals and related articles. The purpose of this study was to find out what drives the adoption of a standard and what is the impact on the company.

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APPENDIX 1. FORM SURVEY

NADCAP SURVEY

I would be very thankful for your time and help to fulfill this questionnaire which is related to Accreditation NADCP for the need of my research. Through this research, I would like to know the effect of NADCP Accreditation towards some aspects. This research is solely for educational purpose

Company Name :
Address :
Nation :

<table>
<tr><td>1</td><td>Scope of Accreditation</td><td>
<table>
<tr><td></td><td>Quality System</td><td></td><td>Electronics (ETG)</td></tr>
<tr><td></td><td>Chemical Processing (CP)</td><td></td><td>Fluid Distribution Components</td></tr>
<tr><td></td><td>Coatings (CT)</td><td></td><td>Heat Treating (HT)</td></tr>
<tr><td></td><td>Composites</td><td></td><td>Materials Testing Laboratory (MTL)</td></tr>
<tr><td></td><td>Conventional Machining (CM)</td><td></td><td>Non-Metallic Materials Testing (NMMT)</td></tr>
<tr><td></td><td>Elastomer Seals (SEAL)</td><td></td><td>Non Destructive Testing (NDT)</td></tr>
<tr><td></td><td>Sealants (SLT)</td><td></td><td>Nonconventional Machining (NM)</td></tr>
<tr><td></td><td>Surface Enhancement (SE)</td><td></td><td>Welding (WLD)</td></tr>
<tr><td></td><td colspan="3">Other….</td></tr>
</table>
Note : please put a cross (X) in the column
</td></tr>
<tr><td>2</td><td>What effect has NADCAP had on driving lean manufacturing at your Company?</td><td>
<table>
<tr><td></td><td>Increased Productivity</td><td></td><td>Improved Visual Management</td></tr>
<tr><td></td><td>Decreased Cycle Time</td><td></td><td>Improved Standardization</td></tr>
<tr><td></td><td>Decreased Waste</td><td></td><td>Other</td></tr>
</table>
Note : please put a cross (X) in the column
</td></tr>
<tr><td>3</td><td>How Long Your Company Accreditated NADCAP?</td><td>
<table>
<tr><td></td><td>1 Year</td><td></td><td>4 Year</td></tr>
<tr><td></td><td>2 Year</td><td></td><td>5 Year</td></tr>
<tr><td></td><td>3 Year</td><td></td><td>More 5 Year</td></tr>
</table>
Note : please put a cross (X) in the column
</td></tr>
<tr><td>4</td><td>Do you believe that NADCAP contributes to the overall aerospace industry s</td><td>
<table>
<tr><td></td><td>Yes</td><td></td><td>No</td></tr>
</table>
Note : please put a cross (X) in the column
</td></tr>
</table>

<table>
<tr><td></td><td>safety record?</td><td></td></tr>
<tr><td>5</td><td>Reasons for Seeking NADCAP</td><td>
<table>
<tr><td></td><td>Costumer Require it</td></tr>
<tr><td></td><td>Company Philosophy</td></tr>
<tr><td></td><td>Cost Reduction</td></tr>
<tr><td></td><td>Improve Product Quality</td></tr>
<tr><td></td><td>Increase Internal Audit</td></tr>
<tr><td></td><td>Improve Service Quality</td></tr>
<tr><td></td><td>Improve Public Image</td></tr>
<tr><td></td><td>Competitive Pressures</td></tr>
<tr><td></td><td>Responsiveness</td></tr>
<tr><td></td><td></td></tr>
</table>
Note : Please choose 5 points from the table by ranging 1 (the lowest) to 5 (the highest score)
</td></tr>
<tr><td>6</td><td>Obstacles Encountered During NADCAP Certification Process</td><td>
<table>
<tr><td></td><td>Implementation Time</td></tr>
<tr><td></td><td>Top Management involvement</td></tr>
<tr><td></td><td>System Change</td></tr>
<tr><td></td><td>Internal Resistance</td></tr>
<tr><td></td><td>Poor Documentation</td></tr>
<tr><td></td><td>Corporate Culture</td></tr>
<tr><td></td><td>Implementation Cost/limitations of Cost</td></tr>
<tr><td></td><td>Inadequate NADCAP Training</td></tr>
<tr><td></td><td>Difficult Interpretation standard</td></tr>
<tr><td></td><td>Over Documentation</td></tr>
</table>
Note : Please choose 5 points from the table by ranging 1 (the lowest) to 5 (the highest score)
</td></tr>
<tr><td>7</td><td>Impacts of NADCAP Accreditation on Quality</td><td>
<table>
<tr><td></td><td>V+</td><td>S+</td><td>None</td><td>S-</td><td>V-</td></tr>
<tr><td>Performance</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Features</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Reliability</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Conformance</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Durability</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Serviceability</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Personal Competence</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

		Perceived quality					

Note : please put a cross (X) in the column

V+ = very positive/5
S+ = somewhat positive/4
None = no impact/3
S- = somewhat negative/2
V- = very negative/1

Appendix 2. Scope Of Accreditation

No.	Name Of Company	Quality System	Chemical Processing (CP)	Coatings (CT)	Composites	Conventional Machining (CM)	Elastomer Seals (SEAL)	Sealants (SLT)	Surface Enhancement (SE)	Electronics (ETG)	Fluid Distribution Components	Heat Treating (HT)	Materials Testing Laboratory (MTL)	Non-Metallic Materials Testing (NMMT)	Non Destructive Testing (NDT)	Nonconventional Machining (NM)	Welding (WLD)	Other....
1	PS	√														√		
2	LY	√								√								
3	WD	√													√			
4	MF	√	√															
5	SN		√									√			√			
6	SPC Ltd														√		√	
7	BZ											√						
8	FTL											√	√		√			
9	TDP		√															
10	YC											√	√				√	
11	GF									√								
12	DPS	√	√	√											√			
13	AR														√			
14	TM		√															
15	AMT	√	√															
16	AC	√	√															
17	AST		√												√			
18	JH											√						
19	CM	√	√	√		√		√				√	√				√	
20	CMF										√							
21	WG															√		
22	SCL	√	√															
		9	10	2		1		1		2	1	6	3		7	2	3	

Appendix 3. What Effect Has Nadcap Had On Driving Lean Manufacturing At Your Company

No.	Name Of Company	Increased Productivity	Decreased Cycle Time	Decreased Waste	Improve Visual Management	Improve Standardization	Other
1	PS				X		
2	LY				X	X	
3	WD						
4	MF						X
5	SN	X	X		X	X	
6	SPC Ltd				X	X	
7	BZ					X	
8	FTL				X	X	
9	TDP						X
10	YC					X	
11	GF					X	
12	DPS	X				X	
13	AR						X
14	TM					X	
15	AMT	X		X		X	
16	AC					X	
17	AST			X		X	
18	JH						X
19	CM				X	X	
20	CMF				X	X	
21	WG						X
22	SCL				X	X	
	Total	**3**	**1**	**2**	**8**	**15**	**5**

APPENDIX 4. How Long Your Company Accreditated NADCAP

No.	Name Of Company	1 Year	2 Year	3 Year	4 Year	5 Year	Most 5 Year
1	PS	X					
2	LY			X			
3	WD						X
4	MF						X
5	SN						X
6	SPC Ltd						X
7	BZ						X
8	FTL						X
9	TDP		X				
10	YC						X
11	GF		X				
12	DPS						X
13	AR						X
14	TM			X			
15	AMT						X
16	AC						X
17	AST						X
18	JH						X
19	CM						X
20	CMF						X
21	WG						X
22	SCL			X			
	Total	1	2	3	0	0	16

No.	Company	1st	2nd	3rd	4th	5th
1	**PS**	Costumer Require	Improve Product Quality	Increase Internal Audit	Improve Service Quality	Company Philosophy
2	**LY**	Improve Service Quality	Improve Public Image	Costumer Require	Improve Product Quality	Company Philosophy
3	**WD**	Improve Service Quality	Company Philosophy	Competitive Pressure	Increase Internal Audit	Costumer Require
4	**MF**	Costumer Require	Not answer	Not answer	Not answer	Not answer
5	**SN**	Costumer Require	Not answer	Not answer	Not answer	Not answer
6	**SPC Ltd**	Costumer Require	Not answer	Not answer	Not answer	Not answer
7	**BZ**	Costumer Require	Not answer	Not answer	Not answer	Not answer
8	**FTL**	Company Philosophy	Improve Service Quality	Competitive Pressure	Improve Product Quality	Costumer Require
9	**TDP**	Costumer Require	Not answer	Not answer	Not answer	Not answer
10	**YC**	Not answer	Not answer	Not answer	Not answer	Not answer
11	**GF**	Costumer Require	Company Philosophy	Improve Product Quality	Not answer	Not answer
12	**DPS**	Responsiveness	Competitive Pressure	Improve Public Image	Improve Product Quality	Costumer Require
13	**AR**	Competitive Pressure	Improve Service Quality	Cost Reduction	Responsiveness	Costumer Require
14	**TM**	Not answer	Not answer	Not answer	Not answer	Improve Product Quality
15	**AMT**	Improve Public Image	Competitive Pressure	Improve Product Quality	Cost Reduction	Costumer Require
16	**AC**	Improve Service Quality	Competitive Pressure	Improve Product Quality	Company Philosophy	Costumer Require
17	**AST**	Costumer Require	Competitive Pressure	Improve Product Quality	Improve Service Quality	Company Philosophy
18	**JH**	Costumer Require	Not answer	Not answer	Not answer	Not answer
19	**CM**	Company Philosophy	Responsiveness	Competitive Pressure	Improve Public Image	Costumer Require
20	**CMF**	Costumer Require	Not answer	Not answer	Not answer	Not answer
21	**WG**	Company Philosophy	Improve Public Image	Improve Product Quality	Competitive Pressure	Costumer Require
22	**SCL**	Not answer	Company Philosophy	Improve Public Image	Not answer	Costumer Require

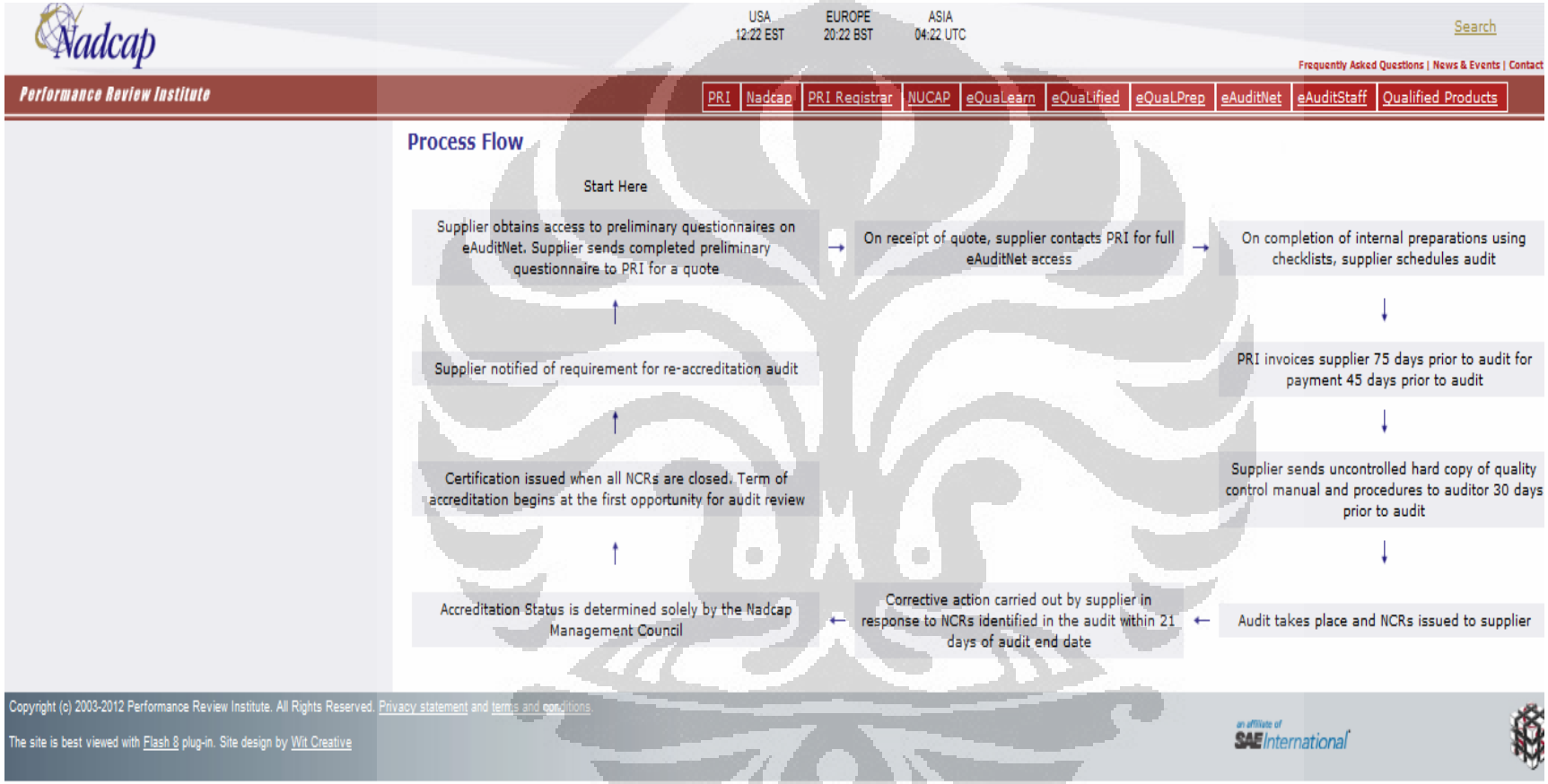
APPENDIX 7. Obstacle Encountered During NADCAP Certification Process

No.	Company	1st	2nd	3rd	4th	5th
1	PS	Inadequate NADCAP Training	Implementation Cost/Limitation Cost	Difficult Interpretation Standard	System Change	Poor Documentation
2	LY	Difficult Interpretation Standard	Inadequate NADCAP Training	System Change	Over Documentation	Implementation Cost/Limitation Cost
3	WD	Inadequate NADCAP Training	System Change	Time Implementation	Implementation Cost/Limitation Cost	Over Documentation
4	MF	System Change	Time Implementation	Implementation Cost/Limitation Cost	Poor Documentation	Internal Resistance
5	SN	Time Implementation	Not Answer	Not Answer	Not Answer	Not Answer
6	SPC Ltd	Implementation Cost/Limitation Cost	Over Documentation	Poor Documentation	Inadequate NADCAP Training	Over Documentation
7	BZ	Difficult Interpretation Standard	Over Documentation	Not Answer	Not Answer	Not Answer
8	FTL	System Change	Internal Resistance	Difficult Interpretation Standard	Inadequate NADCAP Training	Implementation Cost/Limitation Cost
9	TDP	Not Answer	Not Answer	Inadequate NADCAP Training	Over Documentation	Difficult Interpretation Standard
10	YC	Not Answer	Not Answer	Not Answer	Not Answer	Not Answer
11	GF	Time Implementation	Not Answer	Not Answer	Not Answer	Not Answer
12	DPS	System Change	Time Implementation	Over Documentation	Difficult Interpretation Standard	Implementation Cost/Limitation Cost
13	AR	Over Documentation	Difficult Interpretation Standard	Implementation Cost/Limitation Cost	System Change	Time Implementation
14	TM	Not Answer	Not Answer	Not Answer	Not Answer	Not Answer
15	AMT	Poor Documentation	Difficult Interpretation Standard	Over Documentation	Inadequate NADCAP Training	Implementation Cost/Limitation Cost
16	AC	Inadequate NADCAP Training	Difficult Interpretation Standard	System Change	Time Implementation	Implementation Cost/Limitation Cost
17	AST	Difficult Interpretation Standard	Time Implementation	Implementation Cost/Limitation Cost	Over Documentation	Internal Resistance
18	JH	Difficult Interpretation Standard	Not Answer	Not Answer	Not Answer	Not Answer
19	CM	Implementation Cost/Limitation Cost	Over Documentation	Difficult Interpretation Standard	Inadequate NADCAP Training	Time Implementation
20	CMF	Difficult Interpretation Standard	System Change	Time Implementation	Implementation Cost/Limitation Cost	Top Management Involvement
21	WG	Not Answer	Over Documentation	Difficult Interpretation Standard	Implementation Cost/Limitation Cost	Inadequate NADCAP Training
22	SCL	Difficult Interpretation Standard	Implementation Cost/Limitation Cost	Internal Resistance	Not Answer	Not Answer

Appendix 8. Impact Of NADCAP Accreditation On Quality

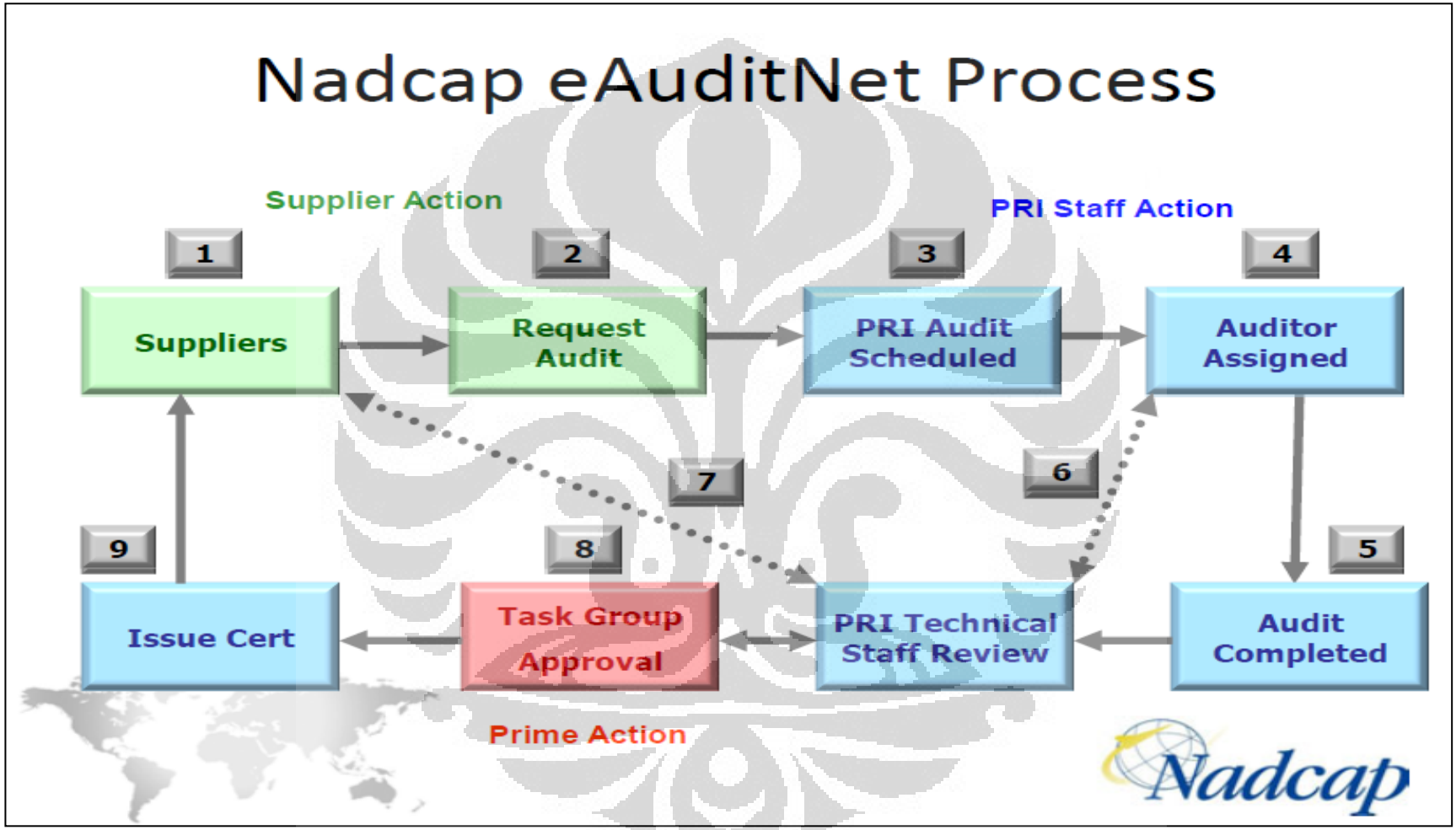
No.	Name Of Company	Performance	Features	Reability	Conformance	Durability	Serviceability	Personal Competence	Perceived Quality
1	PS	4	4	4	5	4	4	3	4
2	LY	5	5	5	5	5	5	5	5
3	WD	3	3	3	3	3	3	3	4
4	MF	4	4	4	4	4	3	5	5
5	SN	3	3	3	4	3	3	4	3
6	SPC Ltd	4	3	3	4	3	3	4	5
7	BZ	4	3	3	4	3	3	5	5
8	FTL	5	3	4	4	4	4	5	5
9	TDP	3	3	4	4	3	3	4	4
10	YC	4	5	5	5	5	5	5	5
11	GF	4	3	4	4	4	3	4	4
12	DPS	4	4	4	4	4	4	4	4
13	AR	5	4	5	5	4	5	5	5
14	TM	3	3	3	3	3	3	3	3
15	AMT	3	3	4	5	4	4	5	5
16	AC	4	3	4	4	4	4	4	4
17	AST	4	3	4	4	3	4	4	4
18	JH	4	3	4	4	4	4	4	4
19	CM	4	4	4	4	4	4	3	4
20	CMF	5	4	5	5	5	5	5	5
21	WG	3	3	3	3	3	3	3	4
22	SCL	4	3	3	4	3	3	4	4

APPENDIX 9. NADCAP PROCESSE FLOW



Source : http://www.pri-network.org/PRI/

APPENDIX 10. NADCAP EAUDITNET PROCESS



APPENDIX 11. ISO 9001:2008 AND AS9100 DIFFERENCES

ISO 9001:2008	AS9100C (2009)
	Highlighted items are addition to ISO 9001:2008
1. SCOPE	**1. SCOPE**
1.1 General	1.1 General
1.2 Application	1.2 Application
2. NORMATIVE REFERENCES **ISO 9000:2005**	**2. NORMATIVE REFERENCES** **ISO 9000:2005**
3. TERMS AND DEFINITIONS	**TERMS AND DEFINITIONS**
	3.1 Risk
	3.2 Special Requirements
	3.3 Critical Items
	3.4 Key Characteristic
4. QUALITY MANAGEMENT SYSTEM	**4. QUALITY MANAGEMENT SYSTEM**
4.1 General Requirements	4.1 General Requirements
4.2 Documentation Requirements	4.2 Documentation Requirements
4.2.1 General	4.2.1 General
4.2.2 Quality Manual	4.2.2 Quality Manual
4.2.3 Control of Documents	4.2.3 Control of Documents
4.2.4 Control of Records	4.2.4 Control of Records
5. MANAGEMENT RESPONSIBILITY	**5. MANAGEMENT RESPONSIBILITY**
5.1 Management Commitment	5.1 Management Commitment
5.2 Customer Focus 5.3 Quality Policy 5.4 Planning	5.2 Customer Focus 5.3 Quality Policy 5.4 Planning
5.4.1 Quality Objectives	5.4.1 Quality Objectives
5.4.2 Quality Management System Planning	5.4.2 Quality Management System Planning
5.5 Responsibility, Authority and Communication	5.5 Responsibility, Authority and Communication
5.5.1 Responsibility and Authority	5.5.1 Responsibility and Authority
5.5.2 Management Representative	5.5.2 Management Representative
5.5.3 Internal Communication	5.5.3 Internal Communication
5.6 Management Review	5.6 Management Review
5.6.1 General	5.6.1 General
5.6.2 Review Input	5.6.2 Review Input
5.6.3 Review Output	5.6.3 Review Output
6. RESOURCE MANAGEMENT	**6. RESOURCE MANAGEMENT**
6.1 Provision of Resources	6.1 Provision of Resources
6.2 Human Resources	6.2 Human Resources
6.2.1 General	6.2.1 General
6.2.2 Competence, Training and Awareness	6.2.2 Competence, Training and Awareness
6.3 Infrastructure	6.3 Infrastructure
6.4 Work Environment	6.4 Work Environment
7. PRODUCT REALIZATION	7. PRODUCT REALIZATION
7.1 Planning of Product Realization	7.1 Planning of Product Realization
	7.1.1 Project Management
	7.1.2 Risk Management
	7.1.3 Configuration Management
	7.1.4 Control of Work Transfers
7.2 Customer-Related Processes	7.2 Customer-Related Processes
7.2.1 Determination of Requirements Related to the Product	7.2.1 Determination of Requirements Related to the Product
7.2.2 Review of Requirements Related to the Product	7.2.2 Review of Requirements Related to the Product
7.2.3 Customer Communication	7.2.3 Customer Communication
7.3 Design and Development	7.3 Design and Development

7.3.1 Design and Development Planning	7.3.1 Design and Development Planning
7.3.2 Design and Development Inputs	7.3.2 Design and Development Inputs
7.3.3 Design and Development Outputs	7.3.3 Design and Development Outputs
7.3.4 Design and Development Review	7.3.4 Design and Development Review
7.3.5 Design and Development Verification	7.3.5 Design and Development Verification
7.3.6 Design and Development Validation	7.3.6 Design and Development Validation
	7.3.6.1 Design and Development Verification and Validation Testing
	7.3.6.2 Design and Development Verification and Validation Documentation
7.3.7 Control of Design and Development Changes	7.3.7 Control of Design and Development Changes
7.4 Purchasing	7.4 Purchasing
7.4.1 Purchasing Process	7.4.1 Purchasing Process
7.4.2 Purchasing Information	7.4.2 Purchasing Information
7.4.3 Verification of Purchased Product	7.4.3 Verification of Purchased Product
7.5 Production and Service Provision	7.5 Production and Service Provision
7.5.1 Control of Production and Service Provision	7.5.1 Control of Production and Service Provision
	7.5.1.1 Production Process Verification
	7.5.1.2 Control of Production Process Changes
	7.5.1.3 Control of Production Equipment, Tools and Software Programs
	7.5.1.4 Post-Delivery Support
7.5.2 Validation of Processes for Production and Service Provision	7.5.2 Validation of Processes for Production and Service Provision
7.5.3 Identification and Traceability	7.5.3 Identification and Traceability
7.5.4 Customer Property	7.5.4 Customer Property
7.5.5 Preservation of Product	7.5.5 Preservation of Product
7.6 Control of Monitoring and Measuring Equipment	7.6 Control of Monitoring and Measuring Equipment
8. MEASUREMENT, ANALYSIS AND IMPROVEMENT	8. MEASUREMENT, ANALYSIS AND IMPROVEMENT
8.1 General	8.1 General
8.2 Monitoring and Measurement	8.2 Monitoring and Measurement
8.2.1 Customer Satisfaction	8.2.1 Customer Satisfaction
8.2.2 Internal Audit	8.2.2 Internal Audit
8.2.3 Monitoring and Measurement of Processes	8.2.3 Monitoring and Measurement of Processes
8.2.4 Monitoring and Measurement of Product	8.2.4 Monitoring and Measurement of Product
8.3 Control of Nonconforming Product	8.3 Control of Nonconforming Product
8.4 Analysis of Data	8.4 Analysis of Data
8.5 Improvement	8.5 Improvement
8.5.1 Continual Improvement	8.5.1 Continual Improvement
8.5.2 Corrective Action	8.5.2 Corrective Action
8.5.3 Preventive Action	8.5.3 Preventive Action