June 21, 2011 (Tuesday) 55th EOQ Congress

CONCURRENT SESSIONS **Tuesday 13:30 – 17:30**
KEMPINSKI HOTEL CORVINUS **Erzsébet tér 7-8, Budapest V.**

SALON CORVINUS **Tuesday 13:30 – 15:00**

13.1. MANAGEMENT SYSTEM CERTIFICATION AND THE AUDITS

Session Chair: ***Olav F. Finsnes****, Norwegian Society for Quality and Risk Management, Norway*

14.30 Improving Flight Safety Issues in the ASD (Aviation, Space & Defense) Industries
Alois Peter (Lou) Magritzer, Oz-Lean Six Sigma-Partners, Australia

Magritzer, Alois Peter (Lou) (Australia), Member of the International Academy for Quality (IAQ)

Having among others Production Engineering & Toolmaking Certificate and an International Management Diploma, Academician in the International Academy for Quality (IAQ), she is a technical expert and an experienced Lead Auditor. In 1994 she got the Juran Medal & now is President of the Juran Medalists' College. In 2001 she was Recipient of Shanghai Quality Magnolia Award (SAQ). In 2007 she got the APQO (Asia Pacific Quality Organization) Presidents' Award. She is Senior Member of ASQ. He has more than 40 years' work experience as Inspector, Lead Auditor, QA Manager, Consultant, Trainer and Coach in the following fields: Automotive industry, Aerospace, Telecom / Electronics etc. She is Head of AQACI (Quality Assurance Services – Merrylands, New-South-Wales), Australia's first QA Consultancy (since 1970) & OZ-Lean Six Sigma-Partners.

Improving Flight Safety issues in the global ASD (Aviation, Space & Defense) Industries
Driven by the new AS/EN/JISQ 9100C-series of QMS standards

Lou MAGRITZER
6/25/2011

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ABSTRACT: **Improving Flight Safety issues in the global ASD (Aviation, Space & Defence) Industries**

PREAMBLE: Some kind of management of Risk, Safety and Quality aspects were obviously practised since mankind's first motorised flight in 1901 by Gustav Whitehead. However, this paper deals especially with a few vital pillars of Flight Safety e.g. the well developed industry-specific Management Systems pertaining to risk based management, Aircraft Safety, Quality, Standardisation and continual Improvement etc. Also considered now a days by many quality experts to assure Flight Safety is the application of the global Six Sigma DMAIC (Define-Measure-Analyse-Improve-Control) Project by Project quality and safety improvement way. With primary focus on Defect/ Error and Quality Cost reduction through proper Variation Control of Product and Processes, supported by properly calibrated Measuring and Test Equipment. As well as an effective Auditing and Certification process of Systems & supply or production of Quality material and Product , and of course, adequate training of people. Especially during the first decade of the 21st Century (2000- 2010) the global Aerospace industry dealt with a number of significant Safety, Quality, Standards and Audit/ Certification related initiatives and issues this paper will aim to proof that "**FLIGHT SAFETY IS THE RESULT OF QUALITY".**

Personal background: This author (Acn. A.P. Lou MAGRITZER) works as an aerospace experienced Quality professional in Australia since 1966, developing from Ground Engineer, Inspector, Auditor, NDT Signatory, Quality Engineer, to Quality Manager, and still ongoing as Trainer, Consultant, Source Inspector, Project Specialist / Project QA Rep, RAABQSA & IRCA certified ISO 9001 and AS9100 Aerospace Experienced Lead Auditor and ASQ- Certified Six Sigma Green Belt and honoured as an Academician of the International Academy for Quality (IAQ). He is a member and office holder for up to many decades of AOQ and APQO, a member and/or certified member of ASQ, WITA, SAE, CQI, RABQSA, IRCA.

MAIN CONTENT INTRODUCTION: (R MEANS REFERENCE NUMBER).

This author is privileged to share with the readers of this paper and the participants of the June 2011 EOQ (European Organisation for Quality) World Congress in Budapest, Hungary, some of the salient points and words used in prior periods compared with now i.e. Reference **(R1):** The 1995 Proceedings, (1169 pages), covering the 49th ASQ-AOC (Annual Quality Congress, in Cincinnati, Ohio, USA). Its huge Key Word Index in was visually analysed to find and rank its 10 most frequently printed key words in 1995. See **Table #1** results below that shows on how many pages (x-), that particular **key word** was printed; later we can see a comparison against more current publications/findings..

Table #1:
Key Word Search in the 1169 pages of the 49th ASQ-AOC Proceedings in 1995 (R1)
Note: Printed **Key word/s shown** in **bold** and printed on how many pages **(in brackets)**

1: **Quality** to **quality tools** (x**51** pages);
2: **ISO 9000** (x**22** pages);
3: **Continuous improvement** to **continuous process improvement** (x**22** pages);
4: **Process** (x**20** pages)
5: **TQM** (x**19** pages);
6: **Empowerment** (x**18** pages)
7: **Statistical to Statistics** (x**17** pages);
8: **Training** to **train the trainer** (x**15** pages)
9: **Assessment** to **auditing** (x**13** pages)
10: **Leadership** (x on **12** pages)

Table #1 Findings : 51 Quality Key words printed on 1169 pages equals a rather sorry figure for Q-Words.
Anyone would expect at least 1 Q- word per PAGE, making it about 1169 "QUALITY" words throughout the 166 papers.
Attached one page "QUALITY" document Titled "Thirteen Fundamental QUALITY Truths" may be used for executive and other management training. It has listed 13 Truth with 16 QUALITY words. The Original was developed by Acn. James HARRINGTON in 1986 and Quality modified by Acn. Lou MAGRITZER, 2011.

MORE ON KEY WORDS
It is apparent now that some currently popular words were not so often used by authors/presenters in 1995 (some 16 years ago) then designated as Key Words, in the huge 49th AQC Proceedings, with 1169 pages, covering the Cincinnati Congress (which this author attended). **(R1)** continued: A count of its Proceeding's 25 page Technical Paper Index shows that 166 papers were presented and printed. For example from the Proceedings 11 page long Key Words Index the count of some currently popular Key Words was then rather low i.e.: **continual improvement** (x1), **audit** (x3), **auditing** (x1), **six sigma** (x2). These four examples were certainly not very prominent key quality

words then in 1995, when compared with now. The first "Six Sigma" Key Word appears on page 150 of the 49th AQC Proceedings, and another 6 times on page 153, of the 9 page paper by Joseph F. St. CLAIR, then Program manager-IBM. The second paper titled "Reducing Variation during Design" shows the key word "Six Sigma" on page217 as **"aix aigma"** a likely printing error. The word " Six Sigma" appears only once more within the very interesting paper on Process Tolerances, by Wayne A. Taylor,(Director Quality Technologies, Baxter Healthcare Corp.) quote: "This is Motorola's Six Sigma objective." The other 162 (~98%) of the 1995 Congress papers did apparently not mention once **"six sigma"** as a key word, nor **"Flight Safety";** and **"risk management"** also scored only once.

Table 1: Findings : It appears that after 1995 "six sigma' may have became more popular amongst quality practitioners in the USA and elsewhere.

PROCEEDINGS AND HEDs/SHEDs

(R2) From the Proceedings- Third China Aviation Summit- Management And Development (16-18 Nov. 1998 , in Zuhai, Guangdong Province, China), this author's paper was titled "AS 9000, the new Aerospace standard- fit for the 21st Century",(page 71-1 to 71-16,) it was one of 86 papers presented. Its main focus was then on the introduction of the new AS9000 Aerospace Industry-specific QMS standard, that was based on the generic ISO 9001/2:1987 version and used by a few leading organisations in the then Australian Aviation Maintenance sector. The second focus was then on the analysis of Human Error Defects (HEDs) and or Suspect Human Error Defects (SHEDs) from data published by CASA, the Australian Aviation Regulator, from January 1993 to July 1996, so the findings could be related to some more current information at later stages. The most frequent five HEDs (from this author's 1998 paper(page 71-6) are shown in Table # 2.

Table # 2: Reported Human Error Defects (HEDs), Total: 1000

1. Incorrect Assembly Operations- 42%
2. Incorrect Parts fitted- 14%
3. Missing Parts- 8%
4. Bogus Parts- 6%
5. Illegal Repairs- 6 %
6. Various other Human Errors- 24%

Table #2 Findings: It appears that from 1993 to 1996 just the two top ranking Human Error Defects (HED) accounted for over 50% of all reported HEDs. Also from Exhibit 2 of the Zhuhai Proceedings (Page71-14 to 71-16) shows a relatively small sample of two dozen typical Human Error Defects; as found in various types of aircraft by Australian maintenance engineers and reported to CASA in 1995.

Table # 2.1. (R2.1) Reported SHEDs' Period: 6 Year Totals, 1993-1998,

Source: a) IASMC Proceedings, Page 113- 125, Paper by LM, "Good Management Systems today. More effective management systems tomorrow." incl. Exhibit 5.2, "Human Error Defect Analysis 1993-1998); Perth, WA, Australia, 17-21 Oct. 1999(AOQ-QUALCON 2000 Proceedings, Sydney, 6-9 Feb.2000, Author: LM, Title: Management in the 21. Century- Management By Standards (Page 275-294).

Table 2.1 Suspect Human Error Defects (SHEDs)-Source: AUS-CAA-CASA (6 year Period 1993-1998) Analysed by L.M.

ITEM	SHEDS Totals	Y 1993	Y 1994	Y 1995	Y 1996	Y 1997	Y 1998	Totals : 6 Years	Average/ Year
1	Incorrect Assy. Op	93	104	96	131	97	86	607	101
2	Bogus Parts	4	13	30	60	52	24	183	<31
3	Incorrect Parts	27	41	36	23	21	16	164	27
4	Missing Parts	11	13	23	18	13	23	101	<17
5	MFG. Error	16	13	19	18	9	15	1835	<306
6	Illegal Repairs	3	13	18	19	14	11	78	13
7	Inadequate Maintenance	4	21	8	15	12	12	72	12
8	Pilot/Passenger Error	8	8	3	14	5	14	52	<9
9	Other	57	56	73	111	113	74	484	<81
	Total all 9 Items of SHEDs	223	282	306	409	336	275	1835	<306

Table 2.1 Findings: The 3 top SHEDS Averaging/Year are: MFG. Error with 306 Items, then Incorrect Assy.OPS and Bogus parts.

Table # 3. Reported Human Error Defects (HEDs), Exhibit 2**:**
***Sample Quantity:** 24,
***CASA Defect Ident** (sample ranging from lowest reported # 95/0007 to highest # 95/1850)
***Ident by Aircraft or by Component only**
****Ident by Aircraft:** 11 off
Beech 2- Airbus 1-BAC 1-Bell 1-BNORM 1-Boeing 1-CAC 1-Cessna 1-Piper 1-SKRSKY 1
HEDs: Incorrect Bearing Fitted; Fuel System Contaminated; Pin Incorrect Fit; Torque Link Incorrect Fit; Rod Damaged; Cable Incorrect Secured; Fuel Error-Pilot; Bolt over-torque; Screw FOD (Foreign Object Damage/ Debris);
****Ident By Component only:** 13 off
ALLSN 1- CONT 2- GE 1- HARTZ 1- LYC 1- MCAULY 1- PWA 3- RROYCE 2-STBROS 1
HEDs: Turbine Faulty; Bearing Failed; Engine Cylinder Separated; Accessory Unit Missing; Propeller Blade Faulty; Gear Stripped; Propeller Blade Incorrect Part; Turbine Illegal Repair; O-Ring Damaged; O-Ring Damaged; Thrust Reverser Faulty; Plug Incorrect Fit; O-Ring Failed;

Table # 3 Findings: Most of the Human Error Defects (HEDs) reported some16 years ago by CASA appear in broad terms rather similar to the once reported in the last few years. Never ever say "NEVER", as one day it will happen; most of these defects / errors appear to be HED's or Human Error Defects /mistakes, and some of them must surely contribute to an increased risk factor on Flight safety.
In this author's experience, by definition **" FLIGHT SAFETY, is the result of QUALITY "** ranging from good Quality to poor Quality.
Any Non- or Poor Quality: material, product, processes ,equipment, machinery, infrastructure, suppliers, regulators, workers, staff, management, planning, training, engineering, auditing, records, specifications, drawings, standards, systems, producing, assembling, testing, controlling, verifying, shipping , or not improving, all together with un-satisfied customers etc. reduces the degree of flight safety.
In general, 'No Quality', means risk galore without real Safety and/or proper Quality margin. Attached is a copy of

MORE ON QUALITY MANAGEMENT SYSTEMS (QMS)

In 1995, this author stated the following personal conviction, quote: "This author believes that many of these reported defects/errors could have been reduced or even avoided at that time, if CASA would have been insisting on an effective Quality Management System (QMS), then based on ISO 9001/2, or more definitely a system based on the then new Aerospace Standard AS 9001/2". To the ISO 9001(1987) generic QMS standard were about 37 Aerospace industry-specific requirements added and some Notes by Quality experts working for aircraft manufacturers and in maintenance sectors etc. However then, as now (in 2011) nobody except some stakeholders, mainly customers and maybe a few switched-on CEO's in the Aviation maintenance industry, required or insisted on the introduction of an ISO or AS based QMS. Hence the HEDs continued to be created, found and reported as normal and published in the FSA magazine. Nowadays, CASA's similar reports named "Selected Service Difficulty Reports" (SDRs), appear in their excellent bi-monthly Journal called "flightsafety Australia" (FSA). However, a visual search for the key word "QUALITY" in the 70 or so Pages of each edition of recent FSA magazines is like searching for a needle in a hay stack. Not good for aviation business, nor for its people, its customers and other stakeholders and their moral. It is like going through a long marriage and never hear the key word "Love". Rather risky!

Table # 4. Reported Findings of the key Word "QUALITY"
A search for the **Q-Word** i.e. **"Quality"** in any edition of "Flightsafety Australia"is normally without much success. However FSA issue No. 80 (May-Jun 2011) (72 pages, plus some advertisement pages) revealed a surprise: the word **"Quality"** actually appeared on page 14/72 in an article titled "Training and Personnel Shortages are common themes of concern". It pays to repeat verbatim its first paragraph: "Heliwest's Grimes says: 'I think training is the big one. I don't think there is enough **quality** training going on in services that support aviation. I see the industry becoming a bit frantic which I don't think is a good thing." This warrants a repeat of the favourite definition used by this paper's author: **" FLIGHTSAFETY is the result of QUALITY."** Like every other good thing or action in this world it is the result of **QUALITY.**

Table # 5: Findings from "Selected Service Difficulty Reports"-(SDR)

A) **Aircraft above 5700 kg**	B) **Aircraft below 5700 kg**	C) **Rotorcraft:**
Total SDR's listed: 83	**Total SDR's listed: 31**	**Total SDR's listed: 7**
Airbus: 8	Beech: 3	Bell: 2
BAC: 4	Cessna: 12	Bolkow: 1
Beech: 1	Diamond: 1	Eurocopter: 2
Boeing: 48	Grob: 1	MDHC: 1
Bombardier: 2	Jabiru: 1	Robinson: 1
CVAC: 1	Kavanagh: 1	
Embraer: 8	Pilatus: 1	
Fokker: 3	Piper: 5	
Hawker-Beech: 1	Swearingen: 6	
Lear: 1		
Raytheon: 1		
Saab: 5		

D) **Piston Engines:**	E) **Turbine Engines:**	F) **Propellers:**	G) **Components**
Total SDR's listed: 13	**Total SDR's listed: 13**	**Total SDR's listed: 1**	**Total SDR's listed: 3**
Continental: 5	Garrett: 5	Hartzell: 1	Continental:2
Lycoming: 7	GE: 2		Mytton: 1
PWA: 1	IAE: 3		
	Lycoming: 1		
	Rolls Royce: 2		

Source: FSA, Nov-Dec 2010, Issue 77, Page 33 to 37/72. Period: 1 August 2010 to 30 September 2010

Note: 24 of the 151 listed SDR's are still under investigation.

Findings: The above **Table # 5** shows the results of **Quality** gone wrong with 3 common groups of Aircraft, plus 2 groups of Engines as well as the Propellers and Component groups. These 7 groups account for a total of 151 SDR's reported to CASA by the Australian Civil Aviation Industry during the two month **period August/September 2010**. Mostly **Quality** gone wrong because of Human Error Defects. These 151 SDR's prove again that no aircraft , component, part or system is likely to be free of HED's or SHEDS or any other Defects throughout its lifecycle. Hence QMS requirements on the ground, in the sea and in the air must be continually improved, to ensure a proper degree of **QUALITY AND FLIGHT SAFETY**.

WHAT IS BARS?

Table 6: BARS-Version 3, June 2010: Overview

The next article in fsa (page 15) titled **" RAISING THE BAR- Miners set a standard for flight safety "** has drawn the attention of the author of this paper to a new and excellent sector-specific document , BARS, the "Flight Safety Foundation's Basic Aviation Risk Standard , version 3, June 2010. FSF Quote "A common standard and auditing process used by contracting companies to evaluate aviation operators to ensure regulatory compliance and the safety of employees." It is specifically tailored for the global Resource / Mining industry Sector. The author of this EOQ paper & presentation could not resist to have a "word for word" review of Flight Safety Foundation's (FSF) approach and content of its 40 page Standard cum QMS Manual titled "Basic Aviation Risk Standard (BARS)". This EOQ paper author's findings are summarised in the following set of BARS Review **Table series 6.1 to 6:9.**

Table 6.1: BARS-Version 3, June 2010-Contact & Structure:
Contact: *BAR Standard Program Office-Melbourne, Victoria
Web: **www.flightsafety.org**
*Or Flight Safety Foundation Headquarters
601 Madison Street, Suite 300, Alexandria, Virginia, US 22314-1756
Structure:
No. of Pages: 40
Contents: Threats 1. to 11, incl. Fig.1 (page 1-18), plus Appendix 1 to 5, (page 19- 36)

Table 6.1 Findings: Contact BAR Offices as required, and thank them for a very good BARS version 3.

Table 6.2: BARS –Contents:	**Table 6.3**: BARS –Appendices: Page 19
All Threats 1.0: Common Controls- Page 6/40	Appendix 1: Aircrew Qualifications and Experience- Page 20
Threat 2.0: Runway Excursions- Page 8	Appendix 2: Basic Aircraft Equipment Fit- Page21
Threat 3.0: Fuel Exhaustions- Page 9	Appendix 3: Abbreviations- Page 22
Threat 4.0: Fuel Contamination- Page 10	Appendix 4: External Load Operations- Page 24
Threat 5.0: Controlled Flight Into Terrain (CFIT)- Page 11	Appendix 5: Offshore Operations- Page 30-36
Threat 6.0: Incorrect Loading- Page 12	
Threat 7.0: Collision on Ground- Page 13	
Threat 8.0: Collision in Air- Page 14	
Threat 9.0: Structural or Mechanical Failure- Page 15	
Threat 10.0: Weather – Page 16	
Defences 11.0: Aircraft Accident –Page 17	

Table 6.2 & 6.3 Findings: Study the 11 Threats and learn from the 5 Appendices, as I did.

Table 6.4 List of this Author's additional BARS findings:

(1) Page 2 Contents does list all 11 Threats
(2) Fig. 1 Presents on Page 4 and 5, Figure 1: titled " Schematic Of Aviation Risk Management Controls and Recovery Measures."
(3) Figure 1 on Page 4 shows in the first Column: the Threats 2 to 10, ranging from Runway Excursions to Weather.
(4) Figure 1 on Page 4 shows in the second Column: Common Controls 1.1 to 1.15 for all Threats 1.0. Ranging from 1.1 Approved Aircraft Operator to 1.15 Airborne Geophysical Operations
(5) Figure 1 on Page 4 shows in the third Column: 9 sets (total 18) of more specific Controls /Recovery Measures. Ranging from Airfield Design to Wind Shear Training.
(6) Figure 1 on Page 4 shows in the fourth Column: 9 sets (total 24) of more specific Controls /Recovery measures. Ranging from Site Assessment to Weather Radar.
(7) Figure 1 on Page 5 shows in the first Column: 6 sets (total 15) of more specific Controls /Recovery measures to avoid a possible Aircraft Accident. Ranging from Drummed Fuel to Sub-chartering of Aircraft.
(8) Figure 1 on Page 5 shows in the second and final Column: 6 sets (total 16) of specific Recovery measures : from Aircraft Certification Standards to Insurance.
(9) Note: Figure 1 spreading over two pages is much more comprehensible if seen in its original 35 coloured blocks.
10) Page 8 to 16 cover Threat 2.0 Runway Excursions to Threat 10.0 Weather
11) Page 17 & 18 cover Defences 11.0 ranging from Defence 11.1 Aircraft Certification Standards to Defence 11.15 Insurance.
12) Page 20 covers Appendix 1: Aircrew Qualifications and Experience- from 3 grades of Pilots, as well as that of a Chief Engineer and Line Engineer
13) Page 21 covers Basic Aircraft Equipment Fit- for Helicopters and Aeroplanes
14) Page 22 & 23 covers Appendix 3: A total of 143 Abbreviations- from AD- Airworthiness Directives to Vne- Velocity Never Exceeded.

Table 6.4 Findings: An Abbreviation list such as in Appendix 3, of the BARS Manual (Basic Aviation Risk Standard) can be an obvious life saver in case of emergency communication by international Flight crews. As no one is expected to remember in an emergency all required abbreviations without a handy list.

See Table 6.5- BARS Abbreviations Analysis per Appendix 3:

Table 6.5: Analysis of BARS' Appendix 3- Abbreviations:

1) BARS Appendix 3 covers a total of 143 Abbreviations from letters A to V except these 5 letters: K and W,X,Y,Z.
2) The following Letters of the English alphabet show the number of times an Abbreviation appears in BARS, Version 3. A-22 times; B-1; C-9; D-4; E-9; F-8; G-3; H-9; I-10; J-1; K-0; L-4; M-10; N-5; O-3; P-7; Q-1; R-4; S-9; T-9; U-1, V-14 times;
Note: The Letters W-X_Y_Z, were not used in version 3 of the BARS Standard,
3) It is also noted that the Abbreviation "QA" is not included in BARS App 3, although it relates in page 15/40 Thread 9.0, in Control 9.3: Supply of Spares i.e. "Maintenance Organisations are to have a list of approved Suppliers who are listed in a Quality Assurance Surveillance Program to ensure that parts received do conform to FAA- approved (or equivalent) design data, and are in a condition for safe operation."

Suggested Point For Improvement (PFI): add "(QA)" behind " Quality Assurance" and include "QA" in Appendix 3 under letter "Q". Another suggested PFI is to reference/record in a page of the BARS Standard/ Manual all the Aviation organisation's Certification details e.g. (QMS) Quality Management System, Certified to ISO9001-2008, plus AS9100 or AS9010 or AS9120:2010; plus any EMS (Environmental Management System) or RMS (Risk Management System) etc. and expiry dates of Certification plus any dates of recent Management System Audits by Regulatory bodies and/or customers.

Table 6.5 Findings: Please see the PFIs stated above.

Table 6.6: Analysis of BARS' use of action words:
R&r = Requirements & recommendations
nS= non Standard action words.
(A) A word for word review of the 40 pages of BARS' use of words:
"others" revealed the following count for:
Total Action Word review count- 180 off
(R1) Shall Requirements- 38 off
(R2) Must-Requirements-23 off
(r3) Should- Recommendations-25 off
(nS) will (9 off), may be (7 off),
(O) Others: Are, are to, are not to be, is to, is not to, to be, ought to be, would be, to use, can be, etc (78)

Table 6.7: Explanation of BARS' word use:
(B) * Explanation:#1- (R1 & R2) shall & sometimes must words are normally used in ISO/AS Standards and QMS development as they are Auditable Requirements (NCR- Non Conformance Report to be raised, for Non Compliance, with prompt CA-Corrective Action and Root Cause Analysis)
*Explanation:#2- (r3) word- should, is used in ISO standards as a recommendation –non auditable.
*Explanation:#3- (nS) word is a non-standard word, generally not used in ISO
or AS standards, cannot be readily audited, and probably not understood in court
*(O) Others- such words should be avoided, also non auditable.

Table 6.6 & 6.7 Findings: Focus on BARS (R1) Shall Requirements- 38 off; (R2) Must-Req'mts-23 off; last on (r3) Should- and Recommendations-25 off

Table 6.8- Suggested CA Fix of BARS' version 3, word use:	**Table 6.9**- Special Copyright Note:
(C) Suggested Corrective Action (CA) by BARS QA management: To convert Version 3 BARS to an auditable Requirements standard *Use generally (R1), the "shall" requirement word *Use the stronger "must" word as required *Use (r3) for non-auditable "should" recommendations/ clarifications *Convert all (nS) and (O) Other words to (R1) and/or (R2) Requirements	Users should refer to page 2/40 for this Standard BARS' Copyright 2010 by Flight Safety Foundation Limited (ABN 41 135 771 345) FSF Ltd., a wholly owned subsidiary of Flight Safety Foundation Inc ("FSF Inc") incorporated in the State of New York, USA.

Table 6.8 Findings: When revising BARS please consider the Recommendations in this EOQ 2011 Word Congress paper STANDARDISATION THE NEW ASD WAY: ISO 9001 & AS 9100 SERIES

This author will now also cover some more risk-based items related to Safety, Quality, Six Sigma, Standardisation and Audit / Certification as listed below i.e. Some very recent Flight Safety Issues reported in the Australian media and **t**he impact of **(R3),** the new AS/EN/JISQ 9100C: 2009-series industry-specific QMS requirements standard is now on everybody's lips. It now covers the global Aviation, Space and Defence Industries (ASD), rather than only the Aerospace industry on its own. This AS9100 Revision C requirement's standard comprises of the following key characteristics/ features": it has 33 pages; It covers the global ASD Industries; it is driven and continuously improved by IAQG, the International Aerospace Quality Group (IAQG); the AS9100 C(for Aerospace Design & Production), AS9110 (for Aviation Maintenance) and AS9120 (for Spare Parts stockists); Industry-specific Standards are ISO 9001 based, word for word; AS 9100 retains every single requirement of ISO 9001; it retains all 133 off ISO9001 Requirements; it has in addition 55 shall words; its Auditing standard AS9101D covers every requirement of ISO 9001; it is a comprehensive Standard with 77 pages: the IAQG creates and maintains updates; All audit reports and forms are integrated in AS9101 Audit standard; All AS auditors must undergo transition training to the latest version of all standards, before they can audit to the new standards; IQAG disposed of the earlier used audit scoring scheme; 12off other selected international standards must be used with the basic AS standards to maintain and audit an ASD organisation's ASD –QMS;

2- Many of the **(R4)** ISO 9001-2008 users were surprised, after receiving the revised 2008 version, without a single change or addition, to its 8 year old generic requirements. On the other hand, the AS 9100C counterpart (customer driven by IAQG, the International Aerospace Quality Group), managed to add many more improvements to their ASD-specific requirements. Expressed differently, the ISO9001:2008 version did appear not to conform with the ISO 9001 Quality Principle - Continual Improvement.

3- A plea by this author and my ISO TC176 SC/2 and QR008 and AOQ associates to all readers and users of ISO 9001:2008 – was to please complete and return **(by mid Feb. 2011),** the second round of the online User Survey questionnaire, selecting URL http://www.iso.org/tc176/sc2/ISO9000UserSurvey was very well followed.

4- Some overview and benefits of the latest **(R5)** ASD- AS9101D Audit standard

5- The surprising outcome of a search for six sigma content in the **(R6)** 1995 Proceedings issued for the 49th ASQ Annual Quality Conference in Cincinnati, USA**.**

6- Never ever say "Never", a) when it comes to Flight safety during onboard meal time. See presentation Photos **(R7)** and b) when it comes to a common global ISO Metric system for all ASD designers, producers, suppliers, users, customers and for all other industries in this world. Can the global economy and education systems still afford two different Measuring systems utilised extensively in only some 3 or 4 countries out of the 208 countries; even parts made from two systems fitted on one aircraft? Larger suppliers maybe able to afford two measuring systems, but what about smaller business? Maybe a Joint meeting by IAQG (International Quality Group), ISO (International Standards Organisation), IEC (International Electricity Commission), SAE (Society Automotive Engineers) and other ASD stakeholders, to work out the waste and costs to the Aerospace industry and world economy and others handicapped by two sets of measuring systems. It is almost a duty in this time and age to make instant decisions, to help the hand-full non-metric Nations, to learn and change. From my experience in countries like Australia, it takes about 25 years to fully change over to the universal metric system, but experience also shows that most of the over "thirties" will never be able to fully change-over.)

7- The same risk applies to ongoing mistakes/errors discovered in the Australian and International Aircraft Maintenance arena. Thanks to CASA (the Australian Civil Aviation Safety Authority) for periodically reporting such Accident and Incident Reports **(R8) in** "Flight Safety Australia" for learning and preventive purposes.

8- Similar defect data categories as the **(R2)** Proceedings of the Third China Aviation Summit (held in Nov 1998 at the Zuhai International Air show.**)**

9- And some interesting aspects related to Six Sigma and Variation control, reported in **(R9)** the 2008 International SAQ & IAQ Quality Conference in Shanghai, China. Also **(R9)** by Jack Welsh with John A. Burne, "Jack straight from the gut"(2002) chapter 21 and page 196 noting "7 sigma Quality Level" plus aspects of **(R11)** Sung H. PARK "SIX SIGMA FOR QUALITY AND PRODUCTIVITY PROMOTION" 2003 and **(R12)** Sung H. PARK & Jiju ANTONY "Robust Design for Quality Engineering and Six Sigma" 2008.

LEAN MANUFACTURING AND SIX SIGMA-WHAT IS IT? (R11)

The answer to this headings question appears by now in about 200 books world-wide and in about 50 books in this writers (LM) possession.

It is also printed in section 5.4 (page131-134), of Prof. Sung H. PARK's book titled "Six Sigma for Quality and Productivity promotion", a 2003 Asian Productivity Organisation Book (206 pages). (1) Park answers the question in a very practical way: **What is lean manufacturing (mfg.)?** PARK states that "Currently (2003) there are two premier approaches to improving manufacturing operations. One is Lean or Lean Manufacturing and the other is Six Sigma. He distinguishes between Lean and Six Sigma as follows: Lean evaluates the entire operation of a factory and restructures the mfg. method to reduce wasteful activities such as: waiting, transportation, material hands-off, inventory and over-production. Park continues: It reduces VARIATION associated with mfg routings, material handling, storage, lack of communication, batch production etc. On the other hand, he describes **Six Sigma** as follows: Six Sigma tools commonly focus on specific part numbers and processes to reduce VARIATION. However, the combination of the two approaches represents a formidable opponent to VARIATION in that it includes both layout of the factory and a focus on specific Part numbers and processes. Park further explains the **difference**s between **Lean and six sigma** as follows: **Lean** focuses on improving manufacturing operations in Variation, Quality and Productivity. Six Sigma focuses also on manufacturing operations, plus all possible processes in the whole factory and offices, including R&D and service areas. Lean attacks variation differently than a Six Sigma system does (Denecke, 1998), as shown in Figure 5.4 (see below).

Lean tackles the most common form of process noise by aligning the organisation in such a way that it can begin working as a coherent whole instead of as separate units. Lean seeks to co-locate, in sequential order, ALL the processes required to produce a product.
While **Six Sigma** focuses on Defective rates and Cost of Poor Quality due to Part and Process Variation based on measured data. Lean provides a solid foundation for SIX SIGMA problem-solving where the system is measured by deviation from the standard and improvements to the standard.
While Lean emphasises Standardisation and Productivity, Six Sigma on the other hand can be more effective at tackling Process Noise and Cost of Poor Quality.
Park describes in Fig.5.4, on page 133/206 (see below)

VARIATION AS VIEWED BY LEAN MFG AND SIX SIGMA:

The VARIATION DEPICTED IN S.H. PARK'S TWO OVAL SHAPED MODELS ARE:

a) Lean -7 step -Method VARIATION and b) Six Sigma- 7 step--Part & Process VARIATION.

Table 7.1 (a) Source of Lean VARIATION:	**Table 7.1 (b) Source of Six Sigma VARIATION**
1- Cost of Poor Quality (COPQ)	**SIX SIGMA AND BEYOND**
2- Scrap & Rework	**Active Standardization**
3- Poor Yield	**1- Machine Maintenance**
4- Poor Cycle Time	**2- Setup Standardization**
5- Raw Material Variability from Vendors	**3- Cleanliness**
6- FMEA	**4- One-Piece Flow**
7- Gage R&R	**5- Process Sequence/Co-Location**
	6- Routing Standardization

LEAN SIX SIGMA

Lean Six Sigma is for decades the most powerful and effective eliminator/reducer of all kinds of Variation, waste and delays, and as such the most sought after set of tools available to achieve QUALITY results in everything we do. Especially highly treassured by the global Aviation, Space and Defence (ASD) Industries.

A book on Six Sigma titled "Jack STRAIGHT FROM THE GUT" **(R9)(**480 Pages), written in 2001, by the world's #1 Chief Executive, Jack WELSH (JW) with John A. Byrne, is a must to read by all the world's CEOs with less than "hundreds of thousands of employees". That's reportedly the number "of GE employees whose ideas and efforts made this book possible." Of the book's 26 Chapters, Chapter 21 (page325-340) titled "Six Sigma and Beyond" should provide any CEO, in any part of the world, with enough inspiration to immediately kick start Six Sigma improvement programs, in their own organisation/s. And it should only take between 15 to 20 minutes to read that last paragraph. Just four sentences of GE's success on the end of page 338 is mouth watering; quote: "When we have customer receptivity, it really works. In 2000, (GE) aircraft engines had 1500 (Six Sigma) projects at over 50 airlines, helping customers earn $230 million in operating margin. Medical Systems (GE) had close to 1,000 (GE Six Sigma) projects, creating over $100 million of operating margins for their hospital customers. By aligning what we measure internally with our customers' needs, Six Sigma has given us better customer intimacy and trust." Also on page 336 are a few hand written notes and two interesting bell-shaped pictures, made by Jack Welsh during a training session, he attended as a six sigma student, titled "Averages versus Variation". JW shows an example with Customer Expectations: of 8 days, order to delivery cycle.

INTERNAL LOOK

The Existing Process Delivery Cycle = a 16 Day "Average" cycle

After Conventional Improvements = 8 Day "Average"

"Customer feels nothing" with 15 days Span (variation),

But with 6 Sigma "treatment" 2 days Span from day 7 to 9, and at "day 8 Customer want date, JW's hand-made sketch should make it easier to follow the Six Sigma logic in the customer's eyes.

" Now the customer can feel the GE 6 Sigma", JW wrote.

IMPROVING FLIGHT SAFETY ISSUES IN THE GLOBAL ASD (AVIATION, SPACE & DEFENCE) INDUSTRIES

INTRODUCTION:

Flight Safety is an ongoing innovative process, an increasingly more important issue for all types of Aircraft; starting with a single seater and particularly important with the largest passenger carrying aircrafts in design or development stage, soon having seats for up to some 800 passengers. The number of casualties in a worst case crash in such a large RPT (Regular Public Transport) aircraft, is just incomprehensible, and all involved must make sure it never happens.

But there is a wise saying "Never ever say: NEVER"; hence rigorous flight safety measures and preventive quality and risk control need to be maintained, in all areas of the global ASD (Aviation, Space and Defence industry), to reduce risks and ensure the best possible flight safety is achieved world-wide.

It took 110 years of BST (Blood, Sweat and Tears), since Gustav Whiteheads first flight, **(R6)** as well as ever more improved standards, tighter regulations and more effective quality tools to get to the current level of Flight Safety.

For new development, production and maintenance, greater innovation and risk mitigation is needed, to achieve higher than the current levels of quality and safety in the civil and military aviation sectors. Effective Flight Safety and Quality levels must be at least maintained from the cradle to the grave on all registered aircraft ie. from the design and development stage of systems, processes, people and product, to including ongoing training, certification and maintenance support to achieve the current targets of required

QUALITY, FLIGHT SAFETY, RISK LEVELS, RELIABILITY GOALS AND CUSTOMER SATISFACTION.

FROM THE BEGINNING OF MOTORISED AVIATION:

Some kind of management of Risk, Safety and Quality aspects were obviously practised before and after mankind's first motorised flight in the USA, on 14. August 1901, piloted by Gustav Weisskopf, (aka Gustav Whitehead), a GBA (German Born American). On that day, as reported in local USA papers, some 110 years ago now, Mr. Whitehead reportedly, flew his own designed, developed and home –built single seater aircraft (powered by twin oil-powered engines, also of his own design and built) in Bridgeport/ Connecticut, USA. What an innovative mind, it was reportedly Whitehead's 21st aircraft, designed and built at home, and flown by him. A correction of the history books and global records appear to be long overdue to recognise the real "First Flight" by mankind in the year 1901. That event is supported by American newspaper reports on the day and photos covering this historic flight; plus his design records and drawings found by an US Air force officer, in the attic of Whitehead's house, long after his death. This aircraft, he named "Taube"(in German) or "Dove" (in English) made history, in Whitehead's fourth attempt of the day, when he reportedly covered a staggering 1.5 miles non-stop flight.

The flight safety measures observed at that time , must have been purely based on instinct for self preservation and survival; as obviously no regulator's oversight, nor any safety standards, books or lectures covering prior flight experience or training would have existed, at the turn of the 20th century.

One hundred years later, this author was privileged to celebrate Gustav Weisskopf's first successful flight during the SKICQ'2001 Quality conference, July 6-8, 2001, (held in Zhengzhou, capital of Henan province, the most populated of the 52 Provinces, with 100 million people, in China and in the world), co-Chaired by Acn. Prof. Jichao XU and Acn. Sung H. PARK. (R 01). At this stage, 100 years after the first flight, this author stated the case for "INTEGRATION OF QUALITY, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS (QSE-MS) —WHO CAN AFFORD NOT TO DO IT?" Such was the progress of Management Systems , Standardisation & Certification world-wide, up to 2001.

Later celebrations around the world include the Wright brothers " First Flight" achievements on 17 Dec 1903, in their plane called "Kitty Hawk", to fly 120 feet distance, in 12 seconds, at 10 feet above ground level (as per website "inventors.about.com/od/wstartinventors/a/the Wright Brother.htm).

Also "inventors.about.com.Aviation Pioneers: An Anthology (Feb 11, 2006), Smaller Manufacturers, depict Gustav Whitehead's flight on Aug. 14, 1901 (www.ctie.monash.edu.au/hargrave/whitehead.html) with two pictures of his airplane rebuilt and in flight.

MORE RECENT AIRCRAFT/ AVIATION DEVELOPMENTS AND IMPACT OF REGULATORS AND REGULATIONS:

Nowadays, almost every one of the 208 countries in the world, has a dedicated Government Agency, such as the CAA (Civil Aviation Authority), to provide rules and to regulate all matters associated with Civil Aviation ; in Australia's case it is CASA (Australian Civil Aviation Safety Authority). Crash investigations in Australia are handled by ATSB (Australian Transport Safety Bureau). Also on the Defence / Military side, there is usually a Government Ministry responsible for Military flight safety.

Furthermore, due to the extensive international flight routes, nowadays covering virtually every corner and part of the world, all National CAA's are likely to be a member of a regional body, for example, EASA (European Aviation Safety Agency); and they can all belong to a global umbrella body, namely ICAO(International Civil Aviation Organisation), as well as IATA (International Air Transport Association).

Nothing of the sort would have been in the mind of the pioneer pilots and aircraft makers, certainly not during the first quarter of the 20th century, in order to help them increase flight safety or reduce associated risks or failures and costs. Most Regulators continuously promote ongoing flight safety through periodic publications and on-line information, covering some more selected aspects and current status of the

following items : a) Flight Safety b) Standardization c) Regulations; d) Auditing & Certification in ASD (Aviation, Space & Defence) Industries and e) Variation Control etc.

a) FLIGHT SAFETY :

A review of a part of casa.gov.au for the definition of **"FLIGHT SAFETY" AND "QUALITY"** was consistent with the following reply: "Adobe Reader has finished searching the document. No matches were found". However, the Australian Government's – Civil Aviation Safety Authority (CASA), covering 13 ceo.pdf pages titled "Safety Management and the CEO" provided a number of examples of what "Managing Safety" means in practical terms:

1) " If you think the cost of Safety is high, just wait till you have an accident".
2) "In the same way the CEO manages financial performances, the CEO must manage safety performance".
3) "Managing Safety is really about Risk and Management".
4) "Safety Management involves judgement, assessing priorities and making decisions".
   Further, the Regulator's i.e. CASA's role in managing Safety was described as follows: " Consequences of an accident… that drives public demand for Governments to put in place regulatory controls".

5) CONTINUED SEARCH FOR FLIGHT SAFETY AND QUALITY DEFINITIONS:

The four elements covering 14 points of the SMS were headed as follows:

(1) Safety Policy, objectives and planning, that includes 7 more points.
(2) Safety Risk Management, includes 4 more points.
(3) Safety Assurance and Change Management, includes 4 more points.
(4) Safety Promotion and training , includes 3 more points.

Special note: However, again a word search for the word 'QUALITY' yielded negative results.

6) MORE ON FLIGHT SAFETY AND QUALITY:

6.1 The above Safety elements also failed to define succinctly the two terms : "Flight Safety" and "Quality". Also the 14 related points did not include the Q-word i.e. " QUALITY". However, bingo, a further search found at last the word "Quality" (on page 8 of 13) embedded in the following sentences:

" Flight Operations "Quality" Assurance (FOQA) programs, or other electronic data collection systems are a good example of comparing data to selected parameters. For example these systems can tell you how often aircraft are deviating from set parameters required for a single stable approach to land."

Special note: At least now the word "Quality" appeared for the first time, in this 13 page long top level management and safety document and other SMS pages and CASA rules reviewed thus far.

6.2 **(R11)** Sung H. PARK & Jiju ANTONY "Robust Design for Quality Engineering and Six Sigma." 2008; covers in section 1.1 (page 1 & 2 of 545) **"QUALITY"** and various "Definitions of **Quality**". **Quality** definitions by 19th century Quality gurus reportedly vary over time, "according to the particular emphasis of **Quality** activities: i.e. 1- "Juran (1964) defines **quality** as " fitness for use." 2-Crosby (1979) describes **quality** in terms of "conformance to requirements". 3- Deming (1986) says that "**quality** is concerned with the present and future needs of the customer." 4- For Feigenbaum (1983) "**quality** is to do with the combined product characteristics of engineering and manufacture that determine the degree to which the product will meet the expectation of the customer". 5- Taguchi (1986) defines" **quality** as the loss of a product causes society once it has been shipped, apart from any losses caused by its intrinsic functions." 6- According to ISO 8402 (International Organisation for Standardization, (1986) "**quality** is the totality of features and characteristics of a product or service that have a bearing on its ability to satisfy stated or implied needs". "7- The most widely used definition of **quality** is that of ISO 9001 (2000). It says "that a **quality** is a characteristic that a product or service must have." "For example, products must be reliable, useable and repairable. These are some of the characteristics that a good **quality** product must have. Similarly, service should be courteous, sufficient and effective. These are some of the characteristics that a good **QUALITY SERVICE** must have. 8- In short, "a **quality** is a desirable characteristic". However, not all **qualities** are equal. Some are more important than others. The most important **qualities** are the ones that customers want. These are the **qualities** that products an services must have. So providing **quality** products and services is all about meeting customer requirements. It is all about meeting the needs and expectations of customers. So a **quality** product or service is one that meets the needs and expectations of customers''…. ("and all Regulatory agencies".) added by this author, LM.

b) **So what is a Safety Management System (SMS) the Australian Government's CASA way.**

7) "An SMS is a systematic approach to managing Safety Risks, including the necessary organisational structures, accountabilities, policies and procedures." Further, "Safety management involves judgement, accessing priorities and making decisions." And more, "Safety Management is about Risk Management that requires "before the event" information."
8) Really, in the experience of this paper's author, managing for "Safety", is an uphill battle without managing for "QUALITY". Hence, the following "combined" definition warrants adoption by CASA and ICAO i.e.:

Why is **"FLIGHT SAFETY the result of QUALITY"?.** Because, **low QUALITY, or no QUALITY,** has a direct negative impact on Flight Safety, much the same it has on any other Safety applications, except that the result of low degree of flight safety can often result in rather large-scale losses of lives.

Agreed, " NO QUALITY" can also often be the root cause of "Inadequate or No Flight Safety", and sometimes much more, such as " Inadequate or Nil Safety margin in the air, ground and sea".

9) **More historic events**: The 100th Anniversary of powered flight in the UK was noted in 2008 in the Aerospace International (Vol. 35, #10, Oct. 2008, page3) "Comment 100 years on, covering current civil and defence issues.

10) The 15th Anniversary issue of CASA "Flight Safety Australia" journal (Issue 77, Nov- Dec 2010, 72 pages) has an interesting look at aviation safety trends since 1995, titled "Fifteen years of Aviation Safety" (from page 8 to 15/72). A couple of quotes under the heading "You're only as good as your last flight" deserve highlighting i.e. First, 'When you are talking high capacity RPT (Regular Public Transport), the aircrafts are getting larger, so that while safety performance has been very strong, there has also been an increase in terms of the outcome of any risk. A fatal single hull loss accident ten years ago (~Y 2000) would typically involve about 150-200 death. Today (Y 2010) it could potentially involve more than 400."

11) Second, according to "Flight International", advances in air safety in the 1990s owed much to two ground-based technologies with no direct relation to flying: the computer and the internet." But now the pilots seem to get more of useful information rather than loose data.
Third, "Boeing's Statistical Summary of Commercial Jet Airplane Accidents 1959-2009 found loss-of-control accidents killed 1759 passengers and crew and 89 people *on the ground* between 2000-2009. That is almost twice the death toll of CFIT (Controlled Flight Into Terrain) crashes, which in the same period (of about 50 years) killed 961 passengers and crew, but no bystanders." The outcome in this paragraph would have been surely much worse, would it not be for the power of International Product Standards and Quality Management System (QMS) Standards.

12) THE POWER OF STANDARDS AND QUALITY

12.1) **ANOTHER SPECIAL Q- NOTE**: Again no surprise, it appears that the elusive word "QUALITY" did not often find its way into the otherwise most excellent series of CASA's "Flight Safety Australia" magazine. Reading its 77th issue some readers might ask the question: "Is FLIGHT SAFETY really the result of QUALITY"? The answer is a definite "YES" when you switch to reading and complying with Quality Management System (QMS) Standards, such as the **(R3)** ISO 9001-2008 and AS 9100C-2009 series of Aviation, Space and Defence (ASD) standards, with its matching AS9101D-2010 Audit Standards.

12.2) **MUCH MORE ABOUT THE POWER OF AS9100 SERIES OF QMS STANDARDS.**

"MAKING THE CASE FOR QUALITY". A quick search of the internet and bingo, there were two articles, that are 4-pagers, in the ASQ series, "Making the Case for Quality". The first one titled "AS9100 Keeps Bosch Communications Flying high in Aerospace Industry" (Dec. 2008). Well worth reading by all ICAO Civil Aviation Regulators' Top Management and all their auditors, financial and technical. The second article was titled: "U.S. Air Force Earns High-Flying Results With Quality Management Specifications for Suppliers". Both are very well written by JANET JACOBSEN (JJ) published on www.asq.org by ASQ- the American Society for Quality. Full marks to the author JJ, of these two articles, who specialises in QUALITY and compliance topics.

HOW TO GET BUY-IN FROM TOP MANAGEMENT?: In order to secure buy in to upgrade your QMS to these ASD standards from "the TOP (in-house executives), and VERY TOP management (usually external Board members)" of the ASD-Industry, this author suggests that each QA Manager and/or ISO9001 Management Representative starts the ball kicking. This 4 page article starts with a profound statement: "When a customer makes a request, the smart Supplier listens carefully." "Further, Bosch Communications Systems, recognises this to be the case when Aviation giant Boeing asked all suppliers to become certified to AS9100, the Aerospace Industry Quality Management Standard, based on ISO 9001". "While aerospace customers represent just 5% of Bosch Communication's revenue , company leaders understand that AS 9100 certification was a necessary step to retain their Business and other customers. This author recommends that all read the four page article , to find out how BOSCH communication Systems, USA, earned their AS 9100, Rev, B, Aerospace QMS Requirements Certification/Registration, including ISO 9100, Rev. B, on 31 Oct. 2008. Or if to busy, at least read ASQ's side bar titled "At a glance…." A summary of four sentences on "www..asq.org" about how Bosch prepared its internal auditor team and how to assess to AS 9100 and ISO 9001.

What's new in the world of ASD Standards?: In the mean time the above AS 9100 B, Aerospace Requirements Standard have been upgraded to 2100 Rev. C level, and adopted by the global Aviation, Space and Defence Industries (ASD); fit for the current 208 Nations in the world. This set of ASD-Standards are to ensure that only conforming products and services are delivered and ultimately risks are eliminated or managed to ensure Quality and Flight safety. The current family of AS9100 series of Standards include a number of Key Requirements and Audit standards; **see Table 8.1 & 8.2:**

Table 8.1 & 8.2 Description and analysis of **latest version AS9100 Standards**

A) Below is an overview of the outline, structure and content of the latest version of AS9100 Rev. C.(2009-01)

ASD-INDUSTRY-SPECIFIC QMS REQUIREMENTS: Including the Total # of "shall/must' Requirements:

Table 8.1: Analysis of AS9100 Rev. C. (2009-03 version) QMS - Requirements	**Table 8.2 : Analysis of AS9100 Rev. C. (2009-03 version) Content, Introduction & the 8 QMS Requirements Clauses**
1)Title & No: **QMS - Requirements** for Aviation, Space and Defence (ASD) Organisations- AS 9100 Rev. C (2009-01) Superseding: AS9100B (1999-11) 2) Structure & QMS Requirements: 33 pages; 3) ISO Shall words: 133 4) AS Shall words: 55 5) 3)+4)=All Shall Words: 188 6) ISO Alpha shall words: 127 7) AS Alpha shall words: 73 8) 6) + 7) =All Alpha shall words :200 9) Grand Total of 5) + 8) =188+200= 388 ISO+AS Requirements 9)Must words:1 off; 10)Figures: 1off; 11) Notes:	1) Table of Contents: 2)Foreword 3)REVISION SUMMARY/RATIONALE 4)INTRODUCTION 5) **The 8 QMS REQUIREMENT CLAUSES:** **Clause 1. SCOPE** **2.NORMATIVE REFERENCES** **3.TERMS & DEFINITIONS** **4. QUALITY MANAGEMENT SYSTEM (QMS)** **5. MANAGEMENT RESPONSIBILITY** **6.RESOURCE MANAGEMENT** **7. PRODUCT REALIZATION** **8. MEASUREMENT ANALYSIS AND IMPROVEMENTS** **6) BIBLOGRAPHY; Page 33/33** .

Table 8.1 & 8.2 Findings: First comply with all Requirements. Second consider all Recommendations

B) Below is an overview of the outline, structure and content of the latest version of AS9101 Rev. D (2010-03)

1) Title & No: QMS - Audit Requirements for Aviation, Space and Defence Organisations- AS 9101 Rev: D

2) Structure & Requirements: 75 pages; Shall words: 188, Must words:1; Figures: 1;

ASD-INDUSTRY-SPECIFIC QMS REQUIREMENTS: Total "shall" Requirements:388

Table 9.1: Analysis of AS9101 Rev. D (2010-03);

1)Title & No: QMS Audit Requirements for Aviation, Space, and Defence **(ASD) Organisations- AS 9100 Rev. C (2009-01)**

2) Structure & QMS Requirements: 75 pages;

Table of Contents: Page 2/75

Table 9.2: Figures:

Table 9.1 Continued:

Table: 9.3: List of Appendices:

Table: 9.4: List of Normative References -12off, that are indispensible for the application of this **AS9101D Auditing Requirements Standard.** Note: For dated references use only the edition cited in this Table. For undated references use only the latest editions.
1--9100* QMS- Requirements for ASD Orgs.
2--9110* QMS- Requirements for Aviation Maintenance Organisations.
3--9120* QMS- Requirements for ASD Distributors.
4 –9104* Requirements for Aerospace QMS Certification/ Registrations Programs
5 –9104/2* Requirements for Oversight of Aerospace QMS Certification/ Registrations Programs
6 –9104/3* Requirements for Aerospace Auditor Competency and Training courses.
7-IAF MD 2: 2007- IAF Mandatory Document for the Transfer of Accredited Certification of Management Systems.
8-ISO 9000:2005- QMS- Fundamentals and vocabulary
9-ISO/IEC 17000;2004-Conformity Assessment- Vocabulary and general Principles.
10-ISO/IEC 17021:2006 –Conformity assessment-Requirements for bodies providing audit and certification of management systems.
11--ISO 19011 :2002- Guidelines for quality and/or environmental management systems auditing.
12- As developed under the auspice of the IAQG and published by various standards bodies (e.g., ASD-STAN, SAE, CEN, JSA/SJAC, ABNT).

Table: 9.5: 4.2 Common Audit Activities
4.2.1 Audit Planning
4.2.2 Onsite Audits
4.2.3 Audit Reporting
4.2.4 Nonconformity Management
4.2.5 Audit Records
4.3 Audit Phase Specific Requirements
4.3.2 Stage 1 Audit
4.3.3 Stage 2 Audit
4.3.4
4.3.5 Recertification
4.3.6 Special Audits

Table 9 Findings: Study ALL AS9101 Rev. D (2010-03) & AS9101 Rev. D (2010-03); Requirements Clauses.

Table 10.1

List of Appendices A – G

Fig 3: Relationship between Appendices and Audit Phases (pp 49 -75)

App. A –Objective Evidence Record (OER for AS9100)

Page 25 to 49/75

- Clause 4.1 to 8.5.3
- Item # 01 to 410
- App B – NCR Report
- App B – Form Instruction Ref. #1 to 27
- App C (PEAR) & Form Instruction
- App D (QMS Process Matrix Report
- Clauses 4.1 to 8.5.3, p 56 -57/75
- App D Form Instruction, p 58/75
- App E – Audit Report, p 59 – 62/75
- App E – Form Instruction, p 63 – 65/75
- App F – Audit Report Stage 1 – p 65/70
- App F – Form Instruction, p 71 – 72/75
- App G – Supplemental Audit Report, p 73 – 74/75
- App G – Form Instruction, p 75/75

Table 10.1 Findings: Get to know the audit requirements and Forms

THE PURPOSE AND POWER OF STATISTICS

Flightsafety Australia (FSA issue 66, Jan- Feb 2009) like for all issues publishes the "Selected Service Difficulty Reports" (SSDR) received from the Australian Civil Aviation Industry. In this case an analysis of the 105 SDRS listed covers the usual breakdown of the seven types common of civil Aviation registered Aircraft/Components. The SSDR reports usually range from Group A to G, apparently covering all types of aircraft, power plants and Components in the Australian Civil Aviation sector. Further analysis of FSA issue # 66 revealed the following **SSDR breakdown statistics:**

Table 10.2: SSDRs

Aircraft above 5700 kg	44 SSDRs
Aircraft below 5700 kg	28
Rotorcraft	9
Piston Engine	8
Turbine Engines	12
Propellers	3
Component	1

Investigation (as to the root cause), is ongoing by CASA against the two groups of 13 SSDRs, which is about 12% for the 2 month reporting period, a credit to CASA, for ongoing work trying to solve ASAP all reported Quality/potential flight Safety problems, for the sake of Quality and Flight Safety.

Group A) Aircraft above 5700 kg = 10 off

Group B) Aircraft below 5700 kg = 3 off.

Note: Similar SSDRs Occurrence figures were reported before are based on data received over the past five years.

COMMON KEY WORDS AND / OR (ABBREVIATIONS): Aviation, Space & Defence (ASD) Industries; Aircraft Safety; AS9100; AS9101; Audit; Certification; Civil Aviation Authority (CASA); Define-Measure-Analyse-Improve-Control (DMAIC); Flight Safety; ISO9001;International Aerospace Quality Group (IAQG); ISO/TC 176/SC2; ISO Metric System, Quality; Quality Costs; Cost Of Poor Quality (COPQ); Quality Management System (QMS); Risk Management System (RMS); Sino-Korea International Conference on Quality (SKICQ) Six Sigma; Suspect Unapproved Part (SUP), User Survey; Variation Control (VC).

CONCLUSIONS: Improving Flight Safety issues in the global ASD industries is a foregone conclusion. Why? Because all the new ASD-Quality Management Systems (QMS), are effective 1. July 2011, and globally applicable and driven by the voice of the leading aerospace experts. They are assigned to the strong action group, the IAQG, International Aerospace Quality Group, all are experienced and qualified Quality leaders and perhaps Auditors in their field of ASD i.e. Aviation, Space, and Defence (ASD). This writer's/ author's immediate task is to seek transition training in the USA to upgrade my RABQSA and IRCA Aerospace experienced Lead Auditor certification, before the deadline 1. July 2011. The ASD Industry's IAQG group's s new set of Requirements Standards, the new AS/N/JSQ9100 Rev C, QMS Requirements Standard with about 128 shall requirements .and the new AS9101D, Auditing Requirements Standard, amongst 12 other companion standards. Many ASD organisations are most likely by now familiar with the ISO9001:2008 generic QMS requirements, about 260 in total. To upgrade to the latest ASD Requirements standards appears to be like claiming Mount Everest.; after an online test, and a week transition training, followed by a one day exam. However, the Industry and all other stakeholders will be the main beneficiaries.

REFERENCE INDEX: FOR PREVIOUSLY PUBLISHED PAPERS BY THIS AUTHOR: LM, AND FOR OTHER DOCUMENTS/STANDARDS:

(R01) A.P. Lou MAGRITZER, **"**INTEGRATION OF QUALITY, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS—WHO CAN AFFORD NOT TO DO IT?": - SKICQ"2001, Proceedings of the Sino-Korea International Conference on Quality Science and Productivity Promotion, (Page 34-44 of 455).

(R1) A.P. Lou MAGRITZER, 1995 Proceedings (1169 pages) of the 49th ASQ-Annual Quality Congress (Cincinnati, Ohio, USA;)

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(R3) AS/EN/JISQ 9100C-2009 QMS- Requirements for Aviation, Space and Defence (ASD) Organisations

(R4) ISO 9001C-2008 QMS Requirements.

(R5) AS9101D-2010 QMS Audit Requirements for ASD- Organisations

(R6) A.P. Lou MAGRITZER, - "SAE-AS 9001-The latest Risk Terminator for the Global Aerospace Industry and other Safety-critical Industry Sectors." Page 189-211 of 260 pages. The 3rd Sino-Korea Bilateral Symposium on Quality, Shanghai, China, July 16-18,2004;

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(R8) "FLIGHT SAFETY AUSTRALIA ". (FSA) various editions

(R10) Sung H. PARK "SIX SIGMA FOR QUALITY AND PRODUCTIVITY PROMOTION" 2003**.** Productivity Series 32.(

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(R16) Special Note: Disclosure of Liability:

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Thirteen Fundamental QUALITY Truths.

1. All QUALITY organizations, companies, divisions, sections, departments, units, teams and projects should have a documented mission that links them into a chain that holds the organization together, keeping it directed at pulling in all of the potential QUALITY customers that they can handle.
2. All QUALITY processes should have a defined customer whose needs and expectations are understood and which are being met.
3. No QUALITY process is so good that it can't be improved although some processes need improvement more than others.
4. There is always a better QUALITY way of doing things.
5. The greatest competitive advantage is knowledge that leads to QUALITY innovation.
6. QUALITY People who understand why they do something do it better and faster.
7. When something gets measured, it gets QUALITY attention
8. There is a direct correlation between internal customer QUALITY satisfaction and external customer QUALITY satisfaction.
9. Every organization has an obligation to provide QUALITY value to the people that invest their hard-earned money and time into the organization.
10. Expended resources related to the organization's employees is a QUALITY investment, not a cost.
11. the elimination of waste is everyone's QUALITY job.
12. Management needs to set the QUALITY example and set the QUALITY talk.
13. Each individual needs to be sure that his/her QUALITY suppliers understand what is needed and not ask for things that won't be used.

Original by Acn. James Harrington, 1986; Quality Modified by Acn. Lou MAGRITZER, 2011.