

Competency Framework for Reliability Engineers

AMC WA committee initiative

7 May 2011

Project Objectives

- Identify core reliability competency sets required by WA resource and infrastructure organisations
- Develop a reliability competency framework
- Discuss approaches to assessing reliability competency

Why?

So that ...

- Organisations can assess reliability competence needs and ability across and within the organisation
- Support a more targeted approach to recruitment, retention and training of competent reliability professionals
- Support deployment of qualified reliability professionals into appropriate roles that utilise their specific skills
- Develop a roadmap and training for reliability professionals

Participants (Workshops 1 & 2)

AMC WA committee

- Andrew Morgan (W1& W2)
- Melinda Hodkiewicz (W1 & W2)
- Zahra Jabiri (W1 & W2),
- Mark Mackenzie (W1 & W2)
- Ernst Krauss (W2)
- Guan Peh (W2)

External SMEs

- Natasha Bartlett (W1 & W2)
- Kecheng Shen (W1 & W2)
- Tim Newman (W2)

Dates

Workshops 1 & 2 held February and April 2011, hosted by Kecheng Shen at UWA

Useful reference documents

- IAM 2008 AM Competence Requirements Framework
- AMC Competency Standard: Certified Associate in Asset Management (CAAM), Certified Practitioner in Asset Management (CPAM), Certified Senior Practitioner in Asset Management (CSAM), Certified Fellow in Asset Management (CFAM)
- SMRP Professional Certification Program for Certified Maintenance & Reliability Professionals
- ASQ's Reliability Engineer Certification (CRE)

Other papers

- Mapping competencies, Application of a visual method to determine the abilities of engineers reveals new and useful insights, S Ranade et al, Mechanical Engineering, 30,2010
- Education in engineering asset management , M Hodkiewicz, ICOMS 2007
- Developing competency in asset management – the IAM competency requirements framework, S Morris, ICOMS 2007
- Creating the next generation of reliability engineers, M.Hodkiewicz, J.Sikorska & P.Simpson, ICOMS 2005
- (2003), The role of the reliability engineer, A O'Malley and M.Karyagina , ICOMS 2003.

Challenges

- Limited reliability competency work is relevant to organisations in the WA resource sector
- Multiple definitions:
 - Reliability : meaning? containing?
 - Engineer/ professional : qualification? job description? assignment?
 - Competency: skills? knowledge? behaviours
- Unclear boundaries:
 - Reliability and Asset management
 - Reliability and maintenance
- Time scale: reliability needs may differ across the different LC phases
- Passing a test (CRE/SMRP) does not always translate the behavioural competency in the workplace

Project Outcomes – to date

- Broadly define mission and function of a reliability professional
- Identify 5 sub-function statements
- Map tools/methods: those that are required to perform a function

Approach – 1st workshop

- Brainstorm to develop list of reliability competency elements
 - action to take
 - method to apply
 - task to complete
 - tool to master
 - model to develop and apply
- List elements against
 - Life cycle phases
 - Skill type (e.g. qualitative/quantitative, analytical/simulative, probabilistic/deterministic, rule based/risk based, deductive/inductive)
 - Role (e.g. Project engineer, reliability engineer, maintenance planner)

Approach – 2nd workshop

- Develop functional statement
- Develop sub-functional statements
- Map reliability tools/methods to the functions

Mission and function of a reliability professional

- Mission: *ensure the asset(s) deliver required reliability*
- Function: *designing and managing asset requirements to ensure operational requirements are met for whole of life.*
- 5 sub-functions
 - Determine what causes a failure
 - Define asset performance requirements
 - Determine what influences LCC
 - Measure and monitor asset performance
 - Maintain or improve asset performance

Identify tools/ skills

RE elements	Life cycle phases			
	Design	Construct /commission	Operate /maintain	Dispose
Functional req. (spec.)	√			
Input tender req./spec	√			
FMEA/FMECA	√		√	
RBD	√		√	
FTA	√		√	
ETA	√			
Monte Carlo simulation	√		√	
Whole of life (WOL)	√		√	√
Sneak circuit analysis (SCA)	√			
RCM	√		√	
RCA			√	
DOE (design of experiments)			√	
Pareto			√	
Control charts			√	
Maintainability study	√			
Sparing	√		√	
Reliability testing	√			
HALT/HASS	√			

RE elements	Life cycle phases			
	Design	Construct /commission	Operate /maintain	Dispose
Performance monitoring			√	
Reliability growth	√			
Data collection	√ Req. spec	√ Set-up		
Data analysis/management			√	
FLAC (fuel, lube, air & coolant management)			√	
CM/PM planning/schedule			√	
Recommend design change		√		
Operability study	√			
Operation readiness	√			
Maintenance tactics	√			√
Metrics design	√			
Verification and validation		√		
Lessons learnt				√
Obsolescence				√
Supportability				√

Map reliability tools/methods to the functions

RE functions	Tools/Methods
Determine what causes a failure	RCA, FTA/ETA, (sneak circuit), FMEA, HALT/HASS
Define asset performance requirements	Weibull, KPIs, pareto, data analysis, RBD, RAMBOS, reliability testing, extract data, control charts
Determine what influences LCC	FMEA, RBD, LCC, sparing, design change, obsolescence
Measure and monitor asset performance	RBD, FRACAS, reliability testing, HALT/HASS, reliability growth, metrics development
Maintain or improve asset performance	RCM, FMECA, maintenance strategy, reliability growth, condition monitoring, performance analysis, spares, operational readiness, design change, lessons learned/body of knowledge, DoE, FLAC

Next steps

- Socialise the work thus far with wider WA community and get feedback
- Decide core/no-core competency: whether or not the tool/method is a “must have” for a function
- Develop ideas to assess current competence (individual and organisational) and identify training opportunities
- Consider qualification options.