



What should a Reliability Engineer (RE) actually do and know?



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Agenda

Reliability Engineering

- Do we even need this?
- What will they do?
- What skills do they need?
- Where can I find one?

Topics

- The gap in maintenance
- The role of the RE
- Required skills
- Proposed learning pathway
- The RE's tool kit
- Ideal RE profile
- Implementing a reliability program



To RE or not to RE, that is the question

- **Maintenance Engineer**

- Operational
 - Line manager for maintenance
 - Execute maintenance
 - Quality assurance, Coaching
 - Fault finding, Root cause analysis
 - Meetings, Admin, People problems
- Tactical
 - Safety, Legal compliance
 - Budgets

- **The Gap**

- Tactical
 - In depth analysis and investigation
 - Long term improvement and optimisation
 - Pro active maintenance
- Strategic
 - Life cycle management and optimisation
 - Trends, Benchmarking
 - Design for maintainability

Deciphering the role | Body of knowledge

SMRP / CMRP – 5 pillars

1. Business Management
2. Equipment Reliability
3. Manufacturing process reliability
4. Organization & leadership
5. Work management

Source: <https://smrp.org/>

IAM Definition

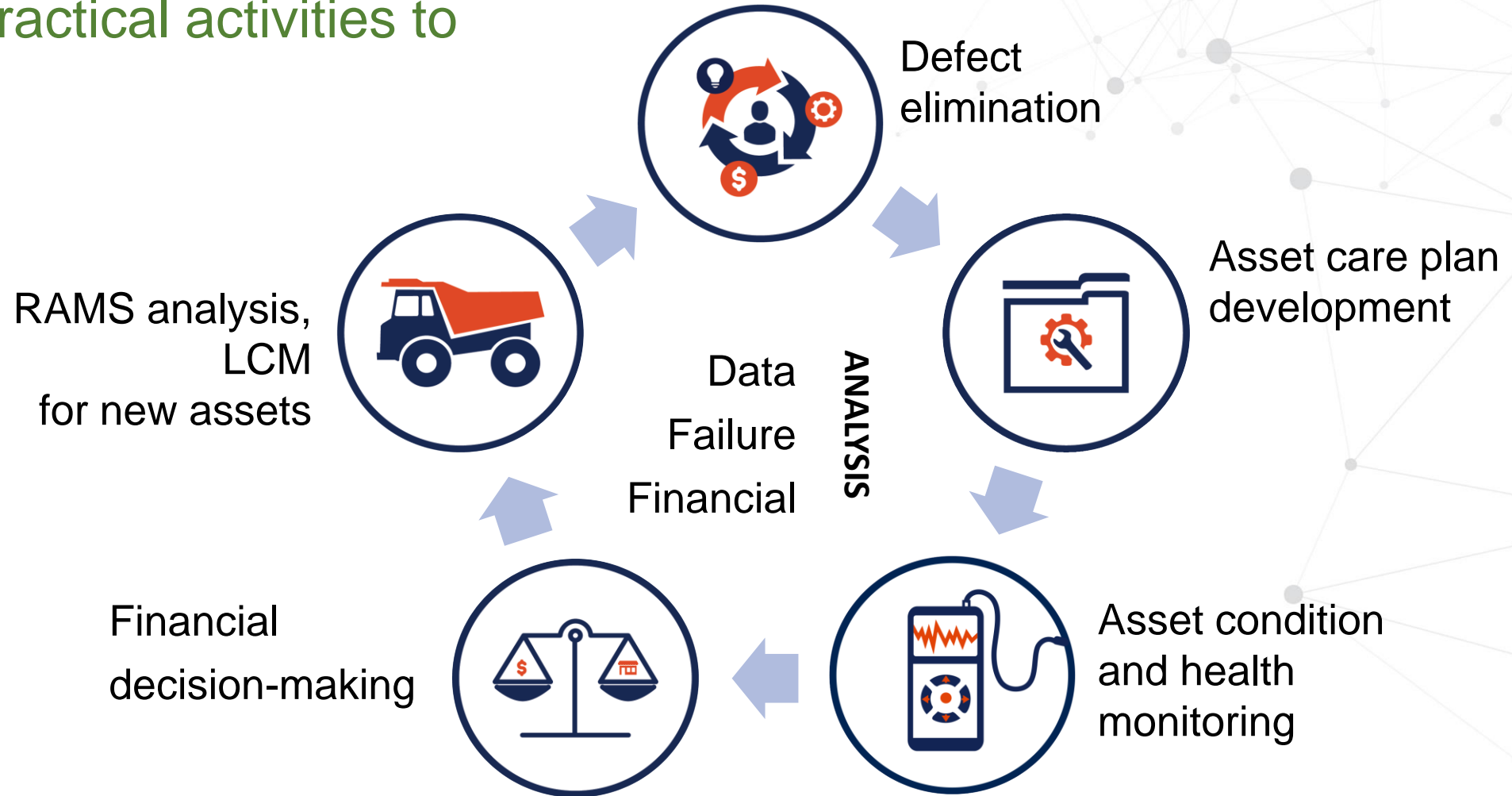
Reliability engineering is the systematic application of engineering principles and techniques throughout an asset's lifecycle to ensure that it has the ability to perform a required function under given conditions for a given time interval.

Source: [An Anatomy of Asset Management \(IAM\)](#)



RE Role

Translating the body of knowledge into specific practical activities to fill the gap



The Role of the RE in Defect Elimination

Identify and solve the root causes of reliability problems by managing the defect elimination process on site

- Define and establish a DE Management system, including triggers for RCA, templates for RCA and business cases, criteria to prioritise DE projects and mechanisms to report on progress, facilitate large RCAs (including warranty claim investigations)
- Apply data analysis techniques as input to RCAs including trending, pareto analysis, jack-knife analysis, analysis of variance and correlations
- Train employees in applying basic RCA process and methods
- Establish a failure reporting and corrective action system (FRACAS) to track asset failures and follow-up actions

The Role of the RE in Optimising Asset Tactics 7

Prevent failures by facilitating the asset tactic development and optimisation process

- Lead the process to identify functional failures and define failure modes, mechanisms, causes, probabilities and consequences
- Facilitate the process to select optimal maintenance tactics, frequencies and standards based on the failure analysis
- Develop the condition monitoring strategy and selection of CM techniques to detect potential problems earlier on the P-F curve
- Prevent defects at source by working with the engineering manager to set and implement specifications/standards for precision maintenance such as alignment, torqueing, lubrication, balancing, etc.



The Role of the RE in Business Improvement

Analyse asset performance and identify opportunities for improvement

- Analyse performance, maintenance and reliability data to identify opportunities for improvement in cost, volume or safety
- Benchmark key performance indicators against other similar operations
- Prioritise improvement opportunities by quantifying the value and compiling a business case for them



The Role of the RE in Acquisition Projects

Ensure the reliability of new assets proactively by doing RAMS analysis as part of operational readiness

- Specify the reliability, maintainability and availability of new equipment based on the operational requirements
- Do RAMS and LCC analysis during the design and development phase to evaluate and select alternative solutions
- Participate in the development of criteria for and evaluation of equipment suppliers, spares suppliers and service providers
- Develop reliability acceptance tests as part of the commission plans
- Use the Warranty Management System to perform defect elimination investigations for critical assets



RAMS = Reliability, Availability, Maintainability and Safety

The Role of the RE in Lifecycle Management

Do life cycle cost analysis to support financial asset decision-making

- Use life-cycle costing (LCC) and equivalent annual costs (EAC) to support repair-replace decisions
- Use cost models to optimise spare part stockholding
- Compile asset management plans for critical assets to define how to maximise their value during the remainder of their lives (maintenance strategies, technology upgrades, mid-life overhauls, etc)



Basic RE Competency model

Context

Business drivers and asset management principles

Data Analysis

Data acquisition, quality, processing and interpretation

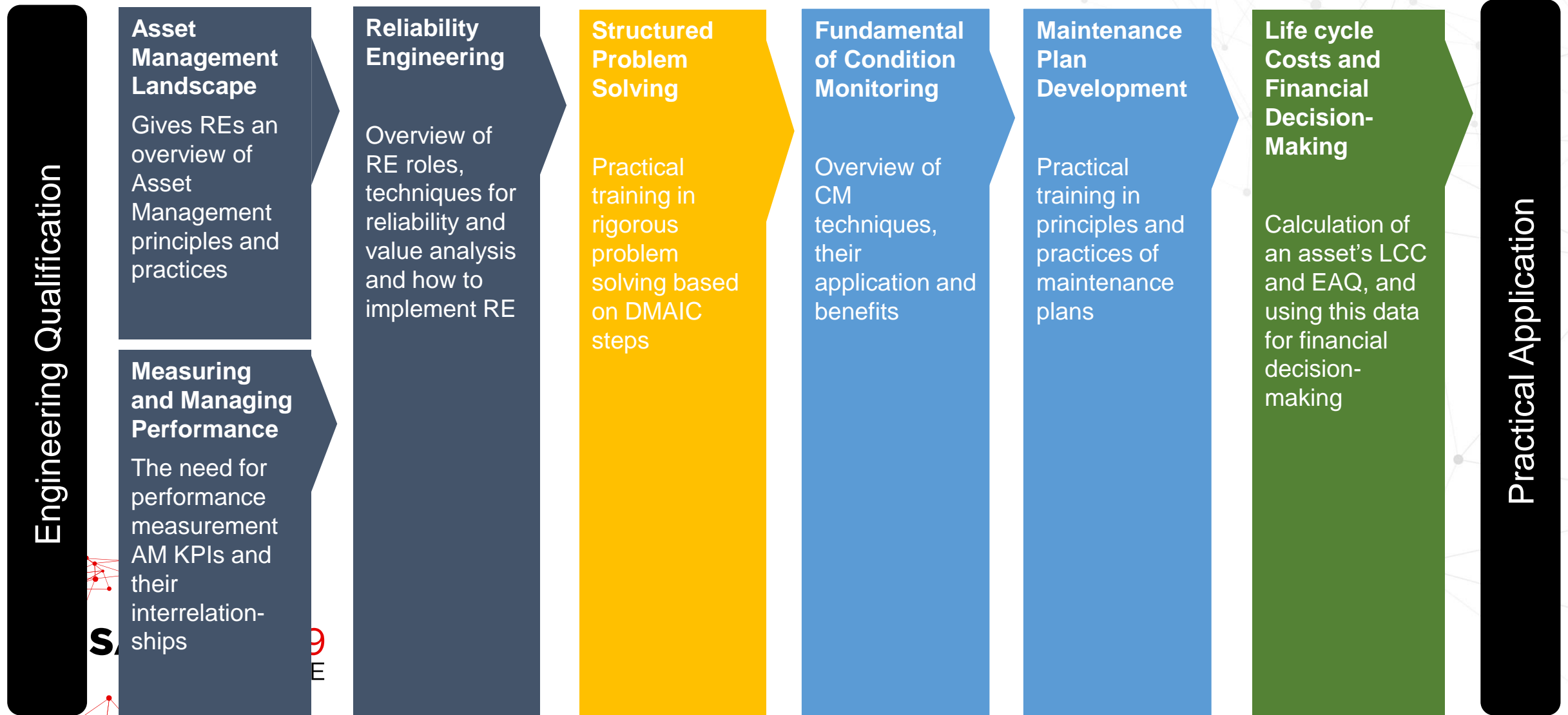
Technical Analysis

Asset criticality and functions
Failure modes, mechanisms and root causes

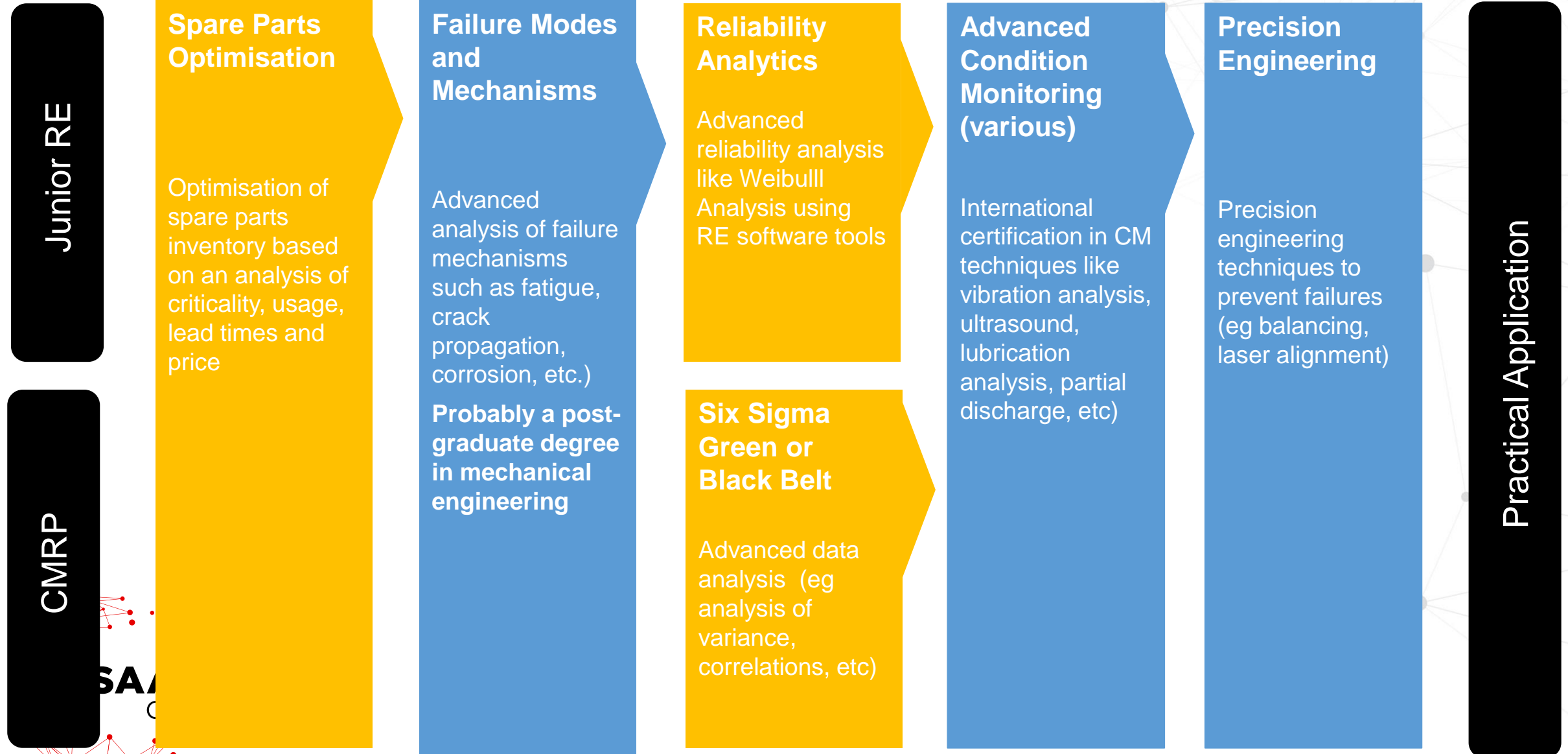
Financial Analysis

Quantify value
Business case
Life cycle costing

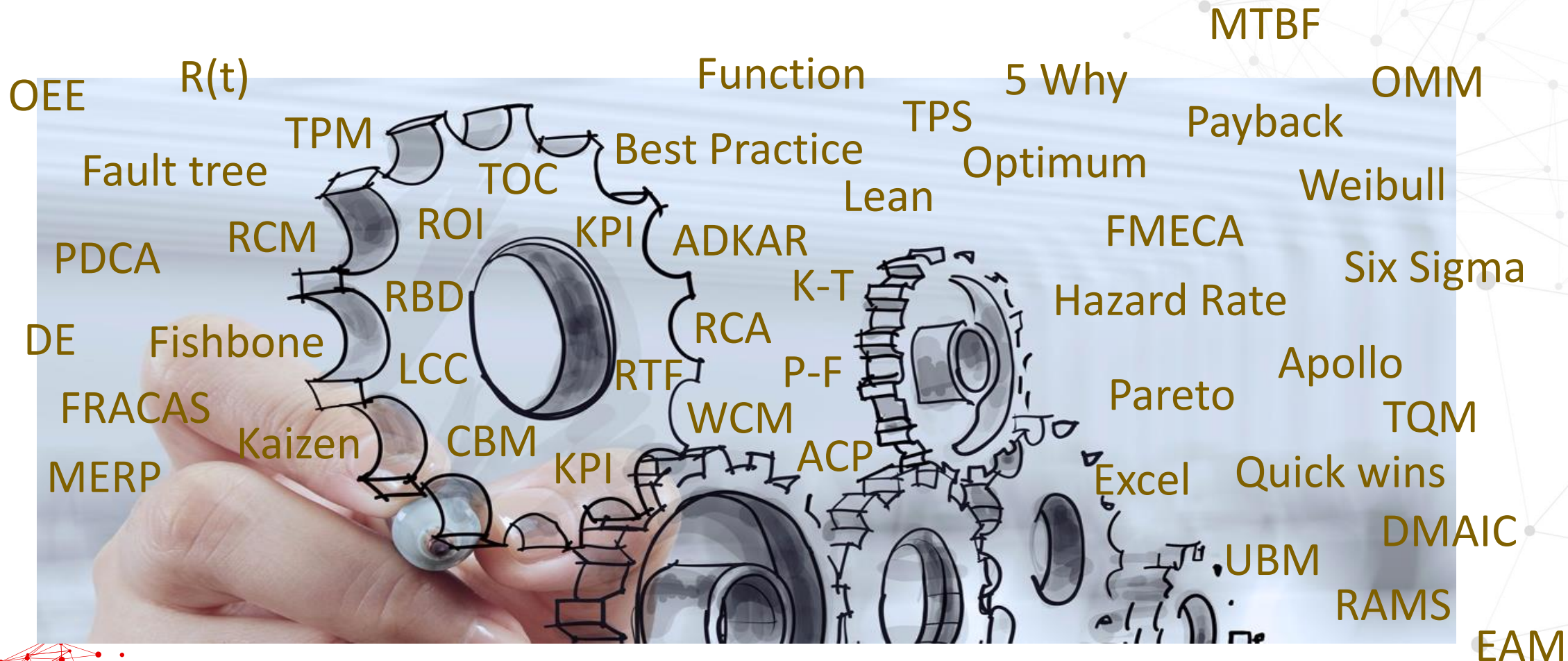
Proposed learning pathway - RE



Proposed learning pathway – Snr RE



The RE Toolkit



Ideal RE Profile

5 Habits of great RE's

- Identify issues
- Understand issues
- Find alternatives
- Decide with data
- Facilitate to implement

Source: <https://reliabilityweb.com/articles/entry/the-5-habits-of-great-reliability-engineers>

Personality traits

- Strong technical background
- Reasonable understanding of the equipment and process
- Expertise in the methodology and tools (the tool kit)
- Very good facilitation skills
- A logical and systematic approach
- Attention to detail
- Energy, Drive, Enthusiasm
- Motivate people into action



Implementing a Reliability Program



Source: 12 Elements of effective reliability management, Drew Troyer

Final Thoughts



- [Struggling with technology LOL ComediHa!.mp4](#)

Thank You

Q&A

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Society for Maintenance and Reliability Practitioners (SMRP)



A nonprofit, USA-based organisation created for practitioners to actively promote maintenance and reliability within their field and to the public

<https://smrp.org/>

- **Mission:** To develop and promote excellence in maintenance, reliability and physical asset management
- **Vision:** To be the global leader for the maintenance, reliability and physical asset management profession
- **Values:** SMRP values data-driven excellence, sharing and collaboration, membership focus, continuous improvement, accountability, trust and respect, integrity and social responsibility



Certified Maintenance and Reliability Professional (CMRP)



- Available to any maintenance and reliability professional, regardless of education background or work experience
- Accredited by the American National Standards Institute (ANSI) according to the accreditation guidelines in ISO/IEC 17024
- Examination based on five pillars of the SMRP Body of Knowledge (BoK):
 1. *Business and management,*
 2. *Equipment reliability,*
 3. *Manufacturing process reliability,*
 4. *Organization and leadership*
 5. *Work Management*

Covers technical proficiency and people skills with emphasis on *application*



The CMRP Body of Knowledge – 5 Pillars

1. Business Management

The skills used to translate an organisation's business goals into appropriate maintenance and reliability goals that support and contribute to the organization's business results

2. Manufacturing Process Reliability

How maintenance and reliability activities relate to the manufacturing process to ensure that they contribute to its improvement

3. Equipment Reliability

The activities that apply to reliability improvement, including the assessment of the current equipment and process capabilities, as well as the selection and application of appropriate maintenance practices, to ensure the equipment and processes are safe and reliable

4. Organization and leadership

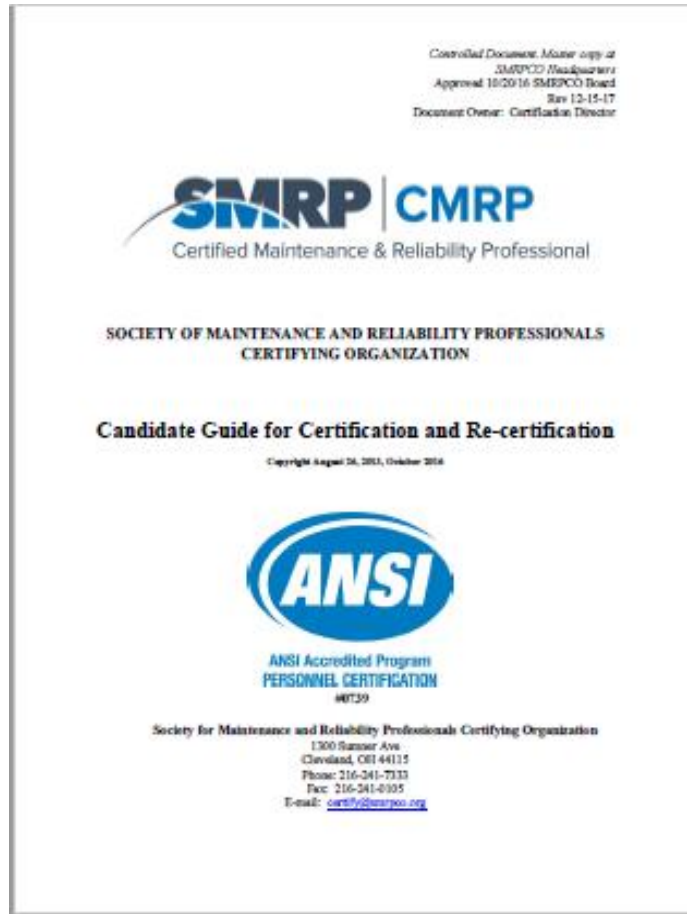
Processes for assuring that the maintenance and reliability staff is suitably qualified to achieve the agreed goals

5. Work Management

The skills used to get the agreed work done, including planning and scheduling, quality assurance and inventory management.



Examination Format

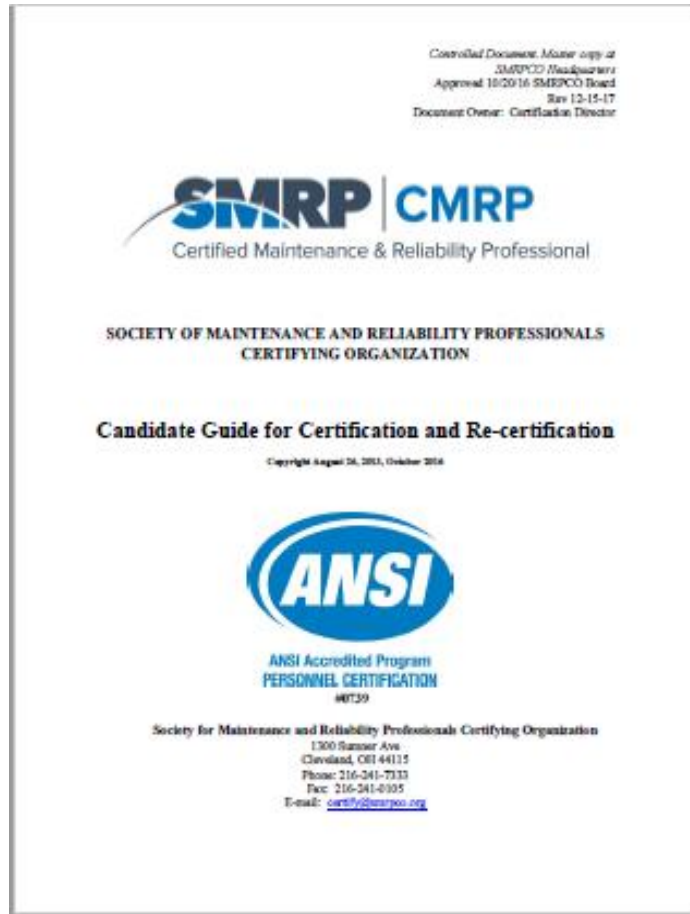


- **Eligibility:** Any maintenance and reliability professional, regardless of education, background or work experience.
- **Mechanism:** Computer-based exam at an approved test center worldwide (not at your home computer...) or manual examinations administered by a SMRP approved proctor
- **Format:**
 - ±110 multiple choice type questions; 2hr 30min allowed time
 - Closed book, no reference materials
 - A scientific, non-programmable calculator is permitted (no other computers)
 - No limit on the number of attempts, but maximum once per six months

Refer to: CMRP “Candidate Guide for Certification and Re-certification“



Registering for the Examination

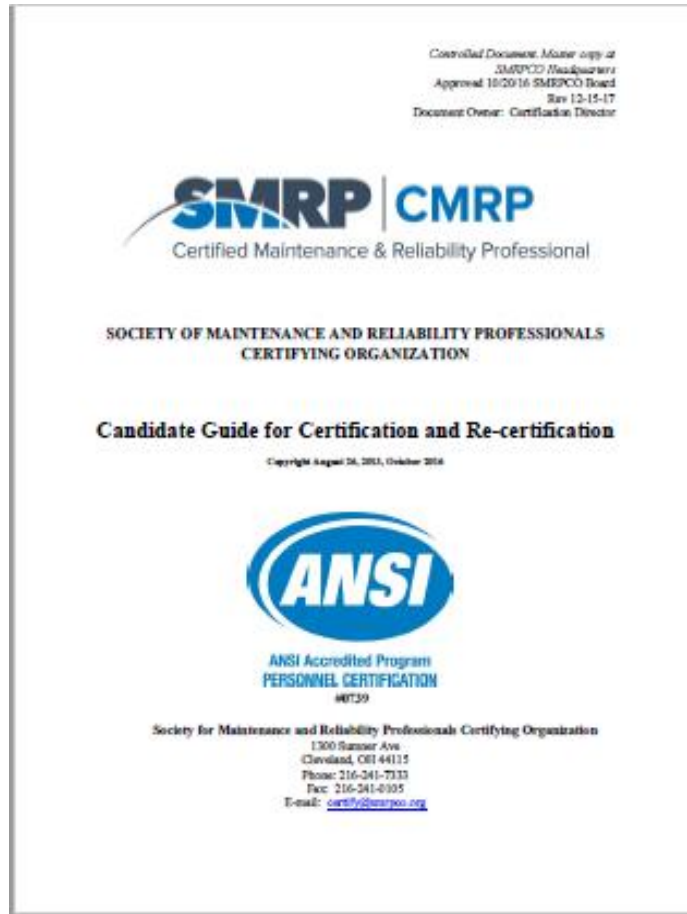


- Locate a test center in your area (<https://www.kryteriononline.com/Locate-Test-Center>)
- Get information about the process, potential exam dates, any additional fees or procedures specific to the test center
- Visit SMRP website (<https://smrp.org/CMRP-Registration>)
- Create a member account on the SMRP website
- Complete and submit an application form online
- Pay the prescribed fees (October 2018 rates)
 - US\$300.00 for SMRP members,
 - US\$470.00 for non-SMRP members
 - Individual SMRP membership = US\$170.00 per year
- Once application was successful and the fees have been paid, you have 6 months to take the exam

Refer to: CMRP “Candidate Guide for Certification and Re-certification“



Certification



- Successful candidates (Certificants) receive a CMRP certificate and are allowed to use the “CMRP” designation
- Valid CMRP’s names appear on the CMRP Directory on the SMRP website
- Certificate valid for 3 years after which you need to re-certify

Refer to: CMRP “Candidate Guide for Certification and Re-certification”

Recommended Books and Reference Material

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- “Maintenance Strategy” by Anthony Kelly
- “Toyota Way: 14 Management Principles from the World’s Greatest Manufacturer” by Jeffrey K. Liker
- “Juran’s Quality Handbook, 7th Edition” by Joseph A. DeFeo
- “Maintenance & Reliability Best Practices” by Ramesh Gulati
- “World Class Manufacturing” Richard J. Schonberger
- “Gateway to World Class Maintenance” by Anthony M. Smith & Glenn R. Hinchcliffe
- “Making Common Sense Common Practice” by Ron Moore
- “The 7 Habits of Highly Effective People” by Stephen R. Covey
- “Successfully Installing TPM in a Non-Japanese Plant” by Edward H. Hartmann
- “Computerized Maintenance Management Systems” by Terry Wireman
- “Maintenance Planning & Scheduling Handbook” by Doc Palmer (1st 3 chapters)



Source: <https://smrp.org/>

