

Reliability Centered Maintenance (RCM2)

Reliability Centered Maintenance is the world's leading method for identifying maintenance and other activities required to sustain reliable performance of physical assets. It is rapidly growing in popularity as news of its success grows and reaches a wider audience.

Reliability improvements, production rate increases, safety and environmental performance improvements, capital cost avoidance along with operating and maintenance cost reductions are all well documented. RCM works and it works well. Like any investment in future performance the method requires training and effort to be applied successfully but payback periods are often on the order of just a few months from program inception.

RCM2 is the method developed by the late John Moubray. John was author of the book, *Reliability-centred Maintenance II*, which was first published in 1991. His method, was developed for use in industrial applications and based on the work of RCM's original developers, Stan Nowlan and Howard Heap in late 1978. RCM2 is fully compliant with SAE JA-1011, the standard for RCM in the industrial applications. Conscious Asset Management is a licensee of Aladon, LLC for delivery of RCM2 services.

The following pages describe a number of services that Conscious Asset Management offers in support of your RCM program.

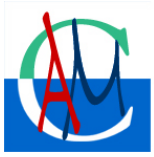
Competency Development and Implementation Support Services

Exploring RCM

We are happy to provide an initial consultation for free over the phone or in person. If we have to travel to meet with you we will ask you to cover our travel costs but the time we spend with you, up to half a day, is on us.

An initial consultation can go a long way to determining whether or not RCM is for you. Often we find that there is some preparatory work needed before RCM is likely to be successful and sometimes we find that we can just jump right in. Either way, it is helpful for your RCM "champion" to have a discussion with us before embarking on this journey. We are highly experienced in RCM having worked with it since its earliest days, working with clients in a variety of industries and under the mentoring of the late John Moubray himself.

Once the choice is made to begin, then we have a number of services designed to provide training, project management, advisory and coaching as you ramp up your RCM program.



Implementation Support

1/2-day Awareness Training

Do you need to get more people on board and ready to give RCM a try? This course is an overview of the reasons for the need to focus on maintenance and for RCM. In the course we cover the various driving forces that make maintenance more and more important today. It includes a unique view of equipment failure and defines what our maintenance objectives must be and gives an overview of the RCM process itself. The material covered is identical to that of the first half of the first day of the 3-day Introductory Training described below. There are no group exercises in this course so class size is limited only by the size of the room used to comfortably seat participants. A handout, “Reliability Centered Maintenance – An Introduction” will be distributed at the end of the course.

1-day Executive Seminar

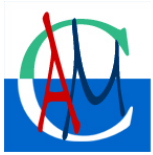
Do you need to sell RCM to other departments or to familiarize operations and maintenance staff who won't be participating in analyses? This is an overview of several driving forces for change requiring a new way of looking at Maintenance Management and how maintenance requirements should be determined using RCM. It is suitable for all employees who have (or think they have) at least some insight into what maintenance is there for. It is extremely effective at “unfreezing” old ways of thinking (for example: maintenance is not there to preserve assets - it is there to preserve their functions) and providing new insights into modern requirements for physical asset management.

Pilot & Project Planning

Have you decided to give it a go, but you don't know where to start? This service is intended for clients who have decided to proceed with at least one RCM2 project, usually as a pilot to prove the concepts or as a series of analysis projects. This planning entails the identification of the RCM2 review group members, providing for their training (if they haven't already had it), identifying the individuals who will review the outputs of their analysis and approve it for implementation, identifying facilitators, scheduling all needed training and the detailed scheduling of project review team meetings taking into account individual team members personal schedules and support resources needed. The planning activity will require approximately two to three days of effort for a pilot project at a single site and is best done immediately before the three-day course. Alternatively it can be fit into the course schedule between the 3-day course and the first week of the facilitators' training.

Planning for an entire RCM project rollout will require more time depending on the scale of the rollout. The sort of information that is dealt with includes:

- What equipment will be covered by the RCM analysis projects?
- How many RCM meetings will be required by each project?
- How many people at each level will be directly involved in the review groups?



- How many different review groups are needed?
- How many review groups will each facilitator work with at once, and how many review meetings will be held on average per week?
- What other factors might have a bearing on the manpower, start date and duration of the project (i.e.: vacations, training commitments, shutdowns, shift cycles, parallel project initiatives, etc.)?
- On what basis are the reviews to be audited, and by whom is this to be done at each site?
- What are the desired outcomes (i.e.: what is the present state and desired state and how will we measure success)?

Some clients opt to plan their own RCM projects. After they have been through a pilot project from start to finish that is certainly feasible. However, we highly recommend Pilot Project Planning for that first project in order to ensure the highest probability of success with your newly trained facilitators. Like any good planning effort it pays off in less wasted time at the outset of your analysis efforts. It is also very useful in determining the numbers of analysis meetings that will be required and keeping the first project scope reasonable for success. Overly ambitious first (pilot) projects often fail since they end up taking longer than expected to produce results and as the length of analysis time wears down the resolve of most new analysis teams. Your analysis team(s) will need some early successes in order to fully buy-into the process and remain motivated for the future analysis projects that they are destined to undertake.

RCM Analyst Training

Our training is intended to both educate and provide a level of practice that enables participants to actively participate in facilitated RCM2 analysis projects.

3-day RCM2 Introductory Training

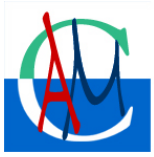
Each course can hold up to 20 participants and requires 3 days to deliver. There is a minimum class size of 6 required for optimum learning. This course can be delivered at your facilities or off-site as an in-house course open only to your own personnel or as part of a public course offering with attendees from other companies. Note that this training is also the first stage in facilitator competency development and it is a pre-requisite for anyone designated for facilitator training.

(3 day) COURSE CONTENT

Introduction to Reliability-Centred Maintenance

Defining the Problem and Gathering Basic Information

- Defining Functions and desired performance standards
- Defining the ways in which assets can fail to deliver the desired performance (Functional Failures)



- Establishing root causes of failure (Failure Modes)
- What happens when failures occur (Failure Effects)

Assessing Failure Consequences

- Protective and warning devices that are not fail-safe
- Failures that threaten safety or the environment
- Failures that effect production or operations (output, product quality or customer service)
- Failures that only entail the direct cost of Repair

Assessing the validity of different types of failure prevention, and setting task frequencies

- On condition maintenance (including condition monitoring and predictive maintenance)
- Scheduled restoration tasks
- Scheduled discard tasks

Deciding what to do if a suitable preventive task cannot be found

- When and how often to do failure-finding routines
- When to redesign
- When to run to failure

Packaging tasks into maintenance schedules and implementing suitable planning systems

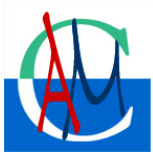
Implementing Reliability-centered Maintenance

- Using supervisors, operators, craftsmen and specialists in RCM2 review groups
- The role of the RCM2 facilitator
- Implementation Strategies
- How to get started

Facilitator Competency Development and Certification

One of the keys to success of the RCM2 methodology is its use of your own facilitators to lead your review groups. Each facilitator requires a combination of training and mentoring to achieve competence in that role and a final audit of facilitated results to obtain our certification as a competent facilitator.

If we have taught your 3-day course we are vigilant in observation of class participants to provide you with our thoughts on who has potential to be a successful facilitator. Prior to facilitator training we also interview those you designate as potential facilitators and develop our recommendation as to their suitability and for any additional needed training for those individuals.



The facilitator candidate must have, as a minimum, training on the 3-day Introductory Training course sometime in the year prior to our facilitator training course. Ideally the candidate has participated in one or more RCM analysis projects but we realize that may not be possible in cases where the company is just getting started in RCM. To ensure that candidates have achieved a minimum level of RCM knowledge before the training we will administer a brief test of their knowledge. This test may be taken at the candidate's own work site but must be invigilated by a member of the senior management team at the site. The test will be marked by us and candidates must be approved before they are permitted to take our facilitator course.

The next stage of competency development consists of a formal 10-day training course. On our Facilitator Course we teach 45 specific and distinct skills grouped in the 5 skill-set groups (listed below) that are required for success as an RCM2 facilitator:

Applying the RCM logic,

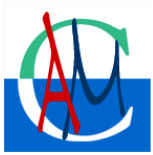
- Defining the Operating Context
- Listing all the functions of the asset together with standards of performance
- Defining functional failures correctly
- Listing all failure modes that are reasonably likely to cause each loss of function
- Listing the effects of each failure mode
- Evaluating consequences correctly
- Selecting routine tasks which deal appropriately with the failure mode and its consequences
- Selecting task intervals on the correct basis
- Selecting appropriate default actions
- Describing tasks adequately

Managing the analysis,

- Preparing for analysis meetings
- Selecting levels of analysis and defining analysis boundaries
- Handling complex failure modes
- Knowing when to stop listing failure modes
- Interpretation and recording of discussions clearly with a minimum of jargon
- Recognition of when the group genuinely doesn't know
- Curtailing attempts to redesign during analysis
- Completing the RCM analysis worksheets
- Preparing an audit file
- Entering RCM data into the computer

Conducting the meetings,

- Setting the scene
- Facilitator conduct
- Asking questions in the correct sequence
- Ensuring questions are understood



- Encouraging participation
- Learning to wait for answers and coach – not answer questions yourself
- Securing a consensus
- Motivating the group
- Managing meeting disruptions
- Coaching the group and individual members

Time management,

- Pace for working
- Number of meetings to hold
- Completion date management
- Preparing for audit
- What to do outside the meetings

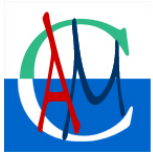
Administration, logistics and managing upwards.

- Setting up the project
- Planning the project
- Communicating the plan
- Meeting venues
- Communicating urgent findings
- Communicating progress
- Participation in audits
- Presentation to senior management
- Implementation activities
- Making RCM a “living” program

The 45 skills are taught and honed in the 10-day facilitator-training program that is delivered at your facilities or at those of another company. The facilitators learn how to guide a group in the application of RCM in addition to consolidating their own knowledge of the subject. Under the guidance of our consultant, they work as a group on a series of exercises. They each take turns to act as facilitator, and the exercises consist of one standard case study provided by us and others based on items of plan chosen from the site at which the course is offered.

There is a minimum class size of 5 for the facilitators training course. The most logical approach for multi-site organizations is to train several from each of the sites on the same course. We recommend that each site train at least two persons – one person more than often felt is needed to allow for a “backup” person in the event of staff turnover or failure of someone to achieve competence as a new facilitator. If needed, it may also be possible to organize and run a “syndicated” course in cooperation with another of our RCM2 clients in order to make-up the full class size required.

The course includes the analysis of a piece of equipment or system at the site that is used for the training so, in addition to avoiding travel costs, it is also advantageous to hold this



training at your facilities. If this “syndicated” approach is attractive to you we will identify other members of the “syndicate” and co-ordinate scheduling of the training at a mutually agreeable time and location.

The next stage of training consists of the onsite advice and guidance to the facilitators.

Mentoring of Facilitators

Following their training the new facilitators will require mentoring to achieve competence in their new role. This is the third stage of facilitator competency development. The experience of the Aladon network is that on average a new facilitator requires 10 days of mentoring support. The actual time required varies between 5 and 15 days for most facilitators.

The mentoring is delivered during the pilot projects that are facilitated by your newly trained facilitators. The pilot projects are those that are planned in the second step of our proposed approach immediately following the rapid assessment visits.

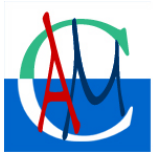
Mentoring is recommended for new facilitators as they will be performing their duties for the first time on their first “live” projects at some time shortly following the facilitators’ course. Despite the training they will be on their own for the first time and they will have questions and they will make mistakes. The average first time facilitator will require approximately 10 days of mentoring support while running 1 facilitated RCM analysis meeting per day. The normal range for mentoring time is from 5 to 15 days. Each of your facilitators should be mentored through her / his first project to ensure success and we caution that although the range of time is 5 to 15 days, most require 10 days.

Our analysis of the Aladon network’s RCM projects over 10 years of delivering these services reveals that some 59 % of the implementations do not achieve desired results and that 94 % of those failed attempts stopped their external support early. They did not include additional training for maintainers and operators and mentoring of facilitators.

Training of the majority of maintainers and operators who interact with maintenance or who might be expected to carry out minor maintenance activities is an important step in managing expectations of the degree of impact that RCM can have on the organization when it is done properly. It can be a mistake to believe that only those who will carry out RCM analyses need to be trained since all the maintainers and most of the operators will be touched by the results of the analyses. Awareness of what is being done and how is critical to obtaining the buy-in necessary for a successful implementation.

Other observations from the available data reveal that the use of mentoring alone increases the success rate from 59 % to 71 % and the addition of contract facilitation increases success rate to 92%.

The last stage is certification of your facilitators. During their mentoring period they will be observed and coached by an experienced practitioner. The results of those first analysis projects will be influenced by the practitioner’s advice to the facilitator. The facilitator’s next project, one on which he is not being mentored, should undergo a



technical audit. The audit will reveal any remaining areas of weakness that must be addressed. We carry out the audit offsite and it takes a day or two depending on the complexity of the system that was analyzed. When the audit is complete we will advise the facilitator on areas of further development and advise whether or not we feel the facilitator can be certified.

Logistics

We can arrange for a training facility near your location or we can use your own facilities. Many clients opt to use their own facilities, often on-site. We highly recommend taking the training off-site to minimize class disruptions and interruptions which invariably detract from the learning experience of everyone present. Regardless of the venue chosen, it must be suitable for the purpose of the training to be delivered:

Training Facilities for RCM Courses

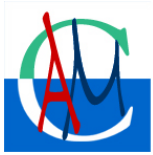
3-day courses and facilitator's training are conducted in the same sort of facility. The training room should be:

Capable of seating the delegates at tables in a "U" formation with a table for the instructor at the head of the "U",

- Equipped with two flip charts, an SVGA or better digital project and a screen,
- All the catering appropriate for training that is carried out in your organization (normal practice is to include refreshments at the start of each day, 15 minutes each at mid-morning and mid-afternoon, and a light 45 minute lunch at about 12h30).
- We provide all printed notes, books and binders for the delegates.
- Courses normally start no later than 08h00 and end at 16h30 each day but scheduling can be adjusted to suit your specific requirements.
- Classroom style facilities are suitable for the ½-day Awareness Training and the 1-day Executive Seminar.

Pricing

Our pricing will be tailored to suit your specific requirements from delivery of a single course to support for an entire program. Sometimes you may only need to train a few. We are here to support you in your choice and help you succeed with RCM2. We want you to be a winner and one of our success stories. Please contact us to discuss your RCM requirements so that we can provide you with a customized quotation specific to your situation.



RCM Toolkit Software

We are often asked if there is RCM software. Yes, there is. It known as the “RCM Toolkit” and it designed specifically to work with RCM2. It has the capability of printing reports that are very helpful, importing and exporting analyses from and to other RCM Toolkit systems (to support analysis sharing and template activities).

CAM is a licensed as a re-seller of the Aladon RCM2 Toolkit software. Description and demonstration of the software is provided as part of the 10-day facilitators’ training. The software may be sold only to clients who have trained RCM2 Facilitators on staff.

It is priced in US \$ for stand-alone and network use or for use across the internet.

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| Stand-alone version: | First copy | \$8 000 |
| | Each additional copy | \$2 000 |
| 5-user Network version | without browser | \$12 000 |
| | with browser (“eRCM”) | \$17 000 |
| Additional users: No fixed price – only 5 concurrent users. | | |
| Each additional language (French and others available) | | \$800 |

Annual support contracts are priced at 15% of the current cost of the software (i.e.: \$1,200 for the stand-alone version and \$1,800 for the network version).

A fully functional demonstration copy of the software is available to facilitators for evaluation purposes at \$800. The demonstration license lasts 60 days then expires unless a full license is purchased. Any data stored in the demonstration copy is not lost if the license is permitted to expire, but it will be inaccessible until the full license is purchased.