ASSET MANAGEMENT COUNCIL

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# THE ASSET MANAGEMENT CAPABILITY DELIVERY MODEL

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# Introduction

'Capability' means the ability of a system, person or organisation to achieve its objectives, and a whole of life capability delivery is the core of asset management.

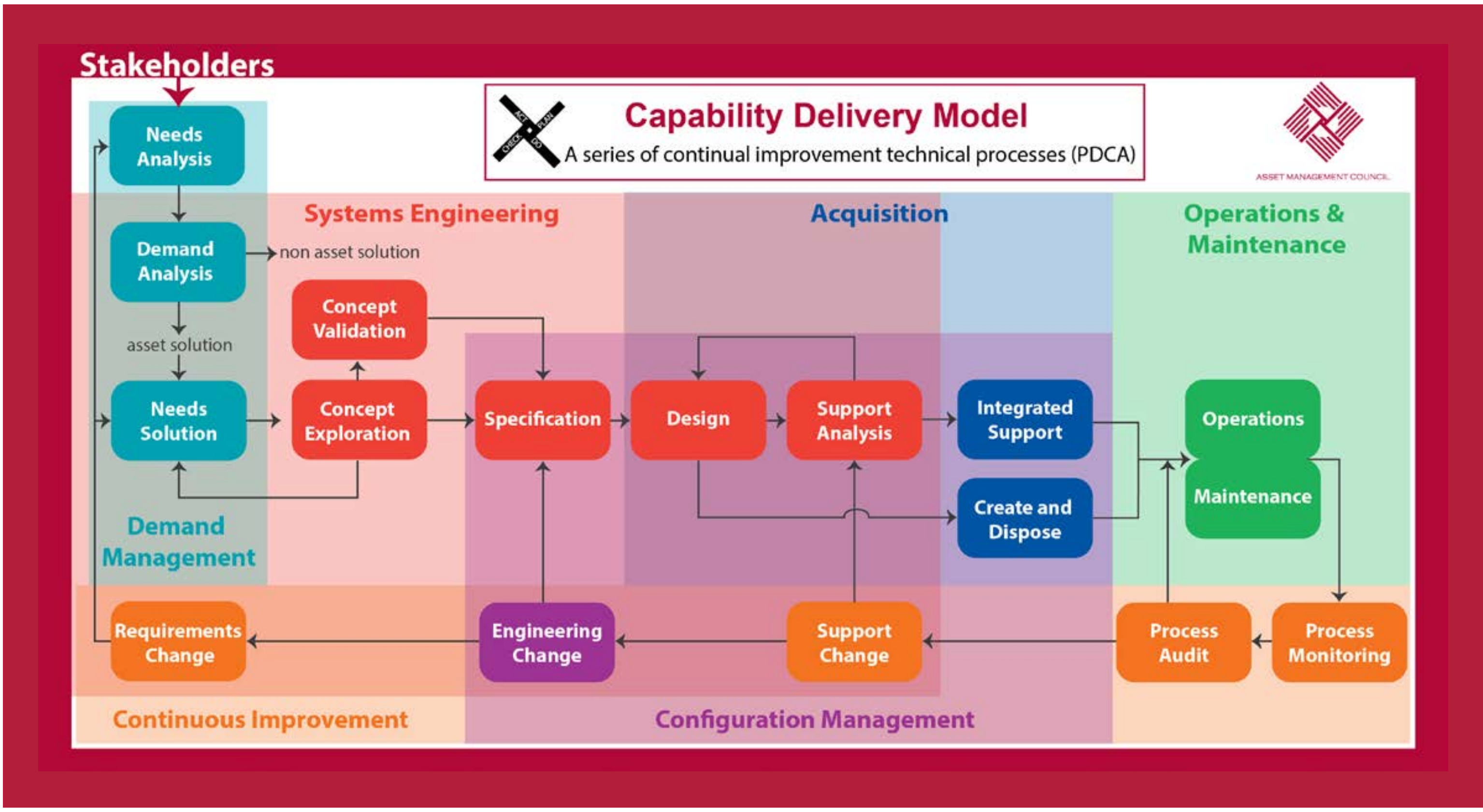
The Capability Delivery Model schematically presents processes and discipline areas that may be used, in part or in entirety, to deliver organisational objectives from the use of physical assets.

The model provides a process view on 'what to do' in terms of delivering assets that meet organisational objectives.

It is the Plan, Do, Check, Act part of the Asset Management Concept Model.

In this eBook, we'll explore the elements of the model in depth.

## The Relationship Between the Elements of the Capability Delivery Model




The Capability Delivery Model illustrates the relationships between:

- Demand management
- Systems engineering
- Configuration management
- Acquisition
- Operations and maintenance
- Continuous improvement

Its function is to provide guidance for using the asset management system, developing an asset management system capability, and developing solutions to ensure capability.

# The Elements of the Capability Delivery Model

## Stakeholder

**Stakeholder** requirements are the prime input for objectives in an asset management system, and inform all planning, decision making and processes. Their requirements are not always easy to capture and quantify, but they are important since they must be matched to the architecture of the elected system. A disconnect between stakeholders and system engineering, for example, could be catastrophic.

## Demand Management

**Demand management** is the balancing of demands from stakeholders, both internal and external. This is done by gathering data on what the often conflicting needs are, then analysing them. Demand management is always looking to the future, aware of needs that might be changing.

## Needs Analysis

A **needs analysis** is done to find out what stakeholders overall think the asset should be providing: Cheaper prices? Reduced coal emissions? Fewer outages? A demands analysis then decides which needs predominate. Indeed, there may be conflicting needs that cannot be simultaneously met.

## Needs Solution

A **needs solution** is where the needs are drawn up descriptively in non-technical, accessible language. This is known as an Operational Concept Document (OCD) or a Concept of Operations (CONOPS) and may:

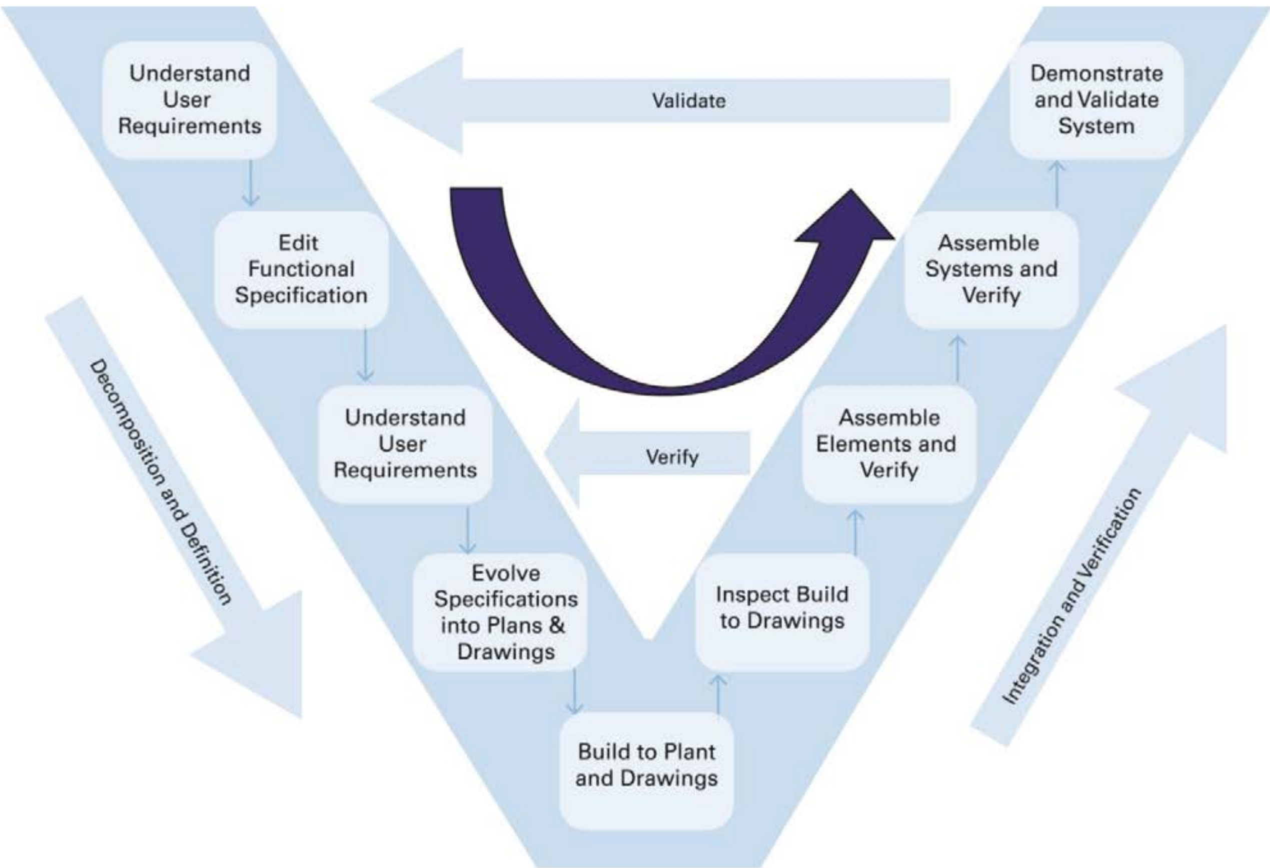
- Document the purpose of the system
- Identify the business needs the system will satisfy
- Document user expectations
- Describe the system's basic concepts
- Describe the system from a user's point of view
- Indicate a range of acceptable solutions

The OCD is a point of reference for more detailed conversations about things like 'reliability' without having to delve into technical definitions of measurable reliability.

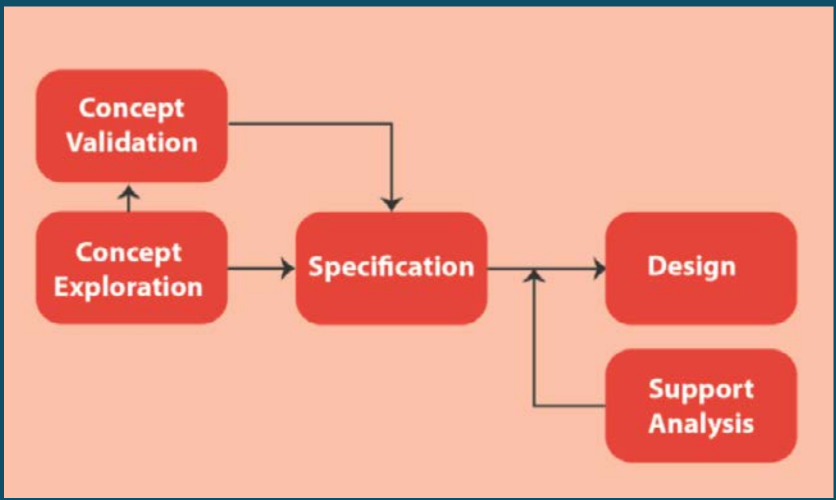
# Systems Engineering

As defined by the **Systems Engineering Society of Australia,** systems engineering "integrates all the disciplines and specialty groups into a cohesive team effort forming a structured development process that proceeds from concept, to production, to operation, to end-of-life. Systems engineering considers both the business and the technical needs of all customers with the goal of providing a quality product that meets the user needs."

## Systems Engineering 'V' Process




## Systems Engineering in the Capability Delivery Model




Systems engineering ensures the output of a process is consistent with user requirements. With constant reference back to the user requirements, an initial concept is generated that defines a need in terms of an asset solution, explores then validates the concept, develops specific system solutions, then provides ongoing support and analysis to the process.

Systems engineering is at the core of the Capability Delivery Model because it connects stakeholder needs at the top of the model to the expenditure required to realise those needs through the asset, whether it be a maintenance or operational expense, or to assure the technical specifications of asset components.

As we can see by the Systems Engineering diagram, the concept starts the process by identifying a need that can be met by the provision, upgrading or replacement of the asset. Fact-finding, stakeholder feedback through surveys, trade-off analysis, feasibility analysis, technical analysis, modelling, simulation and prototyping all make up this stage of **concept exploration** and **validation**, the latter being the verification that there are no high-risk pitfalls associated with the concept under consideration.

**Engineering specifications** are a way of pin-pointing what equipment must be purchased or designed to carry through the concept into the real world.

Planning for this must be commenced in the concept stage, otherwise an organisation may find the design solution specified is beyond the financial and operational objectives of the asset.

To reduce error, most organisations use defined specification formats and content. Specifications also look to the organisation's standards and policies to see what the acceptable design solutions and practices are. Imagine acquiring a piece of equipment that did not contribute to the asset's goal because technical specifications were not fully understood.

## Case Study:

### Redcliffe Peninsula Rail Line

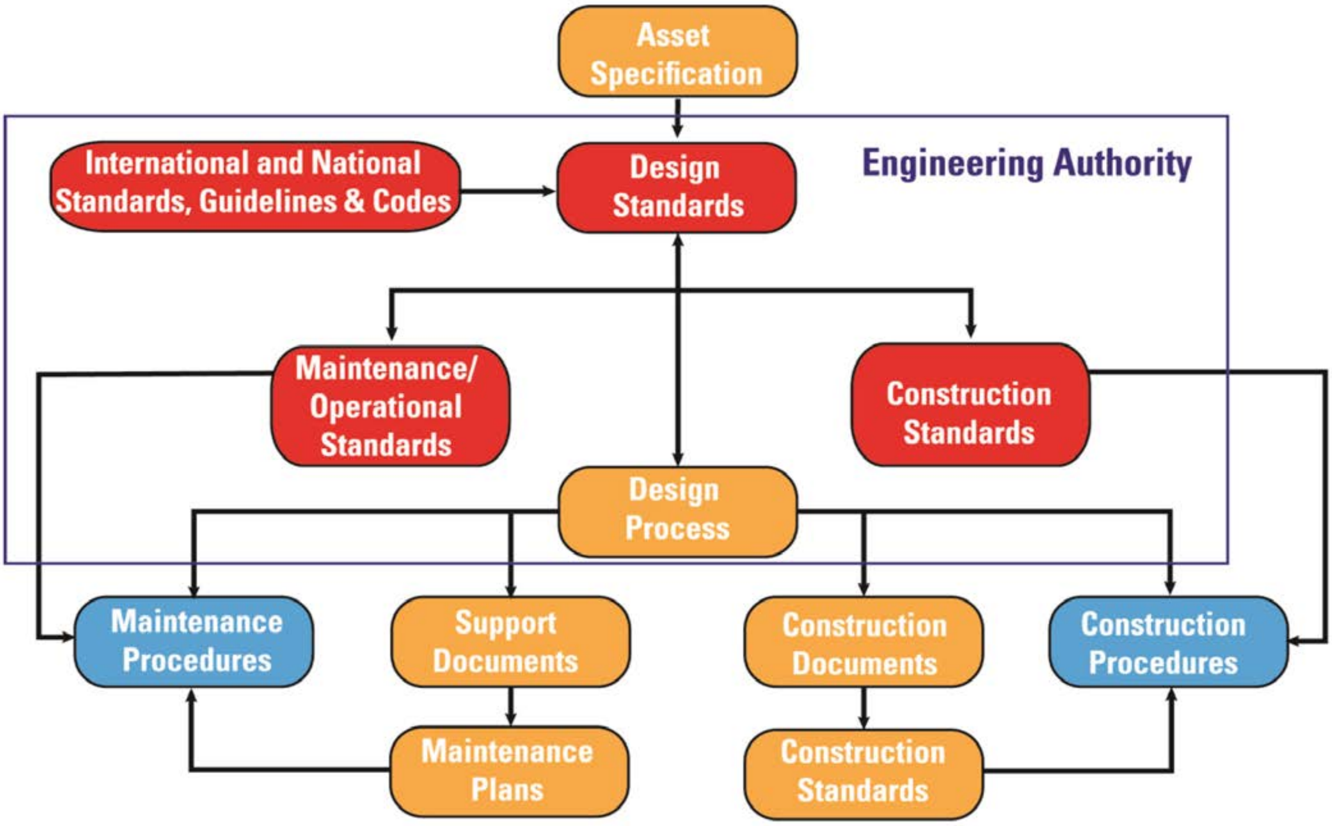
The new Redcliffe Peninsula Line to take train passengers to Redcliffe, north of Brisbane, was completed in mid-2016. The $988 million project was jointly funded by federal, state and local governments. Shortly before opening, it was discovered that the line's signalling system did not meet the operational and safety standards found across the rest of the state's network. It was possible for a train to "run a red light" at the junction with the main line and collide with other trains.


After the signalling problem was solved and the line opened in October 2016, it was discovered there were not enough drivers for the additional trains needed, resulting in cancelled services and delays. The chief operating officer, chair and CEO of QR resigned, and two months later the transport minister **joined them.**

**A report** found that the train driver shortage was due to systemic communication problems within QR and with government. The report recommended removing a layer of management, and improving the 'line of sight' between frontline staff and management. It called on the government to look at overhauling the organisation "to consider the appropriate operating model and accountability for public transportation services".

**Design Management** is another part of systems engineering that must be carried out with regard to industry design standards to maintain the safety and integrity of assets. It allows the organisation to achieve accreditation, such as the AS/NZS ISO 9001 (ISO 9000: 2004 Quality Systems). Applying the wrong standard out of ignorance of the requirement can lead to elevated costs of construction and maintenance.

## Application of Design Standards




From the diagram we see that the asset specification leads to a constructed solution by applying design standards to the design process.

Construction, maintenance/operational and international and national standards all inform the process, which produces support documents such as user manuals, training materials, and a maintenance plan.

The final link in the systems engineering chain, **support analysis,** identifies and predicts what it will take for the asset to operate into the future. Support analysis includes information on the cost and availability of required support – including the spare parts predictions on how the asset is likely to fail and what can be done to fix it.

Required support should be in place from day one of the asset's lifespan. In the case of new acquisition, do employees know what they are receiving at their location, and do they know what to do with it when it arrives?

## Configuration Management

Configuration management is a systems engineering process for establishing and maintaining consistency of a product's performance, functional, and physical attributes with its requirements, design, and operational information throughout its life.

Within configuration management we find **engineering change.** Complex assets such as major capital equipment have thousands of parts requiring tooling, fixtures, gauges, templates, test equipment and software for ongoing functionality. One estimate was that a part may undergo ten engineering changes or more over its life.

Over the life cycle of the asset, the manufacturer must assure that the original configuration at any point in time will satisfy functional requirements and that any replacement equipment corresponds to the approved asset management objectives. Levels of engineering change can be ranked by the level of risk involved with each component.

## Acquisition, Integrated Support, and Create and Dispose

The acquisition area of the model addresses integrated support, and create and dispose. **Integrated support** is the data and equipment needed for the asset to continue delivering value to the organisation: spare parts, maintenance, data & IT, finance, packaging, handling and support, and staff training.

These support items affect two major performance aspects of the asset:

- Its reliability – the length of time between failures.
- Mean down time, or how long it is out of action – also known as the maintainability of the asset.
- The wrong spare, poor training or sporadic maintenance can contribute to the failure of the asset.

Not having the **right spare** in stock could bring an asset to a **standstill**

Poor record-keeping can also contribute to failure: if the inventory shows a spare part is available, but the part cannot be found, a routine repair could become a mad dash around suppliers in the hope they have stock. Before deciding to stock or not to stock a spare part, you should first assess the risk of its absence to the operation of the asset.

Often used spare parts like pumps, motors, gearboxes and blowers can be damaged by the wrong storage environment or careless handling. Managing these spare parts under a preventive maintenance program identifies these problems and nips them in the bud.

# Create and Dispose

The **create** process concerns the newly acquired asset and its suitability to meet the operational and business needs of the asset. Request for tender information can be re-examined if the asset was acquired through tender, and its specification (in the systems engineering sense of the word) checked to make sure it is suitable.

When an asset no longer plays a viable role in supporting service delivery, its worth lies in the benefits to be gained from its **disposal**. The **NSW Treasury Department's Asset Management Plan** identifies the following steps in its disposal plan:

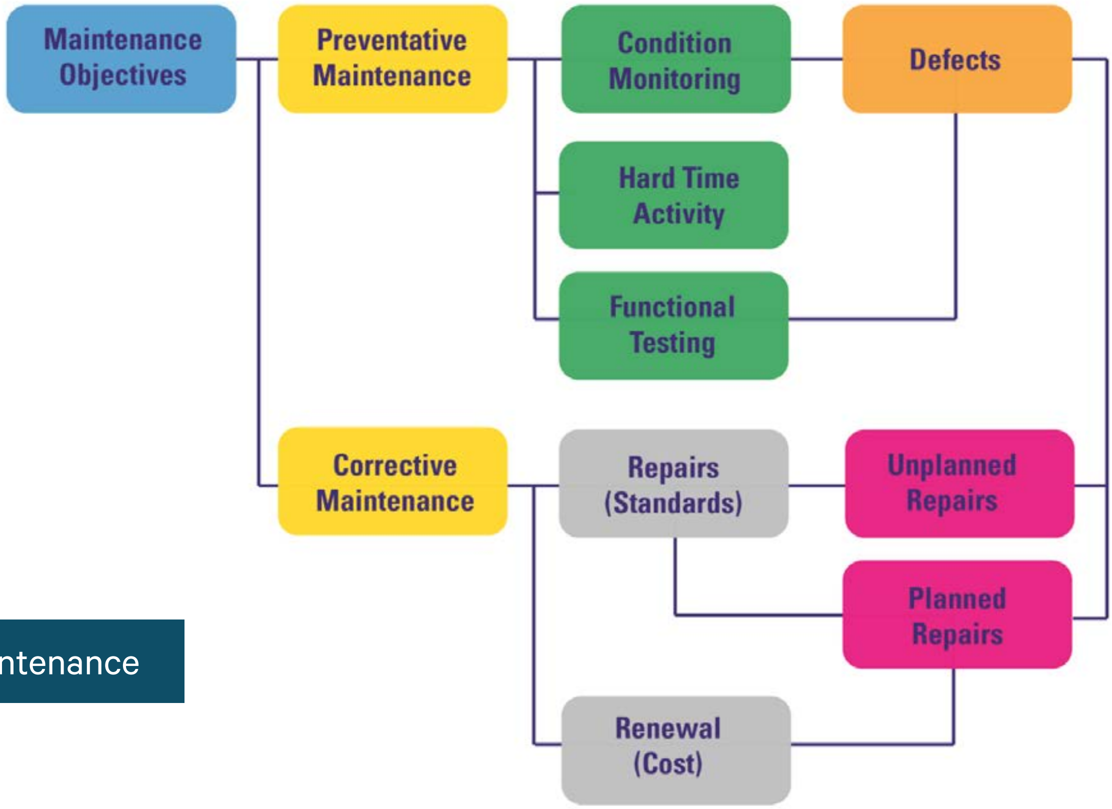
1. Assess in detail those assets identified by the Asset Strategy as surplus to service delivery requirements.
2. Assess the advantages to government, agency and the community in divesting assets.
3. Identify opportunities for increasing asset value before their disposal.
4. Identify disposal requirements including probity considerations.
5. Prepare and implement the Disposal Plan and monitor performance.

The decision to stop using the asset is not 'disposal' in the strict sense. Only when the asset has been removed from the technical maintenance plans and equipment register, and owner accountability has ceased, can the equipment be considered fully disposed.

Disposal should be included in the asset management strategy when the plant or equipment is acquired. Short-life systems should have a disposal plan built in to their acquisition program. But even after disposal, it may be necessary to maintain it in safe condition – an old substation or a falling down warehouse, for example. This is to protect the public and the environment, since hazards can remain beyond the operational life of an asset.

# Operations and Maintenance

The operation and maintenance of an asset begins as soon as it is purchased and ends with its disposal. Between them, these two areas consume most of the cost of asset ownership. The asset must be maintained and operated not only in a way that delivers the value of the asset to stakeholders, but in compliance with statutes and standards.




## Types of Maintenance

Maintenance keeps the asset operating reliably and safely, at minimum cost and in line with organisational objectives. During maintenance, information can be collected that contributes to engineering improvements to the asset.

There are two types of maintenance: **preventative** and **corrective**.

### Preventative Maintenance has three categories:

**Condition monitoring** to examine the condition of the asset to make sure that it will function properly at least until the next maintenance check.

**Hard time activity,** which is done regardless of the condition or length of time the equipment has been in operation, such as cleaning filters, or replacing lubricants and electrolytic capacitors.

**Functional testing** to determine the condition of equipment that may have hidden failures such as smoke alarms, emergency lights and circuit breakers.

### Corrective maintenance returns failed equipment to the asset management policy standard. There are two types of failures.

**Functional failures** are where the equipment has been pushed beyond its limits, resulting in a loss of capability. Ruptured pressure vessels, short circuits in motor windings and failed circuit cards are typical examples.

Type two, **conditional failures,** are defects in the sense that it is not likely the equipment will be able to function correctly in future unless repaired or renewed. Sometimes renewal of the equipment is the answer, acknowledging that the ongoing cost of repairs is likely to exceed the cost benefits of replacing the equipment.

Keep in mind that maintenance and operations are closely linked, as shown in the Asset Capability Model. Neither area can function efficiently without input from the other.

# Continuous improvement

**Continuous improvement** means looking at the asset management processes and asking whether they are operating at optimum level. You may ask why processes should need improving, given the time that went into the needs analysis, the needs solution, concept development, specification, and so on?

The answer is that when those choices were made, certain assumptions, assessments, projections – perhaps outright guesses – were made about the reliability of individual pieces of equipment, their compatibility with other parts, and the environment within which the asset would be operating.

It is only the use of the asset that can give us the feedback we need to know whether we have made the right choices, and we can use this information, if necessary, to alter the support given to maintenance and operations.

The feedback, the combined observations of the maintenance and operations teams, feeds back into the capability delivery model. But the information is fed into the top of the model, not the bottom.

The loop starts at the top, with the stakeholders. Have their needs changed? Is a new needs analysis required? Has there been a disruption in the industry? Have the expectations of the community changed? Is Barry, the only guy who can keep Pump 2 working, about to retire?

Revisiting the top of the model is essential. Having a perfect maintenance record at a coal-fired power station must be placed in context if the community's and the new board's requirements have suddenly shifted to renewable energy. If the stakeholders want something else from the asset – perhaps its disposal – then significant changes will need to be made at all levels, from top management, down to decisions about whether to buy spare parts that may never be used.

To be proficient, continuous improvement needs four elements:

**Process monitoring:** Are the operations and maintenance plans being routinely followed? This is fundamental to the asset management plan since the reliability of the asset depends on them.

**Process audit:** Are the operations and maintenance staff actually doing what they should be, or are they ticking boxes on the checklist without carry out the correlating action?

**Support change:** Do the staff have the support they need to do their jobs? Are the support tasks as documented in the asset management plan – checking, recording, testing – still adequate, or do they need to be changed?

**Requirements change:** A requirement is a capability to which an outcome (product or service) should conform. If it does not, then a solution needs to be found by going back to the demands process – does the asset have to be changed, or is there a non-asset solution?

If an increase in electricity demand during summer places strain on the grid, a solution could be asset or non-asset in nature. Either the asset must generate more power, or perhaps an 'air-con levy' could be applied to consumers to reduce consumption – no doubt turning up the heat on the organisation.

These are the sorts of decisions asset managers must make, not all of them popular, for the asset to remain capable of achieving its objectives.

# Documents Generated by the Capability Delivery Model

## Systems Engineering Management Plan (SEMP)

Describes how the technical and engineering environment of the asset will be maintained to meet organisational objectives. It describes the operational staff and support needed to keep the asset functional.

## Configuration Management Plan (CMP)

The detailed recording and updating of information that describes an asset's physical components. It shows the organisation what type of equipment is in use, how it interconnects, who is responsible for its reliability, and how changes are to be made.

## Operations Management Plan (Ops Plan)

The operations management plan contains goals and objectives and identifies a range of strategies for the organisation to achieve its goals.

## Integrated Logistics Support Plan (ILS Plan)

This covers the operations supply chain as a single entity, instead of separate management functions. It identifies what the asset produces and the processes needed for that to happen. It ensures that the equipment, facilities, spares, technical information and trained personnel needed for the asset to operate are available. The aim is to reduce operating costs and increase efficiency.

## Capital Expenditure (CAPEX)

Plans for when to purchase plant and equipment to upgrade or replace asset components to support capability or reduce OPEX costs.

## Operating Expenditure (OPEX)

Itemised expenditure of annual recurring funds needed for normal operation of the asset.

## Safety Management Plan (SMP)

Details the policies, procedures and roles to make sure activities carried out in the organisation meet industry and regulator safety requirements.

## Environmental Management Plan

Describes how asset operation impacts on the natural environment, and sets out how these impacts can be avoided, minimised and managed to be acceptable to stakeholders. The objective of an EMP is to ensure the environmental impact from continued asset operation and maintenance is sympathetic to the environmental characteristics of the area.

## Heritage Management Plan

Identifies, assesses and develops management plans for heritage assets, such as buildings or historical sites, that through location or acquisition become stakeholders. The plan should reference state and Commonwealth heritage management regulations.

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