Industrial Maintenance Roundtable NSW
Common Interest Workgroup (CIWG)
Report from Meeting on July 25th 2007

Achieving Success with New Assets

(Capital Project Management to Achieve Reliability and LCC)

Draft







This document is compiled from discussions during the NSW IMRt Common Interest Workgroup (CIWG) on Achieving Success with New Assets.

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Achieving Success with New Assets

Attendance List

Attendee	Organisation
Frank Vergan	Bluescope Steel
Reg Brown	Bluescope Steel
Lindsay Begg	Hunter Water
Rowan Longergan	Hunter Water
Doug Reynolds	OneSteel
Brian Lynn	Qantas
Robert Trajkovski	Qantas
Peter Charlton	SIRF Roundtables
Peter Todd	SIRF Roundtables
Azeez Ahamat	Snowy Hydro
Darren Davis	Snowy Hydro
Fredrick Rodrigo	Sydney Water
Nandu Marathe	Sydney Water
Siva Sivasupramaniam	Sydney Water

Introduction

The NSW Industrial Maintenance Roundtable (IMRt) held a Common Interest Work Group (CIWG) meeting on Achieving Success with New Assets focusing on how best to manage capital projects to achieve reliability and minimum Life Cycle Cost. This meeting was held on the 25th July 2007 at the Metro Inn North Ryde. The meeting was attended by 14 people from 7 different organisations. The information and ideas included in the document came directly from the discussions that took place at the meeting.

The scope of the meeting included discussions Project Management Process, Project assessment & Justification, Project Specifications and Project Implementation. The NSW IMRt has held only one CIWG meeting on this topic in 2007 but may hold more meetings on this and related topics in 2008. There is also interest in an on-line working group on this topic to improve the participating organisations internal standards and to publish minimum suggested standards for use by other SIRF organisations.

The IMRt is a maintenance networking organisation coordinated by SIRF Roundtables (SIRF Rt) www.sirfrt.com.au . This report gives feedback to meeting attendees and other interested parties. The meeting included the development of a comparison matrix, which is shown on the following page. This matrix was filled out by attendee organisations to enable comparisons to be made between organisations on the issues discussed.

New Asset Success Comparison Matrix

New Asset Success	Sydney Water	Hunter Water	Bluescope Steel	Snowy Hydro	Qantas	OneSteel (Worley)
What are the processes, Systems and stages involved in justifying new assets?	Identification of needs - Condition Assessment - Growth (EP) - Change in process/technology - Customer Demand - Regulatory Requirement - Stakeholder needs - Environment Management - Options Study - Cost/Benefit analysis - Risk/Benefit assessment/Studies	Depends on Type. Can be to: - Cater for Growth (Must do, no other justification necessary) - Regulatory Requirements (Must do, no other justification necessary) - Based on risk assessment and cost/benefit analysis (Risk vs NPV)	Concept Paper - Idea - Needs - Basic KPI's - Safety & Environmental - Estimates - Identify Risks - Benefits - Concept design - Financial evaluation Present to Stakeholders	Corporate Plan * Business Development * Facility Plan - Asset Strategy - 20 year Asset Plan - Projects Program Feasibility * Studies * Risk Assessment Business Case	- Need, Base Case, Risk Assessment/ OH&S - Pre Purchasing check list - Fit for purpose - Compliance - Standardisation - Feasibility Study - Utilisation-Other unit type available within QF - LCC - ROI - Stakeholder Engagement	- User Requirement Spec - Scope of Project Phases * Assess * Select * Define * Execute * Operate
What are the criteria or considerations that have to be assessed before a project is approved?	- Return on Investment - Best option to meet functional/ operational requirement - REF and Environmental Impact Studies - Cost benefit analysis of various options (Value Management Study)	-NPV (Capital, Op & Maint cost, etc) -Technical merit -Environmental Impact -Regulatory requirements -Safety requirements	-Cost Benefits -Safety/ Environmental Impacts -Risk Study -Timeline -$ Cost - Capital Required -NPV -Peer Reviews	- NPV, IRR - Risks - Resources - Regulatory/ Statutory - Strategic Fit	- 8 Blocker Assessment - Ensure checklist is complete - Meets Fit for Purpose & Functionality - Lead time - Financial Models - LCC, ROI, RFI, RFP - Risk Assessment 1st stage sign off - Selection process with stakeholders - P/O Number to select supplier	- RFI - Timeline - Safety - Benefits
How are operations and maintenance involved in capital projects?	-Review of needs -Review of concepts -Finalise preferred option -Detailed design spec review -Adopting standards and procedures/ asset selection to meed required RAM -Asset commissioning/ maint planning/ training	-Participation in planning workshops -Representative to involve maintenance personnel -Review/ comment on design reports/ specifications -Supposed to have representation at commissioning	* CRS - Customer Requirement Specification * Client Rep/ Manager * MTEC Process Design Review's - HAZOPS, CHAZOPS, FAT * Operational Philosophy Document	- URS - FAT - Design Studies - HAZOP - Risk Review - Implementation - Commissioning - Training	- Review of Product Type - Stake Holder Engagement Process - Op's raise spec & Maintenance Review - Training Part of 8 Blocker - Risk Assessment Review	- Included in URS, Scope & Define Phases - Project Owner + Represent. + Maint + Electrical Represent.
What type of analysis is used to determine maintenance plans (FMECA/RCM etc) and who is involved?	-RCM/FMECA -Input from equip Supplier/ O&M Maintenance manuals -Past experience - Data Analysis -Involvement: Ops & Maintenance	-Suppliers manuals -Maint personnel review maint schedules -Based on schedules of existing similar equipment & previous experience -No formal RCM process	MTEC - RCM etc	- RCM, FMECA - OEM's, Maint Staff, Ops Staff - Strategy Engineers - Reliability Team	- Supplier Documentation - Reg's - Aust Standards - Maint Review Task Card & advise on any amendments	
How is the details of new assets specified?	-Through specifications, drawings Performance Data -Maintenance analysis data Reliability Standards -Total LCC	Detailed specification document -Performance (functional) materials -Protective coatings etc -Based on design manuals & standard specs & approved products	-Functional Requirement Specs -CRS, URS -CODES -Tender Documents -Procedures & Standards	- URS - Standards (Aust, Elect, SHL) - Performance Standards	- RFI - Develops Specification - RFP - Response from supplier to meet specification	- URS - AS Codes - Site Standards
How are procedures, manuals, training, maintenance plans, drawings etc specified in a new asset project?	1) It is specified as standard clauses in the specifications 2) To be supplied prior to commissioning 3) Linked with the final contract payment	Specified by design & tender documents and reviewed by operators and maintenance staff	-MTEC Process -OEM Input -FRS	- Contract Requirements - Project Management Plan - Handover/ Completion Documents	- 8 Blocker - RFI - RFP - Supplier/ OEM advice - Pre Purchase Checklist - QF Policy & Procedures Manual	- From OEM suggestions - Supplied by OEM + modified by OneSteel
How is the success of a capital project judged at completion? Is there a review of success after a number of years?	1) Meeting the expected performance specification 2) Project completion within time, cost & quality (meeting the performance targets 3) Carry out Post Implementation Review	-Performance tests as part of contract (+ ongoing if regulatory requirements) -Corporate KPI's monitored (spills, supply, quality etc)	-KPI's Ongoing -Project Closeout Meeting/ Report -Performance Targets -Cost Analysis	-Project Implementation Review (within 6 months) -Benefits Realisation Review (~12 months past commissioning)	- Facility - Benchmarking other Airlines - Benefits Realisation - Annually - Project Tracking - 8 Blockers	- Meet KPI's - Project Closeout Checklist - Asset Performance

Achieving Success with New Assets

Meeting Attendees

The meeting attendees were either directly involved with the management of Major Capital Projects or had a role in setting standards for new asset project management. The **Qantas** representatives were from their Ground Support Engineering group and are involved with a wide range of improvement projects including acquisition of new assets. Their focus was "How to get the best bang for the buck" on money invested into new assets. **Hunter Water** is interested in a "How to do new asset projects better". They typically write detailed specifications for new project but it is often mostly a copy of what they did last time. Hunter Water has set standards for suppliers for various equipment items but has found there are compromises involved in this. **Snowy Hydro** has a strong focus on achieving built-in reliability with new assets and has a strong upgrade and life extension investment program. Their existing assets are generally achieving high performance but this performance has often only been achieved over 20 years of improvement. Snowy would like to achieve this peak performance at commissioning or within 1 to 2 years.

Sydney Water historically had large engineering and projects groups who designed and installed most new assets. Their current engineering and project resources are much leaner but still have some good standards and processes in place. One of the Sydney water attendees had a specific role of coordinating the interface/ communication between maintenance and projects. They use three typical capital project types:

- Build and Operate projects where Sydney Water specifies functional requirements to meet business objective
- New asset projects involving design, supply, installation and commissioning that Sydney Water project manages (often called turnkey)
- Smaller replacement or refurbishment of existing assets run by Sydney Water

The **OneSteel** representative was a part of the OneSteel/WorleyParsons alliance that is focused on management of a large number capital projects for OneSteel. WorleyP have personnel permanently at OneSteel sites and integrate as a part of the local OneSteel team. WorleyParsons have some well established standards for management of new projects. The **Bluescope Steel** representatives were from a major energy related project (approx $1 Billion) in the Port Kembla steelworks to build 3 major boilers and 2 generators and will recover energy that is currently being waisted in existing steelmaking processes. This project is in its early stages due to be completed in 2012. Bluescope Steel has a mature process to get maintenance and operations input into major projects called MTEC (Manuals, Training, Equipment and Commissioning).

Project Management Process

Sydney Water

Sydney Water's capital projects focus on the system requirements of the service it has to deliver. The process steps to manage these projects are:-

- Create the concept
- An option study is performed
    - Often assisted by external experts
    - Option might include up to Design, Build, Operate and Maintain
- Estimation of returns from each option
- Selection of agreed option
- Tendering to the open market
- Award to a party
- Manage implementation

Bluescope Steel

Bluescope Steel has a strong capital project process with projects up to $10M being able to be approved locally and projects of $50M go to the board. For larger projects a process called MTEC (maintenance, training, equipment & commissioning) manages structured operational and maintenance input into project from an early stage. See the MTEC time line and process flow diagram on the following page. They also have check points at each process stage with a sign-off required for each. This can also be seen in the OneSteel/ Worley Parsons process below.

OneSteel WorleyParsons

OneSteel/ WorleyParsons have a 5 Step Capital Project Process for management of the full project life cycle. This process is founded on achieving asset reliability and business success. See their time line and process flow diagram on the following +1 page. They have found that having the detail and discipline to set a project scope correctly up front reduces the problems and improves the project success dramatically. The formalised check points enable a project to be stopped even if a significant amount of planning work has been carried out (projects don't take on a life of their own).

Snowy Hydro

Snowy Hydro's process to manage new capital asset projects includes:-

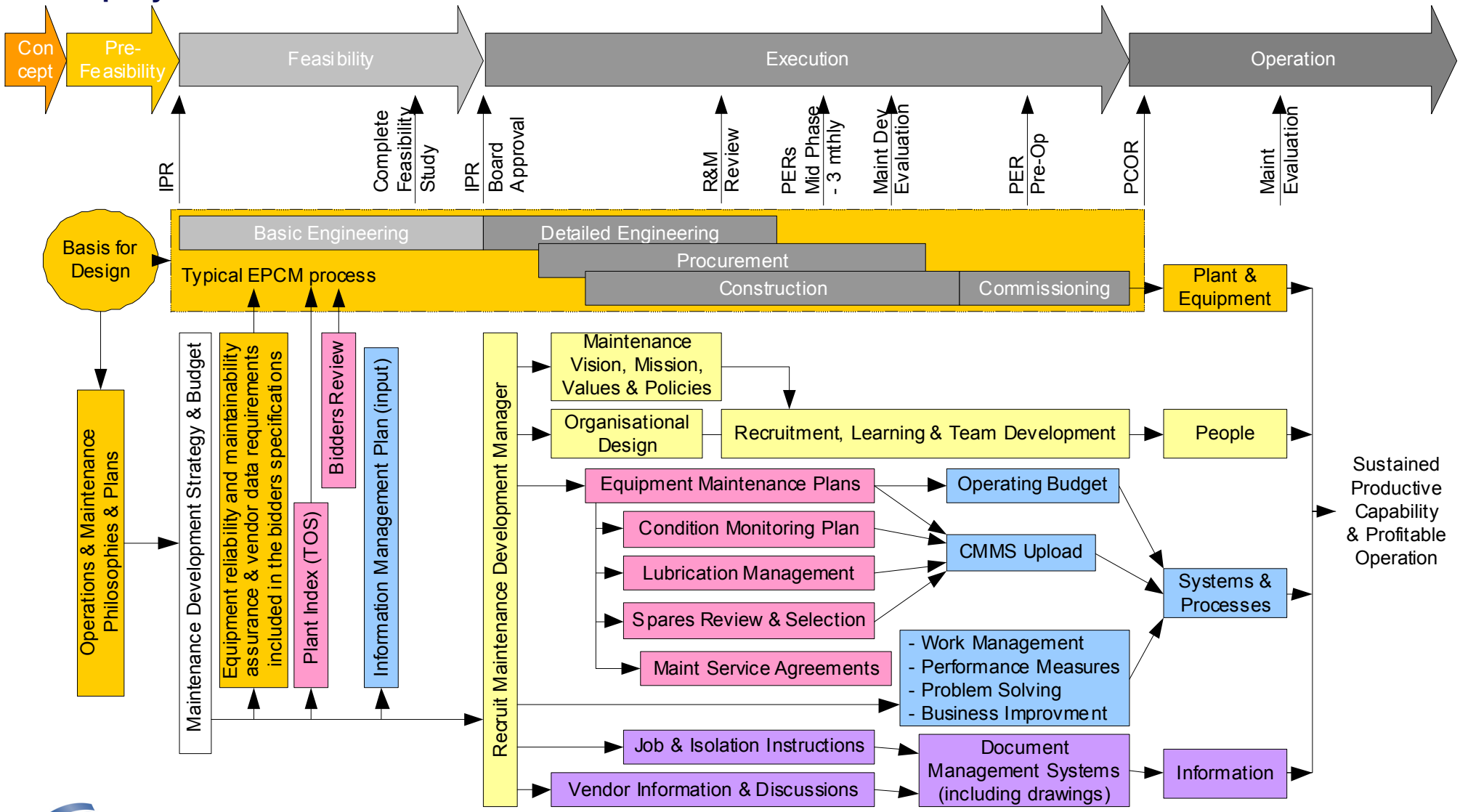
- Creating a URS (User Requirement Specification. Also called CRS – Customer Requirement Specification)
- Options, Proposals and Evaluation
- Approval
- Detailed Design
- Selection of Final Design and Management Approach
- Implementation

Hunter Water

Hunter Water tries to get Operations and Maintenance input into projects at the concept stage. As most of their capital projects are upgrades to existing systems they

BlueScope Steel MTEC process

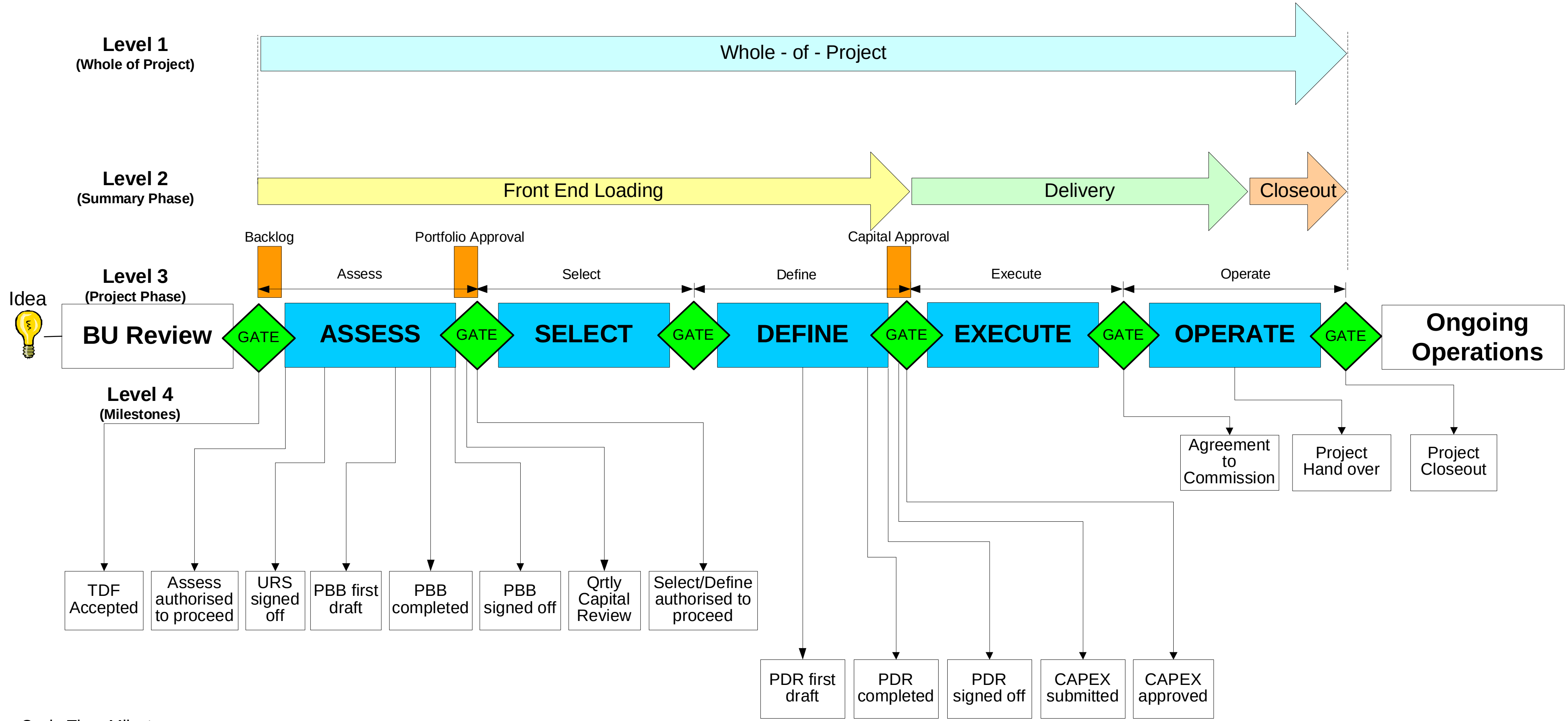
Steel maintenance Network is developing the MTEC process with MTEC coordinators across the company



Steel Maintenance Network
MANUFACTURING EXCELLENCE

WORK MANAGEMENT SYSTEM
Project Cycle Time Hierarchy

onesteel



Key Cycle Time Milestones

	TDF Accepted	PBB signed off	Select/Define authorised to proceed	CAPEX submitted	CAPEX approved	Project Hand over	Project Closeout
LTCP	✓	✓	✓	✓	✓	✓	✓
PGC	✓			✓	✓	✓	✓

have people with significant experience with these systems. Their process tries to get people with hands on experience with the equipment involved at the detailed design stage.

Project Concept & Feasibility Stage

Project Concept or Idea

Project Ideas

At the project idea stage Bluescope Steel use a series of questions to challenge peoples thinking related to its justification. Many projects ideas don't get past this stage.

When Should Assets Be Replaced?

This key question was of concern to Sydney Water as they have a substantial aging asset base. One of the problems is that local asset owners and other stakeholders often want to have bright new shiny assets for a range of reasons. Sydney Water has a basic Flow Chart that tries to assists with this decision that takes into account existing maintenance & operating costs, improved technology available, renewal cost etc. Their philosophy is to make the replacement decision on the assets condition and its cost history. Key assessment parameter of proposals for replacement is on Net Present Value (NPV).

Bluescope Steel suggested that for a range of equipment, obsolescence is a key driver for replacement. It is a major business risk if key equipment breaks down and you can't fix it. Formal Risk Analysis is a key tool is a key tool used to make this assessment.

Project Justification

There was a consensus that a rigorous financial justification should be carried out before any major cost commitments are made.

Data to Support the Analysis of Project Justification

There were a number of comments about problems getting good data to support analysis of project justification. One thing that greatly assists Sydney Water with this decision process for replacement of its assets is that it has now got 5 to 6 years of good data on maintenance costs, MTBF and other reliability parameters in its CMMS system. Typically the payback period has to be less than 5 years but Sydney water are also involved in using Life Cycle Cost analysis. One of the critical items of data is the cost of outages and loss of production.

Bluescope Steel suggested that the key to having good data available in CMMS systems is getting the users to input the required data that will be useful later on. They focus strongly on this for their SAP CMMS system. Bluescope have a project justification system as a part of their 'Capital Process' that focuses on returning value to the shareholder. They realise that competing in the international market. Increased asset infrastructure costs by adding or replacing assets is a major burden to an organisation. There are also a broad range of issues other than costs that have to be

considered such as safety, environmental and community concerns. On recent major projects Bluescope has used a 25 year evaluation period to assess Life Cycle Costs.

There was discussion around the data OEM's supply about actual ongoing maintenance and operating cost for supplied assets. OEM's have a strong motivation to underplay these costs. It was suggested that wherever possible equivalent actual costs from in-house or from similar environments should be used and they are often substantially higher than supplied OEM data (also see RCM Analysis).

Life Cycle Costing Systems

Qantas have used a software system (supported by an ex-IBM engineer) to do Life Cycle Cost (LCC) analysis. They gave the example of the LCC comparison between two generator options where the cost over 10 years was double for one option compared to the other option. Qantas has a specification for LCC analysis.

Option Selections

As asset related projects address the provision of a required function/ providing an added service there will be a number of options to achieve this, some of which may not require capital outlay. The options selection process tries to open the project up to a broader range of options and playing devils advocate to any stakeholder current preferred options.

Options for Suppliers/ Service Providers Arrangements

A core decision on any new asset is who will be involved both in the acquisition project and for the later ongoing operation of the asset. This will include what will be insourced and what will be outsourced and various other ownership and management options. With a greater focus by organisations on LCC, there is stronger motivation to look at other options for service provision such as outsourcing. The comment was made that one of the main reasons for outsourcing of maintenance or operations of an asset's operational phase is often to get over perceived work practices issues. The obvious reason to outsource during the acquisition stage is the lack of resources and expertise. The key risk generally with outsourcing was suggested to be potential loss of important intellectual property.

Qantas looks for how they can gain more benefits through difference suppliers/ service provider arrangements and looking in more detail at the functional requirement, for example:-

- Outsourcing
- Supply & maintain projects
- Competition between internal and external service providers
- Own or lease assets?
- Power by the hour
- Local or Central control of contracts?

One best practice Qantas identified through its international benchmarking arrangements was Horizon Air in the USA as an innovator in management of its assets. Horizon's assets are distributed across USA but they maintain a strong and consistent control through use of their CMMS. Qantas recognises that the systems and

processes used in Qantas Sydney are not often the same as used in Qantas Perth with the tendency for maintenance Silos and are looking at a more consistent approach as a basis to drive improvement. Qantas's existing CMMS is being assessed to provide the systems to achieve the same global support approach.

Bluescope suggested they have been caught out in the past when a supplier owns the operational asset and the contract comes to an end. Who owns the asset? Does it have to be renewed? Assets typically last longer than contracts. Another problem highlighted is that initially under a longer term contract or alliance the supplier may provide competent people and all is well but over time these people can be lost for various reasons and the quality of service can significantly reduce. Bluescope have had many positive experiences with outsourcing with the key comment being around the need for strong cooperation and to see the contractor as a partner who needs to be helped. Examples of success with outsourcing in the Energy Services Department were the complete operational outsourcing of their water treatment plant to GE Water and maintenance outsourcing to Atlas Copco of a group of their compressors. The large maintenance Alliance with Transfield was another example.

For Sydney Water their Alliancing of maintenance has worked well but the long term cost effectiveness is questioned. Longer term Alliances such as the OneSteel/WorleyParsons relationship was though to be better and fairer for both parties with their longer term relationships and people stability. Qantas also indicated that their relationships with contactors have evolved. Where previously there had been little cooperation between in-house personnel and contractors, over time this culture has broken down and contractors personnel now tend to be treated as equals and tools are even shared with contractors. Sydney Water has also been building the cooperation between in-house personnel and contractors but they have contractually drawn the line with tools, which the alliance contactor has to provide 100%. They suggested that the difference between a contact and an alliance is that in well constructed alliance the service providers profit is aligned to the goals of the principle. Sydney Water has some experience of cost going up with the move from an in-house service provider to an alliance contractor. Hunter Water gave the example of tendering to outsource their maintenance and allowing the maintenance personnel to quote. The in-house group easily won and then worked successfully as a separate internal service provider. It was suggested that contacting out service provision can work well if people with the required motivation, knowledge and skills are engaged. Snowy Hydro suggested some of the risks that have been observed are:-

- There is a loss of control and influence of key people working for your business. Loss of loyalty of persons working for your business.
    - Over time loosing the personnel who have the required skills to provide the service without the skills being transferred to others.
    - Loss of personnel with key knowledge that is important for your business (intellectual property)
    - The contractor may be able to make more money elsewhere using the key personnel working for your business
- As a service provider market matures the level of competition often drops making contact negotiation more difficult (observed in New Zealand).
- As an employment markets gives more opportunities, choices and $ people with good knowledge and skills can be more easily drawn away.

Leasing

One option that Qantas looks at with asset projects is Leasing v Purchasing. It was suggested by Bluescope that the trend in international accounting practices will reduce the advantages of leasing, with asset values being required to show on a companies books even if they are leased.

Snowy Hydro indicated that they have investigated leasing options a number of times but the option has never been chosen as the most viable option. Qantas discussed some options and history about acquisition of Boom Lifts where leasing was being considered. Bluescope indicated that all boom lifts, mobile working platforms and mobile cranes on its site are hired and this works very well.

Cultural Issues

There are lots of reasons why achievable performance levels for assets are not realized. In 05/06 Qantas systems recorded $250,000 in costs caused by equipment abuse and so are focusing more deeply on the people and cultural issues required to achieve success. Qantas recognises the leadership role Bluescope Steel played in Australia in taking on DuPont's Safety Culture approach (LTI's from 60 to 0.4). Qantas and many other organisations have emulated this approach and is an example of the major benefits that can be derived from management focus driving desirable cultural change. There is a major opportunity for management of establish a good organisational culture on a Greenfield site.

Project Definition/Specification

Qantas representatives were currently reviewing the IEEE Std 1220-1998, which is a Standard for 'Application and Management of the Systems Engineering Process'. They reported that the standard has very worthwhile information on this topic. (IEEE Standard Abstract: The interdisciplinary tasks, which are required throughout a system's life cycle to transform customer needs, requirements, and constraints into a system solution, are defined. In addition, the requirements for the systems engineering process and its application throughout the product life cycle are specified. The focus of this standard is on engineering activities necessary to guide product development while ensuring that the product is properly designed to make it affordable to produce, own, operate, maintain, and eventually to dispose of, without undue risk to health or the environment.).

Project Specification

Bluescope Steel use two base documents for specifying a project. They are:-

- CRS (Customer Requirements Specification)
- OPD (Operating Philosophy Document)

The procedure for creating a CRS has a number of questions to make people think more deeply about functions and requirements to achieve success. The OPD tires to document the higher level practical details of how the asset will be managed and the services that will be required (eg. number of people and skills, shift patterns, what would be outsourced etc).

Management Structures for Capital Projects

Bluescope MTEC Process

Bluescope Steel started developed a process through the 70's called MTEC (Manuals, Training, Equipment and Commissioning) that integrates maintenance and operational involvement with Capital Projects from an early stage in a projects life cycle. Maintenance and operational goals are set early in the project and the cost for implementation goes into the project justification. This process was developed from hard lessons learned about ignoring maintenance issues in a steelworks environment, which is a large integrated serial process. It is implemented on large capital projects.

As the MTEC team is put in place early and they are integrally involved in all aspects of the project, when the main project team completes their work the MTEC personnel stay on and form the nucleus of the operational and maintenance team for the plant.

People Resources for Capital Projects

Qantas indicated that they have problems funding personnel out of existing operations to support projects, as there are often positions that are already unfilled. The OneSteel rep indicated that one reason for the OneSteel/WorleyParsons alliance for capital projects was to provide additional personnel to be based on-site who can work closely with the local personnel to reduce the coordination/communication workload of getting local input into projects. Bluescope Steel indicated that they use Hatch and Transfield in similar ways. Snowy Hydro nominate asset owner representatives to be a part of a capital project but not full time (up to 3 days a week for large projects).

Maintenance Planning, Procedures, Training and Manuals

It is important that maintenance planning, training and manuals required are costed and specified in the project scope so they can be costed into the projects.

Procedures, Manuals and Documentation

Hunter Water indicated that items such as Manuals and Documentation are specified using AS 2124—1992 Australian Standard General Conditions of Contract. Bluescope Steel spoke about their MTEC process and the fact that ensuring Manuals and Procedures are in place well before start-up is one of the core responsibilities of the MTEC team within a project. It was suggested that it is important to specify in some detail what your require for manuals, procedures, and drawings and specifically discuss during contact negotiations including timing to ensure there is no confusion. Hunter water indicated they use drawing templates as an example of standardising the electronic data supplied. Bluescope suggested that one very critical set of data that needs to be managed is the code from computer, control and PLC systems.

All documentation should be supplied in electronic form. Bluescope and Snowy Hydro have experience and can recommend using the Web based ACCOON system to control all information transferrals and communication for a project. The system was suggested to add security, reduces miss-communications and is good for managing control of changes. Most or the attendee organisations used document management systems to store electronic data on equipment and processes from projects.

Training

One opportunity for on-the-job training during equipment installation is the service agreement with suppliers and vendors to allow local tradesmen to work directly with the suppliers skilled technicians so that information on the equipment can be transferred during the installation process and thus minimise classroom training, which can be ineffective for some applications.

Project Definition Process

Sydney Water has a standard process for developing project scopes that includes a 6 page checklist of items that have to be assessed. This includes review of standard equipment options, review of reliability parameters from similar equipment from the CMMS, required operating guidelines, required standard operating procedures, maintenance requirement and spares required.

Generic Equipment Standards

Sydney Water try to select equipment with a know reliability. They don't want to select say a pump that will only last 3 years when there is a cost effective item available that will last 20 years. They use their Maximo CMMS system to help derive reliability parameters. At the project definition stage current equipment standards are reviewed for suitability for the particular project application.

Bluescope steel has set equipment standards for generic equipment but if a suppler realise they are the preferred option prices have been know to triple. The steelworks has standard suppliers that they have built up relationships with and the supply arrangements include agreed pricing for standard catalogued items are managed by their procurement organisation. Bluescope's experience is that maintaining an equipment standard for specific equipment types requires regular effort over time as technology changes and markets evolve. There always needs to be a balance between standards and current best cost/performance choice.

Hunter Water has a number of preferred equipment suppliers for a range of generic equipment for their use that gets updated as required. This works well for them as it only has equipment items that have been proven to have good reliability, maintainability and performance but as there is often 3 or 4 suppliers it still allows suppliers competition on price. If a supplier wants to get on the list, they have to prove their products reliability, maintainability and performance.

RCM Analysis

Snowy Hydro's experience with RCM on its exiting assets started in 1995 when most of the equipment was analysed with RCM Turbo. A key input into an RCM analysis is the equipments reliability parameters. Their suggestion was to look at what failure frequency data you have available from your equipment and make a judgement on the quality and applicability of the data. Data from an external source needs to be put into the appropriate operational context. The other good source of data is talking to the old hands. As looking through and analysing data and doing an RCM analysis can be very time consuming, the advice was to ensure you focus on what is critical by doing a criticality analysis.

Snowy Hydro's first recent attempt to include a reliability approach into a new asset project was with a new Siemens gas turbine installation and was not considered fully successful. An RCM analysis was specified in the contact but the supplier was not comfortable with doing the analysis on the main turbine and only carried out the analysis on auxiliary equipment. The turbine ended up the supplier's standard maintenance plans.

The second attempt was the acquisition of some ABB circuit breakers and was much more successful. The RCM analysis was carried out in Europe and Snowy has been happy with the result. One of the leaning from this work is to specify the required level of detail for the RCM analysis for the specific application.

Modelling New System

Sydney Water spoke about the need for understanding the likely reliability performance of new assets requires good reliability parameters. As previously discussed there were significant discussions about the complete lack or inadequacy of reliability data supplied by most OEM's (Original Equipment Manufacturers). One advantage of the availability of good reliability data on equipment and operational processes is the ability to model systems. Modelling allows the testing and optimisation of any number of design, operational and maintenance issue at the design stage. There are a number of software systems available to assist with modelling such as AVSIM (reliability modelling) and ARENA (more advanced process modelling). The processes usually involves building a block diagram model of the process and then inputting reliability or other data into each process block and test the inputs and outputs of the system. This allows testing of a range of design issues to achieve the best business result. Qantas has used ARENA to model processes and Snowy Hydro has used AVSIM to model reliability of some of its systems.

A related technique is the building of operator simulators to fully train operators in using new systems and processes before commissioning of the actual equipment starts. This can dramatically affect the likelihood of safety, environmental, equipment damage or operational losses from many systems.

Condition Monitoring

There were discussions on the importance of specifying appropriate Condition Monitoring for new equipment. Bluescope indicated that they specify on-line vibration monitoring for critical applications such as turbines and manual monitoring for less critical applications. There was a number of comments about the effectiveness of Thermal Imaging and laser gun temperature meters for electrical and many other monitoring applications. Qantas spoke about there borescope monitoring of their jet engines and the success of keeping jet engines safely in service longer than any other airline.

Snowy Hydro suggested that just because monitoring does not find any problems does not mean it is not worthwhile and gave the example on the monitoring they do on dam walls. Sydney Water suggested that they have had examples where finding one problems can often pay for many years of monitoring.

Authorisation of Projects

Pre Authorisation

Bluescope Steel indicated that before projects get to the formal approval stage they have to go through an independent review by separate internal groups.

Contractual Arrangement

Sydney Water suggested that one problem with one off turnkey design and construct contracts is the tendency of the service provider to cut corners that may only be revealed through the life of an asset.

Bluescope suggested that it is desirable for larger turnkey projects to imbed a person into the project. This is because the people designing and building the asset get a deep understanding of the philosophy behind its design and operation. This enables them to solve many problems that arise in the future more quickly and effectively. Often when projects finish the personnel that have the deep knowledge on the asset walk away and are lost to the organisation. Embedding personnel into projects allows relationships to be built with the personnel with important knowledge and they become much more willing to transfer this knowledge to local personnel.

Project Implementation

Project Handover

Snowy Hydro has a formal handover document that has to be signed off by the asset owner.

Qantas saw it as important to be able to manage information coming from projects centrally so that information is not lost over time. It was also a priority to insure information from projects go into the appropriate existing systems such as CMMS to make it integrated and accessible.

Examples of Projects Discussed

Qantas

The Qantas reps spoke about the work it is doing to gear up for the new 380 Airbus with risk assessments and activities like the requirement for platform access to carry out maintenance on the plane. There was discussion around their acquisition of Elevated Work Platforms (EWP's) where examples of previous acquisitions had reduced operational effectiveness due to training and support not being properly included as a part to the purchase. There had been a problem with the acquisition process of catering truck due to poor management of documentation provided under the project and poor project handover.

Sydney Water

Sydney water currently has about 250 projects ranging from $30k to $1M each. Most tend to be Supply and Install type.

Asset Operational Stage

Early Problems

Sydney Water uses a 12 month defect liability period and a percentage of the project dollars are held for this period to ensure engagement of the contactors to sort problems out quickly. They have a number of penalty clauses in their contracts.

Warrantee Management

Snowy Hydro suggested that equipment items that are covered by Warrantee should be identified in spares and CMMS systems in an obvious way so that if problems occurs the warrantee responsibility can be followed up.

Organisational Structure

Snowy Hydro have recently integrated their maintenance and operations teams into one combined unit as they believe this will give them the best business result. They suggested it is best to get your organisational structure right before looking for ways to facilitate engagement to drive improvement.

Project Review/ Post Mortem

Snow Hydro suggested project reviews should be carried out at the full completion of a project but also again at 1 to 3 years after the completion, depending on the asset, to determine the success of the new asset.

Bluescope do a Close Out Report to ensure they actually did what they say they were going to do. There are also KPI's setup to monitoring the ongoing effectiveness of the system.

Hunter Water have a Post Completing Review meeting every 6 months to review the success of the 3 or 4 projects completed in that period.

Terminology

URS – User (Customer) Requirement Specification – A document that describes the function of the proposed system plus the criteria or conditions that have to be met for success.

Appendix 1 – BSL Project Checklist

Change Control Process (where relevant)

1. Is formal change control procedure applied to critical equipment and materials, the introduction of new chemicals, control system software changes, major operational and maintenance procedure changes?
2. Does it include the following elements where relevant:
a) Necessary design reviews (HAZOP etc.) and approval?
b) Provision for statutory approvals (EIS, building approvals, workplace safety legislation etc.)?
c) Documentation and CMMS update?
d) Change to emergency procedures?
e) Training requirements (Production and Maintenance)?
f) Critical spares holding?
g) Management of disposals?
h) Safety case review (if applicable)?

Engineering Standards

Do engineering specifications and standards effectively address:
1. Reliability (designed reliability, simplicity, plant redundancy)?
2. Maintainability, accessibility, ease of surveillance, cleanliness, modularity, quick removal?
3. Documentation, spare parts, and training considered in design and equipment selection?

Equipment Selection and Design – Involvement

Are maintenance, operations and reliability personnel involved in equipment design and selection early enough in a project?
Do they use an established philosophy, eg, MTEC (manuals, training, equipment and commissioning)?

Equipment Selection and Design – Standardisation

Is site equipment standardised to minimise parts holding, procedures, training, manuals, and special tools?

Equipment Selection and Design – Whole of life costs

a) Is equipment and vendor selection based upon life-cycle cost projections rather than on merely initial cost and delivery?
b) Do design reviews require reliability and maintainability issues to be addressed?

Handover

Is plant hand-over formalised after successful commissioning and testing?