eChartered

ENGINEERING COMPETENCY REPORT

EXAMPLE A

20 June 2013

ENGINEERS
AUSTRALIA

Table of Contents

About this example

This report is part of a set of example reports that is being developed to provide examples of Engineering Competency Claims and the Engineering Experience Record (EER). These Examples are for use by participants on the eChartered system to guide them.

Before reviewing the example reports applicants should refer to the appropriate *2012 Australian Engineering Competency Standards Stage 2- Professional Engineer or Engineering Technologist or Engineering Associate* available in the Resources section of the eChartered website.

Participants should also refer to Section 5 of the Online Participant Guide, Submission, paying particular attention to Section 5.3. *Writing Engineering Competency Claims (ECCs).* The *Thought Starters for Preparing Engineering Competency Claims in eChartered* available in the Examples section also provides guidance and is recommended reading along with the example reports.

The following 16 example ECC reports were submitted by an electrical engineer who successfully achieved Chartered Membership following their Professional Interview, as well as registration on the National Professional Engineers Register (NPER) and the Stage 2 Assessment for the application to become a Registered Professional Engineer of Queensland (RPEQ).

The author was prepared to meet the requirements of the *Australian Engineering Competency Standards Stage 2.* Each of their claims and their Engineering Experience Record were verified by a responsible senior engineer.

Identifying information has been removed to protect the confidentiality of the author, their employers, their Verifiers, and the projects covered. All Verfication has been removed for the purpose of maintaining confidentiality.

As the new eChartered process develops, Engineers Australia will be able to build a repository of examples. This example is from one of the first to use the eChartered system and successfully complete their Professional Interview.

Engineers Australia expresses its sincere thanks to the engineer who provided these reports to be used to assist others seeking Chartered Membership and/or registration.

Claim 1. Deal with ethical issues

In November 2011 I commenced work as a Senior Electrical Engineer at a multinational engineering firm, for a large iron ore port project in West Africa. My duties include the handling of the Electrical, Instrumentation and Control equipment for contract vendor packages for bulk material handling equipment.

Previously, until end of October 2011, I was working for a German machine manufacturer. With this company my duties included the engineering, design and commissioning of material handling equipment for plants, ports and mines.

In October 2012, while at the multinational engineering firm, I identified an ethical issue.

My previous employer contacted me and asked whether I would be able to actively participate in a technical presentation. This presentation was part of a bidding process for new equipment for a Coal Terminal. I was invited to participate in this meeting as an expert, because from 2009-2011 I was the responsible electrical and control engineer for a project for almost identical machines for another Coal Terminal.

I recognised the potential of an unethical situation based on a conflict of interest. As a first action, I gained information about the new project and found out, that the final client for this new equipment is a potential client for my current employer. This client also employs an Engineering company for this new project which directly competes in some business areas with my current employer.

Such circumstances were new for me. I recognised that I had to avoid any situation which put me into a conflict of interest between my present and previous employer.

I identified the ethical issue of being currently employed by the multinational engineering firm and would present an expertise from my previous company in front of a potential client of my current employer and also a competitive company to the services offered by my current employer.

I consulted the Engineers Australia's "Code of Ethics" for guideline and compliance. Point 1 "Demonstrate Integrity" lists practises which are relevant in this case, such as:

"1.1 d) give due weight to all legal, contractual and employment obligations"

"1.2 d) in managing perceived conflicts of interest, ensure that those conflicts are disclosed to relevant parties"

"1.2 e) respect confidentiality obligations express or implied"

In order to comply with the code I investigated the contractual side of this situation in reference to my employee contract documents with my current employer for any direct or indirect sections which address this topic.

I sought advice by checking my current employer’s relevant key document, the "Code of Business Conduct and Ethics".

I consulted my supervisor and also contacted my functional lead to discuss the situation openly.
With due consideration, we collectively decided to avoid this potential conflict that I should decline. I disclosed to my previous employer, the conflict and declined to participate in this technical presentation.

This conflict situation was not a black and white scenario. My expertise to the technical matter would have been objective and at the first instance it looked like a win-win situation for all parties. However, the involvement in projects, which are not connected with my current employment, potentially bears the risk of conflicts.

It is my strong belief that ethical values, including integrity, reputation, openness, fairness and justice are an essential and integral part of responsible and ethical reflective engineering practise. In the above case, I sought guidance from company governance documentation as well as from my lead to ensure I did not compromise my position with my present employer.

Claim 2. Practise competently

Since November 2011 I have been working as a Senior Electrical Engineer at a multinational engineering firm in Australia for a large iron ore port project in West Africa. My duties include the handling of the EIC (Electrical, Instrumentation and Control) equipment for contract vendor packages, the engineering of electrical equipment and the coordination with other areas, which involve EIC equipment.

The vendor packages of the port area, which I am responsible for, include the bulk material handling equipment. I quickly recognised in my new role that my assigned responsibilities were well within my competencies and my known areas.

My previous career experience has provided me with much exposure to Port and bulk material handling projects. These projects I have participated in over a 16 year period have occurred in several countries in Europe, Asia, South America and Australia. My participation in these projects has provided experience through all project stages including conceptual engineering, design, procurement, software programming and commissioning. I am therefore familiar with most aspects of a front end loading project feed as I now undertake in my existing work with my current employer. This includes:

·The definition of relevant requirements for tender packages.

·Addressing clarification questions from other interfacing disciplines in my current company and potential vendors.

In addition I also mentor and guide less experienced engineers and designers of the team in this area.

However, I also realised the scale of the project is larger, some processes are different and scope of facilities is greater to my previous experience. This includes the responsibility for the electrical, instrumentation and control engineering activities for several areas of the port, such as the infrastructure facilities and marine works.

I am aware of my limited practical experience in such areas. These activities require knowledge and upfront input such as of early construction works, marine communication, navigation aids and mooring equipment. To acquire the necessary knowledge I have looked to consult with others with greater expertise and in some instances engaged external expertise. This applies for example to the Power Plant, high voltage power distribution, protection studies, rail interfaces, port communication and interfaces to infrastructure. To increase my knowledge I have also sourced books and articles from libraries, engineering communities, and my employer’s internal systems.

I value team work and the diversity of experience and knowledge which can be drawn on. I believe this result in a better outcome in specialised engineering work especially for such large scale projects as the iron ore port project.

I understand the need to maintain my skills and keep up to date with the latest technical trends.
I read relevant literature, participate in communities and attend courses such as "Lunch and Learn", "Lessons Learnt", presentations and training. This is not restricted to my specialist field of practise. I also acquire new knowledge in adjacent fields of engineering and management as well as in general education and languages.

To keep track of all my professional development activities, I maintain a spread sheet which lists all activities undertaken including details, such as type, topic, duration, lecturer, presenting company and supporting documents.

Claim 3. Responsibility for engineering activities

Since November 2011 I have been working as a Senior Electrical Engineer at a multinational engineering firm for a large iron ore port project in West Africa. This project requires a rewriting of all clients standard specifications, which were based upon Australian conditions and mostly Australian Standards. As one of my duties I develop relevant technical documents on behalf of the client and review and revise documents from other originators.

I consistently document and share my work. It is essential that I work in a structured and transparent way to ensure team members who interface or provide supporting design have my latest documentation. I avoid using the local drive for project related information, documents and files.
Instead, I store data on the network drive in dedicated folders. I follow the company filing structures and procedures as this allows all team members a quick reference to documents. I ensure the clear numbering and naming of files, including date of development, notes of and tracking of changes.

I communicate and collaborate with the team members to share information. This allows for team members to have the latest information allowing the project work to be efficiently carrying out.

For third party vendor packages I developed the equipment specific Electrical and Control Standard Specifications.
These specifications are base documents, which the third party vendor has to comply with. I ensured that the specifications contained all required information for the vendor. This includes the scope of work, the conditions, references and links to other relevant specifications, schedules, interfaces and risk and design review requirements. I faced several challenges while developing these documents:

Although being familiar with bulk material handling equipment, I do not have personal experience with some specific machines. I initiated conversations and communicated with experts from design, construction, operation and maintenance background. This included peers within my company, the client with its experience in other existing plants and manufacturers.

English language is not my native language. I am aware that technical and non-technical documents which form part of a contract must be 100% correct, precise, structured and do not leave any room for interpretation. To ensure that my documents fulfil these criteria I asked for reviews from native speakers with technical and non-technical background and implemented their feedback.

·With the publishing of these documents I was exposed the first time with the company's online system for projects. I sought advice and guidance from the document control discipline and also spend time studying the guidelines and procedures to ensure that internal and external reviewers as well as the client are able to work with these documents as intended.

As part of the process in the development of specification, a peer review is undertaken. The feedback from others, their corrections and contributions allowed me to substantially improve the quality of my documents. I lodged the documents successfully in the online system for client review and approval.

I review and revise issued documents from other originators, such as contract specifications, scope of work, technical specifications, studies, data sheet templates and drawings from all disciplines

I make sure, that my contributions to these documents are qualified, constructive and clear and therefore help the originators to improve their work. I am aware that I am asked to check the documents as an expert for my area. I therefore do not give opinions, but decisions and instructions. If I have questions, I clarify these with the originator instead of putting them as comments in the review. I check for complete data and

review documents as if I do not have another chance to review. I take responsibility for my review with signing the documents.

One of my duties is the participation in the execution of studies. These studies look, to reduce capital and operational cost, the impact onto the environment and the local community.

I investigate as part of my role, the EIC part of these studies in regards to technical and commercial aspects. I only transmit my engineering outputs and cost calculations after intense consultations with other disciplines to ensure that I fully understand the purpose, background and consequences of the specific variant or option.

Claim 4. Develop safe and sustainable solutions

From July 2010 until October 2011 I was working as a Commissioning Manager at a German machine manufacturer on site. I was responsible for the no load commissioning, load commissioning and performance tests of bulk materials handling machines for a Coal Terminal in Queensland, Australia. The commissioning stage exposes personnel to many activities which are potentially hazardous.

As a Commissioning Manager I am aware of my responsibility to identify the inherent risks and to implement appropriate mitigation measures to minimise exposure to personnel.

To manage the commissioning tasks with providing safety for all personnel carrying out work on the machines, I established a team of dedicated experts from the construction company, the electrical installer, electrical and control engineers, health and safety advisors and commissioning engineers. Together we undertook risk assessments prior to the commencement of activities to ensure that all safety measures for the commissioning activities were in place. This included compulsory commissioning inductions for all workers, morning toolbox meetings, sign in and isolation procedures. We also implemented the accepted safety charters from the involved companies, such as JSA (job safety analysis) or safe work method statements.

To ensure that my work and decisions comply with all site specific procedures, I participated in a theoretical and practical Isolation Training as well as on site audits of the process.

The transition from the construction into the commissioning phase is critical. The first step, the energization ("power on") of the equipment can present the greatest risks. After the energization, the whole machine was considered as "live".

I initiated intense consultations with all involved parties to ensure the safety after the energization. This included the split up of the machines in functional areas to work on. To further mitigate the risk of exposure, I also reduced the amount of people working on the non- commissioning tasks to an absolute minimum. I set up daily briefings with my established team for the commissioning coordination, in peak times twice a day. I also sought guidance and took advises from the end-user's operation and the maintenance division.

I acknowledge that some of the decisions I had to make during the commissioning of the machines compromised the overall commissioning schedule in the short term. For example, I delayed the first energization of the machines until all checks and documentation was received to provide confidence the work could continue in a safe manner.

I also suspended the commissioning work for some days and de-energized the machine to provide full access to the painting company to finish their work. In the first instance, this did not satisfy all stakeholders, being the painting supervision. However, with my daily listings and reports of the commissioning activities, I was able to prove, that with these decisions I could ensure the safety of personnel working on the machines and at the same time made the most efficient use of the working areas.

During the commissioning work I identified several points from the design, installation and supply, which were required to be re-addressed. Several of these issues had a direct impact to the working conditions of operators and the environment. These included visibility of the working areas during night, ease of set-up and operation of the machines and noise level. One important issue with a direct social and environmental impact was the enhancement of the dust suppression system efficiency in regards to the prevailing wind.

In collaboration with the involved parties we discussed the consequences of possible changes including design, finance, schedule, safety and impact to all fields such as operation, maintenance and environment. As a result, I organised and coordinated the changes which were agreed with the client.
With these actions and activities I managed to optimise the performance of the machines. The proof however is the acceptance from operators, owners, clients and the community with the handover of the machines to the port authority.

Claim 5. Engage with the relevant community and stakeholders

In 2000 and 2001 I was working at a German Machine Manufacturer and was responsible for the electrical, instrumentation and control discipline for the engineering, design, software development, installation and commissioning of fertiliser handling equipment in a port in Eastern Europe. This included equipment in a storage hall and on the export wharf.

During the engineering and design phase in Germany I worked closely with the internal business stakeholders. This included the responsible engineers from the mechanical department, the project management and procurement department. From conceptual engineering and design of electrical and control equipment for the machines I am able to ensure my client requirements and their stakeholder requirements are sustainably met. This included the selection of equipment required to operate in environmental conditions down to minus 40 degrees Celsius for material with highly corrosive properties.

After the first engineering reviews, investigations of local conditions and consultations with the client we identified the stakeholder's specific interests. They included having a very robust design, over a long life, low maintenance costing equipment and possibilities for an easy repair of electrical and electronic components. To comply with these requirements I checked the availability of spare parts and service centres in the region. I ensured the reliability and maintainability of the equipment and installation and the ability of sub-suppliers to produce the deliverables in native language.

With the support of a native speaker we produced all in house engineering documents and deliverables in dual language to allow the local companies and suppliers to work with these documents without a permanent need for interpretation.

After the pre-assembly of the equipment in the port area, we commenced commissioning work. I guided a team of German Supervisors and a local commissioning engineer along with local resources. On site, I faced several difficulties such as the language barrier, relaxed working mentality of local workforce, poor safety and sometimes careless handling of delivered equipment and tools.

To deal with these challenges, I intensively refreshed my language knowledge and communicated as often as possible with site personnel in the native language. Over time I built up a healthy working, transparent and honest relation with the operators, stakeholders, management and technical staff at all levels. With this engagement I could convey information efficiently. It allowed me to differentiate between the staff, approach the right people to negotiate requests and therefore enhance my understanding of stakeholder's interests and the appropriate engineering solutions. Both parties appreciated the direct communications which lead to a flat project hierarchy.

As a short term measure, I had to ensure that the delivered equipment, installation and commissioning activities met the overall schedule objectives. This meant I had to consider requests not only from the client, but also from other members of the community such as port authorities and the government.

A very important key milestone for the stakeholders was the official opening of the new bulk terminal with the handover of the machines. The client consulted me, explained the importance of the event and we discussed, agreed and successfully realised the "red carpet reception" to the satisfaction of all stakeholders and the community.

During pre-commissioning I initiated the engagement and the training of local maintenance and operation staff. By undertaking these activities, I was able to transfer engineering expertise to the client allowing them to gain the required operation and maintenance knowledge of the machines at an early stage. I took time to explain the general functionality of the electrical, instrumentation and control as well as specifics. One such

item was the operation procedure and the correct handling of the dust-suppression system to minimise down time of the equipment and the impact for the environment.

The hands-on training provided the local staff with the necessary competence to operate in a qualified, safe and efficient manner.

Claim 6. Identify, assess and manage risks

Since November 2011 I have been working as a Senior Electrical Engineer at a multinational engineering firm in Australia for a large iron ore port project in West Africa. My duties include the handling of the Electrical, Instrumentation and Control equipment for contract vendor packages, the engineering of electrical equipment and the coordination with other areas and disciplines.

As the responsible Senior Electrical Engineer for several areas for this port project, I play an active role in identifying, evaluating and mitigation of risks as well as evaluating residual risks.

This includes the preparation of and participation in several risk management reviews, facilitated by experts from different disciplines. I identify and evaluate relevant risks and provide this input into the risk assessment spread sheets in preparation for the relevant meetings. I actively participate in the risk assessment meetings and handle the relevant follow up actions. I am involved with risk assessments such as:

·Business risks for the company on site:
I identified security issues, for instance the risk of material such as copper being stolen or already installed equipment pilfered;

·Procurement risks for the third party vendor packages:
I estimated and evaluated the impact of changing of project requirements regarding preferred electrical and control equipment during tender and after the contract is signed; I identified and evaluated the risk of not having the electrical equipment properly installed and tested due to schedule restraints and delays which are beyond our control;

·Social and environmental risks for the Marine Facility:
I pointed out the risks and possible consequences of installation of electrical and control equipment in flood risk areas including possible mitigation; I evaluated the risks and consequences caused by lightning strikes, as the port is situated in an area with the highest lightning strike density in the world; and

·Technical and Safety studies for the vendor packages, such as HAZID (Hazard identification in Design), HAZOP (Hazards in Operation). This is still an ongoing process as the vendor packages have to be executed.

For these studies and assessments I make myself familiar with the companies proven risk assessment and project procedures and adapt these to the specific project requirements. This includes the use of documents and templates to identify and evaluate risks and hazards, such as the risk assessment spread sheet. I follow the established guidelines and procedures as these provide a systematic way through all elements of potential risks and their evaluation. I use the risk specific structures and keywords which are adapted to the project with its specifics, cost and duration. This includes:

·the likelihood definition and description (from very rare to almost certain, probability, frequency, structure life);

·the project adapted consequence types (severity level from insignificant to catastrophic, impact to health and safety, environment, equipment, profit, social and cultural heritage, legal, schedule, reputation, availability);

·the risk table, linking likelihood and consequences and defining the risk level;

·the risk actions, depending upon the identified risk level;

·keyword checklist for risk areas such as overspeed, overload, fail to stop, collision, electrical safety, balance, start-up, communication, direction error, balance, operator controls.

I use my knowledge of different types of machines from previous projects such as material handling equipment in Queensland and in Europe to influence the likelihood and consequences in order to mitigate risks. My background and knowledge of standards and equipment both in Germany as well as in Australia allows me to influence and conduct the technical risk management for the equivalent machines, such as the safety related parts of the electrical and control systems.

For the actual project, I brought forward the specific topic of functional safety of machinery.

I investigated the differences between the standard AS 4024 with the two common options of machine safety standards in Europe, IEC 620161 and ISO 13849. I used several sources such as the standards itself, reference projects, technical articles and reports to work out advantages and disadvantages of both ways in achieving the machine safety. I summarised these points and communicated them to the project management as a knowledge base for a final decision by the client.

Claim 7. Meet legal and regulatory requirements

Since November 2011 I have been working as a Senior Electrical Engineer at a large multinational engineering firm in Australia for a large iron ore port project in West Africa. For this large scale project, the company is contracted by the owner and parent company will award contracts to vendors and sub-contractors.

Due to its location, history and present government regulations, the project in West Africa is based upon European standards. As the owner already operates very similar equipment in Australia, most of the existing technical requirements of these Australian Iron ore port facilities must be applied by my company. For this purpose, the existing standard specifications which are based upon Australian Standards had to be reviewed and the content and all referenced Australian Standards had to be replaced with the appropriate European Standards references.

I identified the Australian Standards and content in current documents and replaced the Australian Standard references with the relevant European Standard equivalent. I revised the document content and ensured the compliance with the requirements as per the European Standards. Some of the current documents I reviewed and edited were the Standard Specification for Instrumentation and Control Equipment for Mechanical Packages, for Safety PLC Systems, for Lighting, for Electrical Substations, for Mechanical Drive Assemblies and for Installation and Commissioning of Mechanical Equipment.

I developed, reviewed and revised contract documents for vendor packages, area specific technical documents, design criteria, technical studies and data sheet templates. I checked and ensured the document content especially for the following issues:

I gave reference to applicable legal and regulatory requirements and relevant standards;

I referenced only relevant technical documents and avoided referencing of documents which do not apply;

I ensured that the order of precedence of referenced documents such as specifications, drawings and data sheets is consistent. As this especially applied to contractual documents, I contacted the companies project controls and the responsible contract engineer and asked for compliance with the companies guidelines, the owners interest and legal and regulatory requirements;

I clearly defined the scope of work, work excluded, work included and battery limits;

I structured the document sets and avoid discrepancies within the document and between referenced documents; and

I used the clients approved terms in the correct context and ensure that the same technical terms are used throughout the documents.

One example of a technical specification I reviewed was the Standard Specification for Lighting for the whole project. This document requires approval and permits from the government, as the lighting for the Wharf and Jetty in the Port area may affect the environment, specifically the turtle population. I sought advice from marine and fauna experts to ensure that the lighting specification complies with the applicable regulatory requirements. I also checked the content of existing documents such as studies and White Papers concerning the turtle protection and included these in the standard specification requirements. The actions included the use of specific wavelengths for the lights, the orientation and avoidance of light pollution and reflection.

Claim 8. Communication

From 2004 until 2011 I was employed by a subsidiary German engineering company who is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer. During that time I worked under the Electrical Functional Lead Engineer as the responsible Electrical Engineer for the Project Engineering Team.

I fulfilled a wide range of duties such as managing the engineering team of 10 engineers, supporting the business development and acquisition for domestic and overseas projects and managed the dedicated engineering part of the actual projects.

As a team leader I extensively collaborated with staff members to achieve efficient and well-coordinated project work. This included the build-up of relationships with team members, listening to and solving of work and non-work related issues. I always respect confidentiality and privacy of information, independent of the source of information. Within the parent German equipment manufacturing company I built and used my network to communicate efficiently with all disciplines such as project management, project control, engineering mechanical and hydraulic, procurement, manufacturing, quality control, human resources and finance.

For my work in business development it was essential to use the whole range of communication skills for all kind of audience. To prepare a qualified technical and commercial proposal I read contractual and technical specifications, sometimes several hundreds of pages, mostly in English. I prepared studies, technical and commercial bid documents and presentations. To potential clients I have presented the technical offer and supported it in bid clarification meetings, using several presentation tools.

During the project execution I have collaborated and communicated in written and oral form with all groups of interest stakeholders such as, management, directors, CEO, staff, team members, multiple disciplines, clients, companies and suppliers. I have developed project documents, such as functional descriptions, operation manuals and training documents. I have followed this up by providing training sessions for operators and maintenance personnel.

Despite the different level and characters of an audiences and communication partners, their tones and the means of communications and negotiations, I always show the proper respect and pay attention. I value open and efficient discussions, as these are often the source of innovative ideas. I include the feedback from others into my work, if this improves the project or deliverables.

I am always prepared for meetings, informed about topic, agenda and participants. When organising a meeting, I always provide an agenda, chair and guide through the meeting, address the points adequately, keep and distribute minutes in timely manner.

Although German is my native language, I mostly communicated in the English language as this is the common business language in this field of industry. I worked for several projects in South America, which included several months of engineering and design in the client's office as well as installation, commissioning and training on site. I learned the Spanish language from the beginning and continued the courses in the country, finally being able to actively attend meetings, do presentations and carry out training sessions in the Spanish language.

I respect the national culture and language of the countries in which I work and live. I try to find a level of understanding and way to build relationships and communicate with the help of the national languages.
I am always keen to improve and train my communication skills by asking for feedback from the audience.

I extensively and proficiently use computer based tools and software to develop, modify or publish documents and drawings, such as Word, Excel, Power Point, Visio, Project, Primavera.

Claim 9. Performance

From July 2010 until October 2011 I was working as a Commissioning Manager at a German equipment manufacturer. I was responsible for the no load commissioning, load commissioning and performance tests of bulk materials handling machines at a Coal Terminal in Queensland.

I faced several challenges during this commissioning period. Due to delays in the overall schedule, the financial forecast for this project was not positive and the remaining budget very tight. In addition, the extended schedule affected all sub-suppliers and contractors, putting additional pressure to the budget situation. The coal which is required for the load and performance tests could not be delivered in sufficient quantities and at appropriate times. Technical problems and remaining work had to be addressed. The contractual requirements to prove the performance was very specific and was not subject to changes during the project execution stage.

As some of these conditions were beyond my control, I identified the schedule as a key element to mitigate their impact. I consulted the project management and developed a guideline, schedule and specific detailed test sheet templates for the commissioning period and the performance tests. I discussed with the client's representative and the superintendent for the commissioning in developing and agreeing to the detailed commissioning schedule and conditions for the performance tests. In the performance test sheets we considered schedule issues like operator shift plans, shipping and train schedules including risks and alternatives. We agreed upon several measures and opportunities to bring the overall schedule forward in all stakeholders' interest. Some of these measures included increased working hours and flexible shifts for the commissioning team depending upon available material inloading or outloading capacities. We also allowed schedule gaps to provide opportunity to complete outstanding or adjustment work and maintenance tasks.

The load commissioning and performance tests had to be properly documented, I ensured that the developed test sheets included all the details necessary to prove the compliance with the contractual agreed parameters to pass the tests. I used clear instructions, dedicated fields to fill and therefore to allow operators to use these sheets also without supervision. The required performance tests included several operating modes for several scenarios in different working areas. With the breakdown of the performance test in recordable sections I made sure that the test process is flexible enough to react to changing scenarios while still progressing with the required commissioning and testing.

I initiated the installation of a "blackbox" on the machines to monitor the performance of the machine. I set this blackbox up to record and save all relevant data such as movements of the machines, speeds, material flow detection, positions, faults, alarms and most importantly the coal flow rate. The readout, maintenance and evaluation of the data I put in the hands of a graduate engineer, which we gave the opportunity to gain practical engineering experience on site. With the collected data I could not only prove the performance as agreed with the client, but also observe the operators actions, investigate repeating alarm messages and especially their causes. I used this data to compare with the Port's fault history list and together with the port staff we worked out the ways to reduce the faults on the machines as well as from the upstream and downstream equipment.

I proved that the blackbox added great value to the improvement of the overall performance of the machines and served several aspects at a time in the interest of all involved parties. It was also used in illustrating that many of the problems and alarms were initiated as a result of off board disturbances.

With the help of the detailed test documents, the blackbox, an agreed commissioning schedule and other tools I was able to manage, track and record the commissioning and performance test process and their results. The documents and collected data allowed the company to progress with an effective and professional claim management. I also prepared the base for the successful handling of variations.

Claim 10. Taking action

From 2004 until 2011 I was employed by a medium sized German engineering company which is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer, including all Electrical, Instrumentation and Control scope of work.

During that period I worked under the Electrical Functional Lead as the responsible Electrical Engineer for the Project Engineering Team. In this role I was responsible for the management and execution of several projects, starting from acquisition until close out.

I supported the parent German equipment manufacturer business development team with proposals for the North and South American Market. I evaluated the tender documents and relevant specifications, collaborated with other disciplines to define the EIC (Electrical, Instrumentation and Control) scope and prepared the technical and commercial proposals. I participated in presentations to the clients and supported the bids in clarification meetings. I contributed to a number of successful proposals. I handed over the successful proposals in kick-off-meetings to the Project execution team.

For several of the successful projects I was assigned as a Lead Engineer for the project dedicated EIC-team. This work included all aspects and responsibilities of a Lead Engineer function such as technical coordination and guidance, planning and managing of resources, budget, development of the project schedules and definition of the requirements regarding activities and deliverables. I coordinated and managed the execution of the projects including engineering, design, manufacturing, software development, documentation and commissioning.

I used several tools to ensure the compliance with the allocated budgets and resources. This included the use of ERP (Enterprise Resource Planning) Software with modules such as Material Management and Controlling. Other standard tools I have used include Microsoft Project and Excel in combination with the company's templates and forms for project management, time-sheets, logistics and deliverables. I have ensured to comply with these management tools and with the companies procedures. This was required to ensure the company maintained ISO 9001 certification for relevant areas such as project management, planning and expediting, engineering, design and quality management and assurance.

I have worked closely with the procurement department to include their material management reports and feedback to allow monitoring and management of the budget.

In addition to the budget I also maintain records of project changes, variations, changes of scope, schedule or technical requirements. I include the actual information into project documents, updated the schedule and revised activities, priorities and resources.

I have developed project reports on progress, technical issues, budget, deliverables, man-hours and forecasts which were used for the company's project management meetings.

As the EIC-team works with many different projects, the scheduling of resources in regards to the projects was crucial. I coordinated the schedules and resources together with the Electrical Functional Lead and the Team Leaders for design and software. We collaborated to set priorities for the engineering and design work and consequently assigned resources to these tasks. As a result, the Engineers and Designers worked in multiple projects and I ensured the continuous efficiency with permanently reviewing their tasks and duties.

Claim 11. Judgement

From 2004 until 2011 I was employed by a medium sized German engineering company which is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer, including all Electrical, Instrumentation and Control scope of work.
From 2008 until October 2011 I was working as the Lead EIC (electrical, instrumentation and control) Engineer for a Coal Terminal in Queensland, Australia.

This project included the engineering, design, manufacturing, construction and commissioning of bulk materials handling equipment. For this project, the German manufacturing company worked together with Australian Partners for the EIC and Construction. I executed the EIC engineering in both Germany and Australia. The design and software development was executed by an Australian electro-technology company, the partner of the German manufacturing company for the EIC-part in Australia as they had specific knowledge of Australian Standards.

My duties included the multi-discipline coordination for the EIC part and managing and supervising the engineering, design, manufacture and software work in Australia, which was carried out by the Australian electro-technology company.

I started the engineering work in Germany and after the first process in the engineering was made I eventually moved to Australia to work in the Australian electro-technology company's engineering and design office.

This company did not have extensive experience with this specific type of machines. To ensure that the company were able to achieve the desired outcomes I provided a leadership role in technical support and guidance. I supervised and influenced the company's work for all technical aspects of the EIC engineering, design and software. This included the engineering calculations, the electrical and instrumentation equipment, Switchroom and Operators Cabin design. As a base for the PLC (Programmable Logic Controller) - Software I developed and provided the functional description which the company used to write detailed functional specifications and developed the control software. I coordinated all interfaces between the Australian electro-technology company, the German manufacturing company's mechanical department, suppliers and the client.

As far as my engineering knowledge allowed me to, I managed all clarifications from and to the Australian electro-technology company including decisions regarding the technical and schedule aspects. With my decisions I ensured that our sub supplier stayed within the boundaries of the existing agreements, contracts and specifications. I took responsibility for my judgement with issuing the relevant documents and approved change orders and variations. I sought approval from the project management for queries which had substantial impact on the budget and / or overall schedule.

I ensured to maintain transparency by keeping records of my actions and decisions. This was important as due to the contractual situation and the gaps and discrepancies in the scope of work and specifications, conflicts of interest between the German manufacturing company and Australian electro-technology company occurred. I used tools such as RFI's (Request for Information), RFI-register and variation-sheets to monitor, manage and solve situations with discrepancies and lack of information. To monitor the work progress I required weekly work reports and held schedule meetings, mostly combined with short engineering meetings which I held on a regular base.

The close working relationship with the Australian company's engineers and designers allowed many clarification discussions, resolution of problems in a timely and efficient manner.

As several situations were not possible to resolve within the distance between the German mechanical engineering location and the Australian company offices, I advised the project management from both companies to interrupt the design work in the Australian company office and organised a couple of days of interface meetings in the company's German head-quarter. The Australian electro-technology company lead engineers and designers travelled to Germany and we had intensive and efficient multidiscipline discussions, including mechanical – electrical interfaces, specific functionalities and mechanical calculations of the machines. With the gained knowledge out of Germany, the Australian company continued their work more efficiently and I was able to keep the schedule for the equipment, deliverables and documents.

Claim 12. Advanced Engineering Knowledge (PE) Knowledge of Standardised Practices (EA) Knowledge of Technology (ET)

From 2004 until 2011 I was employed by a medium sized German engineering company which is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer, including all Electrical, Instrumentation and Control scope of work.
From 2005 until 2007 I was working as the Lead Electrical, Instrumentation and Control Engineer for a Project in South America. The Project was a green-field Copper Mine. The German manufacturing company scope included the heap leach pad areas with all bulk materials handling equipment and machines.

To demonstrate the abilities and performance of some new developed equipment to the client, a fully functional test version was manufactured and put into operation in Germany. I was the designer and developer of the PLC (Programmable Logic Controller) software for this equipment.

I closely collaborated with the mechanical engineer to ensure the required functionality.

The client also requested a full simulation of the control and communication functionality of the leach pad area equipment. For this purpose, I initiated and managed the development of a simulation environment for the control and communication system. The simulation emulated the complete materials handling system environment and was running on a simulation software platform. It was connected to the office-set-up of the control and communication system for the leach pad area.

The electrical engineering and design was performed mainly in South America. I worked with an international team of engineers, designers and equipment suppliers. I initiated several studies and calculations to find the optimum solution for the power supply, distribution and location of the substations and transformers. The calculations included fault level, short circuit and voltage drop calculations. Based on information from the process engineer I investigated several scenarios for the usage, starting up, breakdown and redundancy of the heap leach area electrical equipment.

Claim 13. Local knowledge

From 2004 until 2011 I was employed by a medium sized German engineering company which is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer, including all Electrical, Instrumentation and Control scope of work.
In 2008 I started working in Australia as the Lead EIC (Electrical, Instrumentation and Control) Engineer on a Coal Terminal project in Queensland. This project included the engineering, design, manufacturing, construction and commissioning of new bulk materials handling equipment for the Coal Terminal.

As the responsible engineer I ensured that the EIC equipment of the machines was engineered, designed and manufactured according to Australian Standards, client's technical and contractual specifications and for the tropical marine environmental conditions. As this was my first project in and for the Australian market I made myself familiar with all relevant documents, starting from the comprehensive contract, the scope of work and the referenced technical documents such as the client's standard specifications and drawings. I studied the relevant Australian standards and also gained engineering knowledge from consulting local experts, training sessions, meetings and design reviews with several parties. This included engineering areas such as protection studies, electrical engineering and design and safety requirements.

I acquired the required knowledge of specific Australian standards such as AS3000 Wiring Rules and AS4024 Safety of Machinery. Especially for the application of the AS3000 I relied on engineers with detailed knowledge and experience as I was exposed the first time to this standard and there is no equivalent in Europe Standard. Practising my work in Australia, communicating with the engineering companies staff and discussing details with local engineers provided me with effective and quick learning results.

In the detailed engineering and design stage I was confronted with the Australian Standard requirements from AS4024.1-2006 especially the part 1501 Design of safety related parts of control systems. I ensured that the electrical, instrumentation and control of the machines complied with the applicable safety category, which was selected as a result of the risk assessment hazard analysis process. This included the selection of suitable equipment, like emergency stop switches, safety limit switches, redundant encoders, inclinometers, the designing of the control system network for this category and the implementation and validation of the relevant functionality in the safety PLC (Programmable logic controller).

After the project was awarded, I used the opportunity for a site visit to make myself familiar with the local environmental conditions. During the design stage I ensured that the equipment will be suitable for the torrential rains, cyclones and marine environment. The measures included the selection of suitable material for instrumentation, installation material and motors as well as electrical enclosures.

I applied engineering knowledge contributed by the electrical engineering company in Australia, which were responsible for the design, manufacturing and installation of the electrical, instrumentation and control equipment. I collaborated with the company's engineers and designers to gain local engineering knowledge in a very productive way. I worked together with other local suppliers and manufacturers to ensure that their equipment is fit for purpose.

Claim 14. Problem analysis

From July 2010 until October 2011 I was working as a Commissioning Manager for a German equipment manufacturer. I was responsible for the no load commissioning, load commissioning and performance tests of bulk materials handling equipment for a Coal Terminal in Queensland.

My duties included the development of the collision detection and avoidance strategy, specification, and overseeing the design and implementation into the machine control system.

As part of the commissioning process we set the physical limits on the machine to ensure collisions are prevented. During the course of commissioning I identified four main collision related problem groups.

The first steps of commissioning for machine movements showed that not all required clearances are achieved within the defined range. Installations, such as lamps, cable trays and walkways created collision points. In coordination with the designers and construction companies we eliminated these collision points via modification.

The functional tests of the machine movement groups revealed the designed locations of limit switches and their activating strikers either restricted the movement range or did not initiate the stop of the movement early enough to avoid collisions. We relocated and adjusted the limit switches and set-up all control parameters accordingly. This applied for encoder values, frequency converter parameters such as ramp down times and software limits. The following tests were carried out under the most severe test scenarios such as power failure or emergency stop activation. All changes and set-up values were recorded in protocols, on drawings and in the machine book.

The integrated functional tests revealed collision scenarios due to installations of the machine on the conveyor bund. This included changing slopes along the bund and changing slopes of the stockpile area and bed. I carried out investigations and tests, covering all possible areas and scenarios to find the potential collision points and limitations. Together with the commissioning team and in coordination with the client we eliminated these and set-up limitations and restricted areas for those which could not be eliminated. We ensured the settings contained thorough checks to guarantee the correct set-ups and limitations of the machine movements.

The collision detection and avoidance of machines sharing the same conveyor bund was not clearly identified early in the design stage HAZOP. The machines are working with over lapping working ranges. The collision detection and avoidance system has to guarantee minimum distances between these machines under all circumstances.

I evaluated the existing documents, such as specifications, risk analysis, operation strategies and port handling philosophies. I ensured that the installed equipment matches the general needs described in there and analysed the gaps in the definitions and requirements. I requested the client to define data such as operation scenarios and restrictions, priorities of operation and separation distances. I researched and investigated collision avoidance systems from other operational terminals and material handling systems and adapted the solutions and methods for the coal terminal. Based upon this knowledge and understanding I established a detailed basis of design for the anti-collision system between the machines. This description included a summary of the selected safety category, description of proposed hardware, software, instrumentation and HMI (human machine interface), collision separation definition, approaching zone actions, position information reliability and failure and bypass scenarios. The client agreed to the proposed basis of design and we developed, implemented, tested and validated the collision detection and avoidance system.

Claim 15. Creativity and Innovation / Advanced Operation / Predictable Operation

From 2004 until 2011 I was employed by a medium sized German engineering company which is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer, including all Electrical, Instrumentation and Control scope of work.
From 2005 until 2007 I was working as the Lead Electrical, Instrumentation and Control Engineer for a Project in South America. The project was a green-field Copper Mine. The parent German equipment manufacturer's scope included the heap leach pad areas with all bulk materials handling equipment. The innovative Mobile Conveying Technology from the company for the leach pad areas was newly developed.

The Mobile Conveying system consisted of crawlers, supporting and moving a long conveyor along the leach pad area for the stacking or reclaiming of the Copper oxide or sulphide.

I applied my theoretical and practical knowledge of automation systems, sensor techniques, controls, drives, hydraulic, mechanics and communication systems to develop suitable solutions to control this new and complex mechanical system. In collaboration with the mechanical experts we developed the functional and performance requirements as well as opportunities to achieve these. With these definitions I selected the instrumentation for detecting positions, tension, inclination and pressure. I also developed the control and communication structure, including local PLC's (programmable logic controller) for each crawler, communicating via Fieldbus with one main PLC in the electrical Switchroom, which is installed on the machine.

I engineered and designed the electrical, instrumentation and control system for the mobile conveyors, suitable for the harsh environment in the location of operation. With the proper selection of the instruments I ensured that the necessary accuracy of detection is achieved and at the same time the system remains as robust as possible.

I considered the mechanical limits and the system acceleration with the selection of appropriate drive parameters

I designed the PLC software to failsafe, for the control of the mobile conveyor system and as robust as possible with using a strictly structured programming. This structured programming included Input – and Output links, comments throughout the networks, protected function blocks and the use of common data blocks for parameters.

I developed the concept for the relocation of the mobile conveyors with a semiautomatically pivot around a 180° curve operation. The required accuracy of the curve operation was dictated by the location of the concrete bridges over the overland conveyors which were customized for the mobile conveyor crawlers. The mobile conveyors are equipped with several GPS (Global Positioning System) -rovers and I used the local GPS-coordinates of the leach pads to permanently calculate the position targets and corrective actions. I integrated the curve operation into the PLC-software and carried out simulations off-site. On site I tested, monitored and optimized this curve operation under the difficult condition. The system once commissioning commenced was operational and therefore the given time for the curve commissioning was very limited.

Overall, I ensured the long time performance of the innovative mobile conveyor system, a low level of maintenance and a resulting high level of acceptance from the stakeholders including operators and maintenance personnel.

Claim 16. Evaluation

From 2004 until 2011 I was employed by a medium sized German engineering company which is responsible for all Electrical, Instrumentation and Control scope of work for a German equipment manufacturer, including all Electrical, Instrumentation and Control scope of work.
From 2005 until 2007 I was working as the Lead Electrical, Instrumentation and Control Engineer for a project in South America. The project was a green-field Copper Mine. The parent German manufacturing company's scope included the heap leach pad areas with all bulk materials handling equipment. The innovative Mobile Conveying Technology from the company for the leach pad areas was newly developed.

As the mobile conveyors for this project were the first of its kind, several deficiencies in electrical, instrumentation, control and communication resulted. Especially during commissioning I identified several deficiencies, which I evaluated and eliminated.
I evaluated the situations and proposed technical solutions with the consideration and impact onto schedule, budget and long term performance. With the on-site construction team I realised the changes, tested and validated these.

I recorded all these points for further projects and included the changes in the red-line drawings and documents.

During commissioning the clients' control system maintenance team became more and more involved and despite the provided training and against our recommendations, they accessed and modified the software code. I understood that this situation could lead to hazardous situations for personnel and equipment and notified the supervisor in written form. With this action I finally achieved, that a strict site-regulation was put in place regarding software-code-changes.
I also restricted the access to functions in the software, which included safety related parts or calculations.

To improve the leach pad system further, I assessed the recorded alarm history and fault statistics on a regular base, at peak times every morning during the commissioning team briefing. Using this history as a basis of sound evidence, I was able to efficiently set commissioning and fault finding priorities for the team.

I evaluated the project and incorporated my experience into the electrical, instrumentation and control engineering and design of future projects. This included measures to improve the safety and reliability of the equipment of the mobile conveyors.

The product "mobile conveyor" was included in several other projects after the project in South America was finished. I ensured the continued performance enhancement of the new projects by incorporating the evaluation and experience of the previous projects. I also further researched and applied new technologies in consideration of the local conditions such as environment, material to transport and standards and regulations.

Prepared by Fiona Tregoning

Engineering House
11 National Circuit Barton ACT 2600
Phone: (02) 6270 6571
Fax: (02) 6273 2354
Email: ftregoning@engineersaustralia.org.au
Web: www.engineersaustralia.org.au/echartered

ENGINEERS
AUSTRALIA