STAGE 1 COMPETENCY STANDARD FOR ENGINEERING ASSOCIATE

ROLE DESCRIPTION – THE MATURE ENGINEERING ASSOCIATE

The following characterises the senior practice role that the mature, Engineering Associate may be expected to fulfil and has been developed from the role portrayed in the *Engineers Australia - Chartered Status Handbook*. This is the expectation of the development of the engineer who on graduation satisfied the Stage 1 Competency Standard for Engineering Associate.

Engineering Associates have a wide range of functions within engineering enterprises and engineering teams. Examples of their roles may include feasibility investigation, scoping, establishing criteria/performance measures, assessing and reporting technical and procedural options; design and development; component, resources and materials sourcing and procurement; construction, prototyping, manufacture, testing, installation, commissioning, service provision and de-commissioning; tools, plant, equipment and facilities acquisition, management, maintenance, calibration and upgrades; operations management; procedures documentation; presentation and reporting; maintenance systems design and management; project and facility management; quality assurance, costing and budget management; document control and quality assurance.

Engineering Associates are often required to be closely familiar with standards and codes of practice, and to become expert in their interpretation and application to a wide variety of situations. Many develop very extensive experience of practical installations, and may well be more knowledgeable than Professional Engineers or Engineering Technologists on detailed aspects of plant and equipment that can contribute very greatly to safety, cost or effectiveness in operation.

In other instances, Engineering Associates may develop high levels of expertise in aspects of design and development processes. These might include, for example, the use of advanced software to perform detailed design of structures, mechanical components and systems, manufacturing or process plant, electrical and electronic equipment, information and communications systems, and so on. Other examples might be in the construction of experimental or prototype equipment. Again, experienced operators in these areas often develop detailed practical knowledge and experience complementing the broader or more theoretical knowledge of others.

Engineering Associates need a good grounding in engineering science and the principles underlying their field of expertise, to ensure that their knowledge and skills are portable across different applications and situations within the broad field of practice. Equipment, vendor or context-specific training in a particular job are not sufficient to guarantee generic competency. Given a good knowledge base, however, Engineering Associates may build further on this through high levels of training in particular contexts and in relation to particular equipment. Aircraft maintenance is an excellent example.

The competencies of Engineering Associates equip them to certify the quality of engineering work and the condition of equipment and systems in defined circumstances, laid down in recognised standards and codes of practice.

Engineering Associates may lead or manage teams appropriate to these activities. Some may establish their own companies or may move into senior management roles in engineering and related enterprises, employing Professional Engineers, Engineering Technologists, and other specialists where appropriate. In Australia, the term ‘para-professional' is frequently used to describe the Engineering Associate occupation.

STAGE 1 COMPETENCIES

The three Stage 1 Competencies are covered by 16 mandatory Elements of Competency. The Competencies and Elements of Competency represent the profession's expression of the knowledge and skill base, engineering application abilities, and professional skills, values and attitudes that **must be demonstrated** at the point of entry to practice.

The suggested indicators of attainment in Tables 1, 2 and 3 provide insight to the breadth and depth of ability expected for each element of competency and thus guide the competency demonstration and assessment processes as well as curriculum design. The indicators should not be interpreted as discrete sub-elements of competency mandated for individual audit. Each element of competency must be tested in a holistic sense, and there may well be additional indicator statements that could complement those listed.

Definitions of terms used in the statements of the Competencies and Elements of Competency follow those used by the International Engineering Alliance in Section 4 *Common Range and Contextual Definitions* of *Graduate Attributes and Professional Competencies* Version 2 - 18 June 2009, available at http://www.washingtonaccord.org/IEA-Grad-Attr-Prof-Competencies-v2.pdf

STAGE 1 COMPETENCIES and ELEMENTS OF COMPETENCY

1. KNOWLEDGE AND SKILL BASE

1.1. **Descriptive, formula-based understanding** of the underpinning natural and physical sciences and the engineering fundamentals applicable to the practice area.

1.2. **Procedural-level understanding** of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the practice area.

1.3. **In-depth practical knowledge and skills** within specialist sub-disciplines of the practice area.

1.4. **Discernment** of engineering developments within the practice area.

1.5. **Knowledge** of engineering design practice and contextual factors impacting the practice area.

1.6. **Understanding** of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the area of practice.

2. ENGINEERING APPLICATION ABILITY

2.1. **Application** of established technical and practical methods to the solution of well-defined engineering problems.

2.2. **Application** of technical and practical techniques, tools and resources to *well-defined* engineering problems.

2.3. **Application** of systematic synthesis and design processes to *well-defined* engineering problems.

2.4. **Application** of systematic project management processes.

3. PROFESSIONAL AND PERSONAL ATTRIBUTES

3.1. **Ethical** conduct and professional accountability.

3.2. **Effective** oral and written communication in professional and lay domains.

3.3. **Creative**, innovative and pro-active demeanour.

3.4. **Professional** use and management of information.

3.5. **Orderly** management of self, and professional conduct.

3.6. **Effective** team membership and team leadership.

Table 1 Knowledge and Skill Base: Elements and Indicators

ELEMENT OF COMPETENCY	INDICATORS OF ATTAINMENT
1.1 Descriptive, formula-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the practice area.	**a) Applies** science and engineering fundamentals to investigate and address new problems, applications procedures, practices and requirements, extrapolating from a defined and established operating context.
1.2 Procedural-level understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the practice area.	**a) Rigorously and objectively applies** analysis, characterisation, measurement, interpretation, assessment, evaluation, visualisation, simulation, decision making, knowledge management and communication tools and techniques pertinent to specialist sub-disciplines of the practice area.
1.3 In-depth practical knowledge and skills within specialist sub-disciplines of the practice area.	**a) Proficiently executes** advanced tasks, processes, techniques, and procedures in a para-professional support role using plant and equipment, instrumentation, measurement and test facilities, materials, components and systems.
1.4 Discernment of engineering developments within the practice area.	**a) Maintains a broad understanding** of development trends and emerging issues disseminated within specialist sub-disciplines of the practice area.
1.5 Knowledge of engineering design practice and contextual factors impacting the practice area.	**a) Identifies and applies** engineering design principles of a standardised nature, relevant to the area of practice and specialist sub-disciplines. **b) Identifies and understands** the interactions between engineering practice and people in the social, cultural, environmental, commercial, legal and political contexts in which they operate, including both the positive role of engineering in sustainable development and the potentially adverse impacts of engineering activity in the practice area. **c) Appreciates** the issues associated with international engineering practice in the practice area. **d) Is aware of** the fundamentals of business and enterprise management. **e) Identifies** the structure, roles and capabilities of the engineering workforce.
1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the area of practice.	**a) Understands** the standards and codes of practice, as well as the legislative and statutory requirements which underpin practical and technical work in sub-discipline(s) specialisations of the practice area. **b) Appreciates** the principles of safety and risk management and the health and safety responsibilities of the engineering team operating within the practice area. **c) Appreciates** the broad principles and implications of sustainable engineering practice. **d) Understands** the role of engineering project management tools and procedures as a basis for planning, organising and managing resources.

Notes:

1. *'practice area' means the broad area of engineering such as aviation, mechanical, civil, telecommunications, etc.*
2. *'specialised sub-discipline' means the specific domain of technical practice within a practice area such as aviation maintenance, mechanical design, foundation design, communications equipment installation, etc.*

Table 2 Engineering Application Ability: Elements and Indicators

ELEMENT OF COMPETENCY	INDICATORS OF ATTAINMENT
2.1 Application of established technical and practical methods to the solution of well-defined engineering problems.	**a) Provides** practical input to the analysis of key issues, **applies** established diagnostic processes to investigate causes and effects, **applies** codified methods for characterisation and analysis as well as performance and behaviour evaluation, **fluently applies** standardised solution methodologies and formulates substantiated conclusions. **b) Uses** systematic and rigorous processes to reliably judge the appropriateness and/or practical validity of tasks, processes, practices, data, results and documented information that may be ambiguous, ill founded, illogical or subject to uncertainty. **c) Proficiently selects and combines** available components or elements to create a system, **documents** outcomes and **systematically verifies** performance against specifications and overall requirements of the system. **d) Accesses** appropriate knowledge resources as input to investigatory work and practical problem solving. **e) Thoroughly evaluates** alternative practical approaches to the solution of technical problems in the practice area. **f) Critically observes, assesses and systematically reports** in accordance with procedural requirements and codes of practice. **g) Reliably interprets, applies and verifies compliance** with standards and codes in the conduct of standardised engineering tasks relevant to specialist sub-disciplines in the practice area. **h) Contributes responsibly and appropriately** to the identification, quantification, mitigation and management of technical, health, environmental, safety and other contextual risks associated with practical engineering application in the practice area. **i) Appreciates** the need to ensure compliance with legislative and statutory requirements applicable to specialist sub-disciplines in the practice area.
2.2 Application of technical and practical techniques, tools and resources to well-defined engineering problems.	**a) Proficiently identifies, selects and applies** the materials, components, devices, systems, processes, resources, physical tools, plant and equipment relevant to the area of practice. **b) Proficiently applies** computer based engineering tools and resources specific to specialist sub-discipline(s) of the area of practice, and **recognises** the limitations and accuracy of such tools. **c) Proficiently and safely implements** laboratory test and measurement outcomes including experimental procedures, calibration and operation of equipment and facilities, interpretation of result data and the formulation of reliable conclusions. **d) Understands** the application, capabilities, working limitations and performance expectations of the physical tools, plant and equipment as well as instrumentation and test facilities that support the underlying trades and specialist work within the practice area. **e) Recognises** common sources of error and **eliminates or compensates** for them, and **quantifies** their significance to any conclusions drawn. **f) Appreciates** the need for systematic approaches to the acquisition, commissioning, operation, upgrade, monitoring, maintenance and management of engineering plant, facilities, equipment and systems. **g) Understands** the role of quality management systems, tools and processes within a culture of continuous improvement.

Table 2 (cont.) Engineering Application Ability: Elements and Indicators

ELEMENT OF COMPETENCY	INDICATORS OF ATTAINMENT
2.3 Application of systematic design processes to well-defined engineering problems.	**a) Proficiently applies** technical and practical knowledge and problem solving skills as well as established tools and standardised procedures to design components, system elements, plant, tools, facilities and/or resources to meet clearly specified user requirements. **b) Accommodates** contextual factors that impact the practice area, and in particular ensures that health, safety and sustainability imperatives are addressed as an integral part of the design process. **c) Engages** with technical and practical elements of a whole systems design cycle, including tasks such as: - interpreting and negotiating specified user requirements and acceptance criteria; - systematically addressing sustainability criteria; - ensuring that health, safety and technical risks are adequately addressed; - ensuring compliance with essential engineering standards and codes of practice; - consideration of alternative approaches and justifying an optimal approach; - developing and completing the design using standardised tools and processes; - implementing the design using standard presentation/development/prototyping/fabrication/construction techniques; - checking the design outcome and/or verifying performance against specified user requirements using standard audit processes, acceptance testing and/or evaluation procedures; - documenting and reporting the design outcome. **d) Is aware of** the accountabilities of the members of the engineering team in relation to the 'design authority' role.
2.4 Application of systematic project management processes.	**a) Engages** with basic project management tools and practices in the execution of *well-defined* technical project work. **b) Supports** a project development cycle through the application of standardised processes, methodologies, tools and resources within a complex, but clearly partitioned engineering environment. **c) Contributes** to well-defined and technical project activity as a member of the engineering team and/or through leadership of technical and trades personnel. **d) Identifies** the requirements and resources, and realistically assesses the scope, dimensions, scale of effort and indicative costs of well-defined practical and technical project activity. **e) Is aware** of the need to accommodate relevant contextual issues into practical and technical project work, including the fundamentals of costing and financial control. **f) Is aware** of the need to plan and quantify performance over the full life-cycle of an engineering project, managing practical and technical outcomes within the overall implementation context. **g) Is able** to implement sustainable practices to achieve sustainable outcomes in all facets of practical and technical project work.

Table 3 Professional and Personal Attributes: Elements and Indicators

ELEMENT OF COMPETENCY	INDICATORS OF ATTAINMENT
3.1 Ethical conduct and professional accountability.	**a) Demonstrates** commitment to uphold the Engineers Australia - Code of Ethics, and established norms of professional conduct pertinent to the practice area. **b) Understands** the need for 'due-diligence' in certification, compliance and risk management processes. **c) Understands** the accountabilities of the engineering team for the safety of other people and for protection of the environment. **d) Is aware** of the need to recognise and protect intellectual property rights.
3.2 Effective oral and written communication in professional and lay domains.	**a) Is proficient in** listening, speaking, reading and writing English, including: - comprehending critically and fairly the viewpoints of others; - expressing information effectively and succinctly, issuing instruction, engaging in discussion, presenting justification, and negotiating - to technical and non-technical audiences and using textual, diagrammatic, pictorial and graphical media best suited to the context; - representing a technical position to professional engineering colleagues or to the to the broader community; - appreciating the impact of body language, personal behaviour and other non-verbal communication processes, as well as the fundamentals of human social behaviour and their cross-cultural differences. **b) Prepares** high quality engineering documents such as sketches, charts, diagrams, plans, drawings, spreadsheets, databases, presentations, reports, technical instructions and manuals.
3.3 Creative, innovative and pro-active demeanour.	**a) Applies** creative approaches and procedures to the solution of well-defined problems, **appropriately challenges** existing engineering practices and **identifies** practical opportunities for improvement and innovation. **b) Seeks out** new developments and practical approaches and considers their application within specialist sub-discipline(s) of the practice area.
3.4 Professional use and management of information.	**a) Is proficient in** locating and utilising professionally published knowledge, information and data. **b) Critically assesses** the accuracy, reliability and authenticity of information. **c) Is aware** of common document tracking and control procedures.
3.5 Orderly management of self, and professional conduct.	**a) Demonstrates** commitment to critical self-review and performance evaluation against appropriate criteria as a primary means of tracking personal development needs and achievements. **b) Understands** the importance of being a member of an engineering community, learning from its knowledge and standards. **c) Demonstrates** commitment to life-long learning and development. **d) Manages** time and processes effectively, **prioritises** competing demands to achieve personal, career and organisational goals and objectives. **e) Presents** a professional image in all circumstances, including relations with clients, stakeholders, as well as with colleagues across wide ranging disciplines.
3.6 Effective team membership and team leadership.	**a) Understands** the fundamentals of team dynamics and leadership. **b) Functions** as an effective member of the engineering team, including those with multi-cultural dimensions, and as a leader of a technical and/or trades team within the area of practice. **c) Earns** the trust and confidence of colleagues through competent and timely completion of tasks. **d) Recognises** the value of alternative and diverse viewpoints, scholarly advice and the importance of networking with other para-professional and professional colleagues. **e) Confidently pursues and discerns** expert assistance and professional advice. **f) Takes initiative and fulfils** the leadership role whilst respecting the agreed roles of others.