ECSA

ENGINEERING COUNCIL OF SOUTH AFRICA

An Effective Regulator Assuring Engineering Excellence

Discipline-specific Training Guide for Registration as a Professional Engineer, Technologist, and Technician in Aeronautical Engineering

R-05-AER-PE/PT/PN

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DEFINITIONS

Aeronautical: The branch of engineering concerned with the design, production and maintenance of aircraft.

Aerospace: The branch of engineering that deals with the design, development, testing and production of aircraft and related systems of aeronautical engineering, and of spacecraft, missiles, rocket-propulsion systems and other equipment operating beyond the earth's atmosphere astronautical engineering.

Applicant: A person applying to ECSA for registration in any of the categories as per section 18 of the Engineering Professions Act, 46 of 2000.

Broadly defined engineering problems have several of the following characteristics**:**

- The scope of the practice area is linked to the technologies used and the changes due to the adoption of new technology into current practice.
- The practice area is located within a wider context; it requires teamwork and has interfaces with other parties and disciplines.
- Require the use of a variety of resources, including people, money, equipment, materials and technologies.
- Constrained by available technology, time, finance, infrastructure, resources, facilities, applicable laws, standards and codes.
- Require the resolution of occasional problems arising from interactions between wide-ranging or conflicting issues such as technical, engineering and other issues.
- Have significant risks and consequences in the practice area and related areas.

Candidate: A person registered with ECSA after completing relevant accredited engineering undergraduate or postgraduate programme or qualifications assessed to be equivalent by ECSA for the specific registration category.

Certification: Formal recognition awarded to an education or training programme through a quality assurance procedure specifying that it meets the criteria laid down for the type of programme.

Commitment and Undertaking: An agreement entered into between an employer and ECSA under which the employer commits to the training of Applicants to the standard required for registration in an identified Professional Category. A Commitment and Undertaking may be entered into for one or more of the Professional Categories.

Competency Assessment: A summative assessment of an Applicant's competence against the prescribed standard based on evidence from the Applicant's work and other assessments that include a Professional Review.

Competency Standard: Statement of competency required for a defined purpose.

Complex engineering work: This work is characterised by the following:

- The scope of activities may encompass entire complex engineering systems or complex subsystems.
- The context is complex, varying, multidisciplinary and unpredictable; it requires teamwork and may need to be identified.
- It requires diverse and significant resources, including people, money, equipment, materials and technologies.
- Significant interactions exist among wide-ranging or conflicting technical, engineering or other issues.
- It is constrained by time, finance, infrastructure, resources, facilities, standards and codes, and applicable laws.
- It has significant risks and consequences in a range of contexts.
- The solution is not readily apparent.
- The problem statement has many inter-related conditions and may require first-principle, empirical judgement to create a solution within a set of originally undefined requirements or conditions.

Engineering problem: A problematic situation that is amenable to analysis and solution using engineering sciences and methods.

Engineering sciences: These have roots in the mathematical and physical sciences and, where applicable, in other natural sciences; they extend knowledge and develop models and methods to lead to engineering applications and solve engineering problems.

Flight testing: A specialised branch of Aeronautical Engineering that develops the specialist equipment required for testing aircraft performance and associated systems. Instrumentation systems are specifically deployed in test aircraft, using proprietary sensors, transducers and data acquisitioning systems. It is a method to determine how well a flight vehicle performs in the air and it covers a spectrum of airborne data-gathering activities, including Research and Development and verification and validation to ensure that an air vehicle and all its systems are safe to operate and are fit for purpose.

Ground testing: A barrage of tests that aircraft must undergo on the ground before first flight. It is mandatory for new aircraft, aircraft undergoing maintenance and aircraft that have undergone significant structural or systems modifications to undergo testing on the ground before first flight. Ground testing may be performed on the aircraft's subsystems or components in dedicated test facilities (e.g., engine test cell or avionics test laboratory) prior to installation into the higher-level aircraft system.

Ill-posed problem: A problem for which the requirements are not fully defined or may be defined erroneously by the requesting party.

Integrated performance: An overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained. For example, a design requires analysis, synthesis, analysis of impacts, checking of regulatory conformance and judgement in decisions.

Level descriptor: A measure of performance demands at which outcomes must be demonstrated.

Management of engineering works or activities: The co-ordinated activities required to:

- direct and control everything that is constructed or results from construction or manufacturing operations
- operate engineering works safely and in the manner intended

- return the engineering works, the plant and the equipment to an acceptable condition by the renewal, replacement or mending of worn, damaged or decayed parts
- direct and control the engineering processes, systems, commissioning, operation and decommissioning of equipment
- maintain engineering works or equipment in a state in which it can perform its required function.

Mentor: A professionally registered person who guides the competency development of a Candidate in an appropriate category.

Over-determined problem: A problem for which the requirements are defined in excessive detail, making the required solution impossible to attain in all its aspects.

Outcome: A statement of the performance that a person must demonstrate to be judged competent at the professional level.

Practice area: A generally recognised or distinctive area of knowledge and expertise developed by an engineering practitioner by virtue of the path of education, training and experience followed.

Range statement: The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated.

Supervisor: A person who oversees and controls engineering work performed by a Candidate.

Well-defined engineering problems: Problems composed of inter-related conditions and requiring underpinning methods, procedures and techniques to create a solution within a set of originally well-defined circumstances.

ABBREVIATIONS

B.Eng	Bachelor of Engineering
B.Eng (Tech)	Bachelor of Engineering in Technology
BSc (Eng)	Bachelor of Science in Engineering
B.Tech (Eng)	Bachelor of Technology in Engineering
C&U	Commitment and Undertaking
CEA	Complex engineering activities
CoP	Code of Practice
CPD	Continuing Professional Development
DoR	Degree of Responsibility
DSTG	Discipline-specific Training Guide
ECSA	Engineering Council of South Africa
ELO	Exit-level outcome
IPD	Initial Professional Development
ND	National Diploma
PE	Professional Engineer
PGD	Postgraduate Diploma
PN	Professional Engineering Technician
PT	Professional Engineering Technologist
URS	User Requirement Specification
TER	Training and Experience Report
TES	Training and Experience Summary
VA	Voluntary Association

INTRODUCTION

All persons applying for registration as a Professional Engineer, Technologist and Technicians are expected to demonstrate the competencies specified in document **R-02-STA-PE/PT/PN** through work performed at the prescribed level of responsibility, irrespective of the Applicant's/Candidate's discipline.

The *Training and Mentoring Guide for Professional Categories* (document **R-04-T&M-GUIDE-PC**) provides key aspects of training, which are:

- duration of training and length of time working at level required for registration
- principles of planning, training and experience
- progression of training programme
- documenting training and experience
- demonstrating responsibility.

It is therefore important to standardise the framework for all engineering disciplines to ensure that all ECSA registration categories are aligned.

BACKGROUND

The illustration below defines the documents that comprise the Engineering Council of South Africa (ECSA) system for registration in professional categories. The illustration also locates the current document.

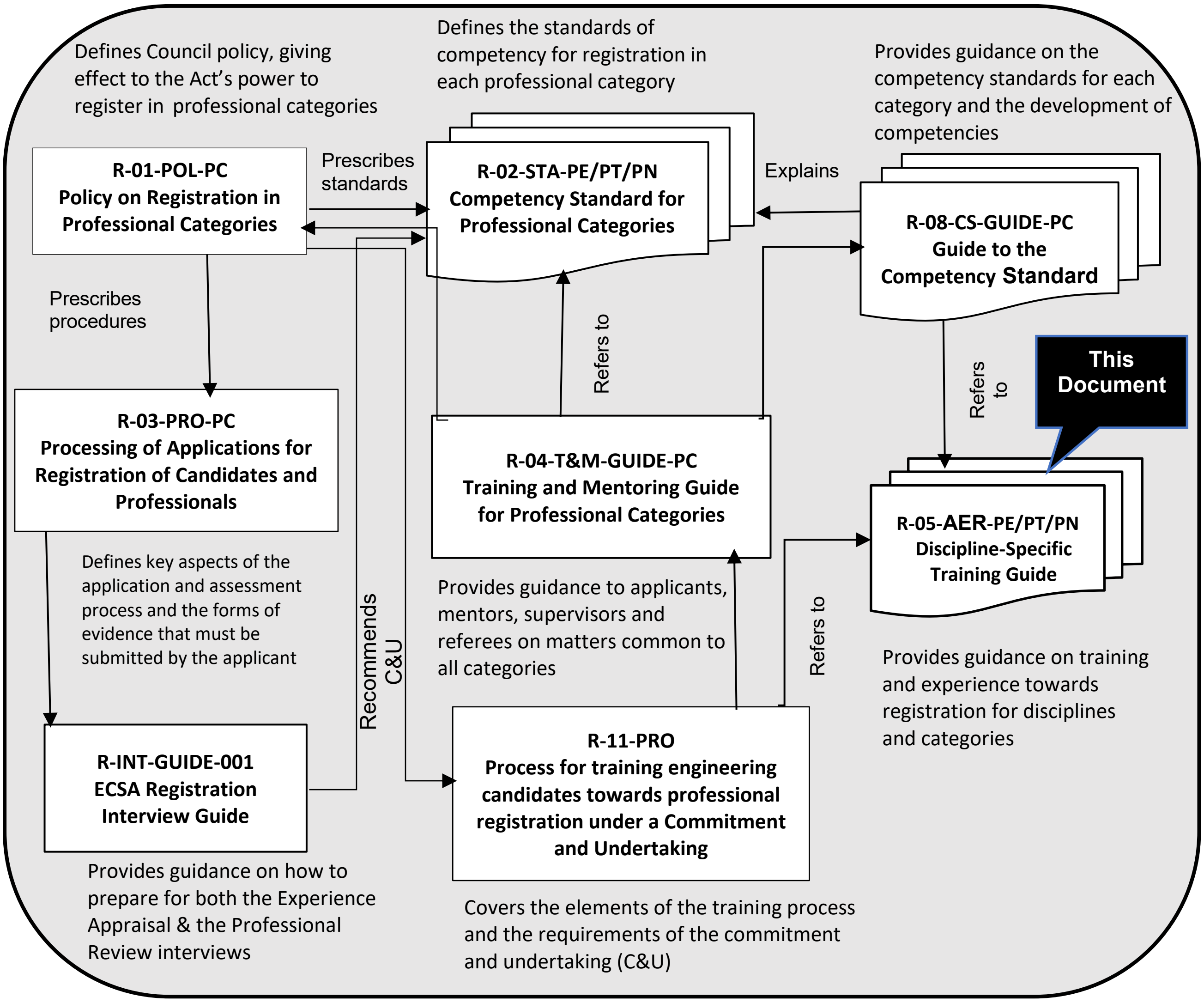

Figure 1: Documents defining the ECSA registration system

1. PURPOSE OF THE DOCUMENT

All persons applying for registration in a professional category are expected to demonstrate the competencies specified in document **R-02-STA-PE/PT/PN** through work performed at the prescribed level of responsibility, irrespective of the trainee's discipline.

This document supplements the generic *Training and Mentoring Guide for Professional Category* (**R-04-T&M-GUIDE-PC**) and the *Guide to the Competency Standards for Registration in Professional Category* (**R-08-CS-GUIDE-PE/PT/PN**).

This document must be read in conjunction with the following documents:

- **R-01-POL-PC** – Policy on Registration in Professional Categories
- **R-03-PRO-PC** – Processing of Applications for Registration of Applicants and Professionals
- **R-04-TM-GUIDE-PC** – Training and Mentoring Guide for Professional Categories
- **R-02-COP-AER** – Code of Practice for the Performance of Aeronautical Engineering Work.

This guide, **R-04-T&M-GUIDE-PC** and **R-08-CS-GUIDE-PE/PT/PN** are subordinate to the **R-01-POL-PC**: Policy on Registration in Applicant and Professional Categories, **R-02-STA-PE/PT/PN**: Competency Standard and **R-03-PRO-PC**: Processing of Applications for Registration of Candidates and Professionals.

2. AUDIENCE

This Discipline-specific Training Guide (DSTG) is specifically directed towards Candidates who have studied Aeronautical Engineering or have specialised in Aerospace Engineering and are undergoing in-service training as either Aeronautical/Aerospace Engineers, Technologists or Technicians. The guide is also applicable to Aeronautical Engineers, Technologists or Technicians who have studied other engineering disciplines but whose postgraduate specialisation is primarily in the aeronautical or aerospace field and who wish to be assessed for professional registration based on their work in an aeronautical/aerospace environment.

The guide is intended to support a programme of training and experience through incorporating good practice elements.

The guide applies to persons who have:

- completed the education requirements in Aeronautical Engineering qualifications prescribed for the category
- obtained qualifications recognised by the Washington, Sydney and Dublin Accords for which the ECSA is a signatory thereof
- registered with the ECSA as a Candidate Engineer, Technologist or Technician
- embarked on a process of acceptable training under a registered Commitment and Undertaking (C&U) programme under the supervision of an assigned mentor guiding the professional development process at each stage.

Note: Marine Engineering and Naval Architecture

Because of the relatively small number of Candidates in the field of Marine Engineering and Naval Architecture, the Aeronautical Engineering Central Registration Committee (CRC) evaluates applications in this field. ECSA does not have a DSTG in Marine Engineering and Naval Architecture. Candidates and their mentors may make use of the guidelines given in this document and transpose the appropriate subject matter.

2.1 Persons registered as a Candidate with ECSA

Candidate refers to a person registered with ECSA after completing a relevant accredited engineering undergraduate or postgraduate programme or qualifications assessed to be equivalent by ECSA for a specific registration category. Candidates can carry out training and development under a C&U candidacy programme according to document **R-11-PROC-PC** or through a training academy's programme as outlined in document **A-01-POL**.

The training under a C&U or through a training academy is structured to align with ECSA standard competency outcomes for the benefit of the Candidate. Professional mentors, supervisors, coaches and Candidates must ensure that the training covers all developmental aspects aligned with the competency outcomes required for registration as a professional.

Mature applicants for registration may apply the guide retrospectively to identify possible gaps in their development.

2.2 Persons not registered as a Candidate with ECSA

Regardless of the development path followed, all Candidates for registration must present the same evidence of competence and be assessed against the same standards. Application for registration as a professional in a specific category is permitted without being registered as a Candidate Engineer, Technologist or Technician and without training under a C&U. Mentorship and adequate supervision during the period of training are, however, key factors in effective development to the level required for registration.

If the employer does not offer a C&U, the Applicant should establish the level of mentorship and supervision the employer is able to provide. In the absence of an internal mentor, the services of an external mentor should be secured. The Voluntary Association (VA) for the discipline may be consulted for assistance in locating an external mentor. A mentorship programme can be developed and should keep abreast of all stages of the development process. Applicants in Aeronautical/Aerospace Engineering can consult the following ECSA-recognised VAs:

- Aeronautical Society of South Africa (AeSSA)
- International Council on Systems Engineering (INCOSE SA Chapter).

(Refer to the ECSA website regarding alternative, recognised VAs that can be consulted)

This guide is written for the recent graduate who is training and gaining experience towards registration. Mature Candidates for registration may apply the guide retrospectively to identify possible gaps in their development. Applicants who have not enjoyed mentorship are advised to request an experienced mentor (internal or external) to act as an application adviser while they prepare their applications for registration.

3. TYPE OF ENGINEERING WORK

In terms of Section 27(1) of the Engineering Profession Act, the Council must draw up a Code of Conduct for Registered Persons and may draw up a Code of Practice in consultation with the Council for the Built Environment, VAs and registered persons.

Aeronautical engineering (earth's atmosphere) professionals perform and supervise engineering work that is concerned with the design, development, manufacture, operation, and maintenance of all types of aircraft and spacecraft based on the engineering sciences underlying flight dynamics, aerospace structures, electronic systems in avionics, navigation, control and communication, and propulsion systems.

Note: Aerospace Engineering

Aerospace Engineering professionals (outside earth's atmosphere) also extends in performing and supervising engineering work that is concerned with the aerospace (spacecraft) based engineering activities. The recognition of this engineering discipline was endorsed for inclusion by ECSA during the Discipline-specific Training Guideline review conducted in 2025 under the consensus received from respective South African tertiary institutions. The Aerospace Engineering speciality is therefore now recognised under the Aeronautical Discipline-specific Training Guideline and type of engineering problems and typical practice areas have been updated accordingly to include this Aerospace Engineering speciality area.

Aeronautical engineering professionals must have a strong understanding of mathematics, physics and sciences, as well as excellent problem-solving skills and attention to detail. They work in a variety of industries, including manufacturing, aircraft maintenance, research and development, military, aviation authorities, aerospace authorities and academic manufacturing, among others. Their education, training and experience and exposure determine the category in which Candidates can register and what type of engineering problems they can solve.

The levels of engineering problems for the different levels of registration are as follows:

- **Professional Engineer:** Solves complex engineering problems and performs complex engineering activities.
- **Professional Engineering Technologist:** Solves broadly defined engineering problems and performs broadly defined engineering activities.

- **Professional Engineering Technician:** Solves well-defined engineering problems and performs well-defined engineering activities.

The characteristics and details of each level descriptor can be found in the Competency Standard for Registration, document **R-02-STA-PE/PT/PN**, which defines the competencies required for each category.

Refer to **APPENDIX D** of this document for detailed information regarding the Aeronautical Engineering profession detailed type of activities performed by the Aeronautical (Aerospace) Engineering professionals that are generally appointed in one or more of the following positions:

Table 1: Aeronautical/Aerospace Engineering professions

Engineers	Technologists	Technicians
Design Engineer	Design Engineering Technologist	Design Engineering Technician
Systems Engineer	Systems Engineering Technologist	Systems Engineering Technician
Certification Engineer	Certification Engineering Technologist	Certification Engineering Technician
Flight Test Engineer	Flight Test Engineering Technologist	Flight Test Engineering Technician
Engineering Academic	Engineering Academic	Engineering Academic.
Research Engineer	Research Engineering Technologist	Research Engineering Technician

3.1 Typical practice areas

Practising Aeronautical/Aerospace Engineering professionals generally specialise in one or more of the following expert fields (the list is not exhaustive):

- Aerodynamics
- Aeroelasticity
- Aircraft design
- Aircraft performance monitoring
- Aircraft structure

- Aircraft systems (hydraulic, pneumatic, and avionics)
- Airport/Airfield management
- Avionics
- Certification and system safety programmes
- Flight testing
- Flight operations and technical support
- Propulsion systems
- Stability and control
- Wind-tunnel testing
- Astrodynamics
- Rocket Propulsion
- Materials for Space Applications
- Spacecraft Dynamics & Control
- Spacecraft Design & Structures
- Thermal Control Systems
- Space Environment.

3.2 Research and development

This type of work may be performed in research and product-development centres of business organisations or at academic institutions. Applicants must undertake research and development work that is predominantly Aeronautical/Aerospace Engineering in nature, and this work should include an in-depth application of the various aspects of Aeronautical/Aerospace Engineering, including product or system testing under controlled experimental conditions.

Note: Aerospace Engineering

The sections that proceeds can thus be considered interchangeable with the term of Aeronautical and Aerospace Engineering Candidate and Professionals.

4. DEVELOPING ENGINEERING COMPETENCIES

Aeronautical engineering offers a wide spectrum of specialist areas as listed in section **3.1**, and this document underscores the crucial competencies required for individuals aspiring to register as aeronautical engineering professionals. These competencies, regardless of the work sector, are essential for success in the field. The 11 outcomes specified in document **R-08-CS-GUIDE-PE/PT/PN** are the pillars of these competencies. In some instances, these competencies may not be readily available within an individual's current role, project or position. In such cases, secondment to another department or employer or seeking guidance from an external mentor is recommended. Progression throughout the candidacy period presented in document **R-04-T&M-GUIDE-PC** and **Table 2** (see Section **5**) refers to the gradual increase in the degree of responsibility (DoR) Applicants are exposed to during their professional training. The required level of responsibility is included in brackets under each subheading for ease of reference.

Applicants and mentors who are unsure whether the engineering work they are considering is complex, broadly defined or well-defined should refer to document **R-02-STA-PE/PT/PN**, the Competency Standard for Registration. Document **R-02-STA-PE/PT/PN** provides detailed information about the characteristics and requirements of each level descriptor, defining the competencies needed for each category. The VAs applicable to the Aeronautical Engineering professionals and their functions and services to members provide a broad range of contextual knowledge for Candidate Engineers, Technologists and Technicians that continues through the full career path of the registered professionals.

This balance of this section provides a set of guidelines for each competency (as per the competency standard) for each registration category.

4.1 Training for registration as a Professional Engineer

4.1.1 Outcome 1: Define, investigate and analyse complex engineering problems (Responsibility level E)

As per the ECSA outcomes, engineers are expected to be able to define, investigate and analyse complex engineering problems that include the following:

- Defining the engineering problems and procedures for solving the problems.
- Investigating and evaluating pertinent information and identifying systems and subsystems of complex problems, including collecting, organising and evaluating information from all applicable sources including in-situ investigations where appropriate.
- Analysing relevant assumptions, inputs and required outputs of a complex engineering problem.

The complex engineering problem may be a design requirement, an applied research and development requirement or a problematic situation in an existing component, system or process. According to ECSA, the definition of 'complex' in complex engineering problems can be defined as follows:

Composed of many inter-related conditions, requiring first-principle empirical judgement to create a solution within a set of originally undefined circumstances.

Aeronautical engineering forms an integral part of broader engineering systems and infrastructure in technologically complex designs, manufacturing and processing techniques, aircraft and spacecraft product development, and research environments.

All Applicant are therefore required to demonstrate their ability to solve complex aeronautical problems, as explained in document **R-08-CS-GUIDE-PE/PT/PN**. Solving such problems typically requires the application of aeronautical engineering sciences and engineering judgement.

4.1.2 Outcome 2: Design or develop solutions to complex engineering problems (Responsibility Levels C and D)

The engineering design or development of solutions to complex engineering problems includes the identification and/or development of clear requirements or needs. Based on these needs, an appropriate approach for the design process is chosen to resolve the complex problem. The preferred option or way forward is influenced by factors that best fit the solution, taking into consideration cost, practicability, innovation and any impact outside the requirements. The design process, depending on the problem tackled and the chosen approach, could include the following:

- Advanced application of theoretical knowledge with respect to these systems; Applicants must incorporate calculations with clearly defined inputs of the formulae used and detailed interpretation of the results obtained.
- Applicants must demonstrate how the calculated results have been used to provide the solution to the problem at hand and indicate the economic benefit to the project or the operating work environment (e.g., improved efficiency, reduced environmental footprint, capacity enhancement or simplification of system).
- A complete and final solution with relevant documentation should be made available including sufficient detail to show that the complex problem was solved and presenting the implementation plan.

4.1.3 Outcome 3: Comprehend and apply advanced and local knowledge of the widely applied principles underpinning good practice that is specific to the jurisdiction in which the Engineer practises (Responsibility level E)

Evidence should be provided to demonstrate that individuals have a thorough understanding and mastery of the engineering principles and technologies relevant to their areas of practice. Furthermore, they should be able to apply first-principle analytical thinking to effectively address and solve complex problems within their domain.

In demonstrating advanced application of theoretical knowledge with respect to these systems, Applicants must incorporate calculations with clearly defined inputs of the formulae used and detailed interpretation of the results obtained.

Applicants must demonstrate how the calculated results have been used to provide the solution to the problem at hand and indicate the economic benefit to the project or the operating work environment (e.g., improved efficiency, reduced environmental footprint, capacity enhancement or simplification of system).

In applying technical and scientific knowledge gained through academic training, Applicants must also demonstrate the financial and economic benefits of engineered solutions synthesised from scientific and engineering principles at a sufficiently advanced level.

4.1.4 Outcome 4: Manage part or all of one or more complex engineering activities (Responsibility level D)

Engineers are very often given the responsibilities to lead and manage multi-disciplinary teams and or the work done by an aeronautical engineer may frequently cross the boundaries between engineering disciplines and specialist areas or at least be influenced by interfaces with other disciplines. To that effect, special consideration must be given to the competency of Management and Communication.

The display of personal and work process management abilities in the competence area is typified by:

- managing self, people, work priorities, processes and resources when performing complex engineering activities
- planning, organising, leading and controlling complex engineering activities
- managing contracts and other agreements and the ability to establish and maintain professional and business relationships.

4.1.5 Outcome 5: Communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities (Responsibility level C)

In the field of aeronautical engineering, effective communication and inclusive collaboration are critical to the success of complex engineering projects. Aeronautical engineers consistently demonstrate their ability to convey technical concepts clearly across multiple media, ranging from detailed design reports and digital simulations to oral presentations and collaborative digital platforms. These professionals engage with a wide array of stakeholders, including multidisciplinary engineering teams, regulatory bodies, industry partners and end-users. Their capacity to communicate precisely and inclusively ensure that project objectives are clearly understood, risks are effectively managed and innovative solutions are developed and implemented efficiently.

Competency indicators: Effective and clear communication is typified by the following:

- **Accurate technical documentation:** Ability to create precise and comprehensive reports, specifications and manuals that are essential for design validation, certification and maintenance procedures.
- **Effective use of visual aids and tools:** Skilled in using engineering drawings, system diagrams, simulations and 3D models to visually represent complex systems and data for clear understanding.
- **Tailoring communication to audience:** Demonstrates the ability to adapt messaging, both written and verbal, based on the technical expertise and needs of diverse stakeholders.
- **Clear oral communication in multidisciplinary teams:** Communicates effectively in team settings, ensuring that all members, from software developers to flight crews, understand technical goals and constraints.
- **Active listening and feedback integration:** Listens attentively to input from others and integrates feedback into engineering processes, showing respect for team collaboration and continuous improvement.
- **Concise presentation of technical data:** Presents complex data and engineering decisions in a concise and understandable manner during reviews, audits or client meetings.
- **Use of collaborative communication platforms:** Proficient in using digital platforms (e.g., project management tools, shared documents, messaging apps) to ensure smooth and transparent communication across teams.
- **Documentation for certification and compliance:** Prepares clear and regulatory-compliant documentation required by aviation authorities, ensuring that all engineering activities meet legal and safety standards.

- **Cross-cultural and international communication skills:** Communicates effectively with global partners and suppliers, showing cultural awareness and language sensitivity in international projects.
- **Crisis and risk communication:** Provides clear, timely and calm communication in high-pressure or emergency situations, enabling rapid and effective decision-making that prioritises safety and compliance.

4.1.6 Outcome 6: Recognise the reasonably foreseeable economic, social, cultural and environmental effects of complex engineering activities seeking to achieve sustainability (Responsibility level B)

Aeronautical engineers play a vital role in shaping the future of sustainable aviation by recognising and addressing the broader impacts of their work. In the course of complex engineering activities, they are trained to consider not only technical performance and safety but also the economic, social, cultural and environmental consequences of their decisions. Whether designing more fuel-efficient aircraft, developing quieter propulsion systems or selecting environmentally responsible materials, aeronautical engineers strive to minimise negative impacts and promote long-term sustainability. Their ability to anticipate foreseeable outcomes and integrate sustainable practices into engineering solutions reflects a deep commitment to responsible innovation and global stewardship.

- **Social effects:** Impacts on communities and individuals, such as improved connectivity, job creation and public safety, as well as concerns like noise pollution or displacement due to airport expansion.
- **Environmental effects:** Consequences for the natural environment, including emissions, fuel consumption, noise pollution and resource use, with efforts focused on reducing the ecological footprint of aircraft and aviation systems.
- **Cultural effects:** Influence on local and global cultural values, such as respecting indigenous land during infrastructure development or ensuring that aviation technologies align with cultural expectations and practices in diverse regions.

4.1.7 Outcome 7: Meet all legal, regulatory and cultural requirements and protect the health and safety of persons during all engineering activities (Responsibility level E)

Applicants are expected to have a working knowledge of the following regulations and Acts and of how the legislation affects their working environment:

- Engineering Profession Act, 46 of 2000 (EPA), its rules
- ECSA Code of Conduct
- Occupation Health and Safety Act as amended by the Occupation Health and Safety Act, 181 of 1993 (OHS Act)
- Civil Aviation Act, 13 of 2009
- International Regulations on Aircraft Safety and Airworthiness:
    - Federal Aviation Authority (FAA) Regulations (USA)
    - FAR 14 CFR (Code of Federal Regulations)
    - European Aviation Safety Agency (EASA) Regulations on airworthiness (EU No. 748/2012 Part 21; 640/2015 Part 26; 1321/2014 Parts -M; -T; -66; -145; -147)
    - Def Stan 00-970: Requirements for Design and Airworthiness for Service Aircraft
    - Military Standards (Mil-Std.)
- Labour Relations Act, 66 of 1995
- Environment Conservation Act, 52 of 1994
- Environment Conservation Amendment Act, 50 of 2003.
- Electronic Communications Act, 36 of 2005
- Industry-specific work Instructions, technical standards and specifications.
- Applicable SABS standards
- South African Space Affairs Act, 84 of 1993
- South African National Space Agency policy and guidelines
- South African Civil Aviation Regulations and Standards
- National Conventional Arms Control Act, 41 of 2002
- NRS Standards
- Public Finance Management Act, 1 of 1999.

The Applicant is expected to have a basic knowledge of the applicable Acts applicable to their area of practice. This list is not exhaustive.

Other Acts not listed here may also be pertinent to an Applicant's specific work environment. Candidates are expected to have a basic knowledge of the relevant Acts and to investigate whether any Acts are applicable to their particular work environment.

Note: International any Other Applicable Standards acceptable after proper justification.

4.1.8 Outcome 8: Conduct engineering activities ethically (Responsibility level E)

Aeronautical engineers are entrusted with responsibilities that have far-reaching implications for safety, security and public trust. As such, they must conduct all engineering activities with the highest ethical standards. This involves making decisions with honesty, integrity and transparency, while prioritising the well-being of society, the environment and future generations. Whether dealing with safety-critical systems, managing confidential information or navigating complex regulatory environments, aeronautical engineers must uphold professional codes of conduct and ensure their actions align with ethical principles. Ethical practice is essential not only for compliance but for sustaining the credibility and accountability of the engineering profession.

ECSA has developed the Code of Practice for the Performance of Aeronautical Engineering Work to supplement the Code of Conduct for Registered Persons: Engineering Profession Act, 46 of 2000.

Section 27 of the Engineering Profession Act, 46 of 2000, empowers ECSA to draw up codes of practice in addition to codes of conduct and requires all registered persons to comply with such codes. While codes of conduct regulate behaviour, codes of practice regulate engineering practice.

The Code also details the ethical values and professional standards that ECSA expects all registered persons to adhere to as prescribed under the Code of Conduct for registered persons in terms of the Act.

Registered Persons must abide by the Ethical Rules of Conduct as listed in the Code of Conduct:

- Competency
- Integrity
- Public Interest
- Environment
- Dignity of the Profession.

It is expected that Registered Persons, in the execution of their engineering work, will execute their work with integrity and in accordance with generally accepted norms of professional conduct, without prejudice to public health and safety.

4.1.9 Outcome 9: Exercise sound judgement by evaluating the outcomes, impacts and alternatives in the course of complex engineering activities (Responsibility level E)

Aeronautical engineers are frequently required to exercise sound judgment when navigating complex engineering activities, where the stakes are high and the consequences far-reaching. This involves critically evaluating potential outcomes, considering both technical performance and broader impacts, such as safety, cost, environmental effects and regulatory compliance. By systematically weighing alternatives and anticipating risks, aeronautical engineers ensure that decisions made throughout the design, testing and operational phases support both mission success and public safety. Their ability to make informed, ethical and forward-thinking choices is fundamental to the advancement of aerospace technology and reliability.

Sound engineering judgement involves the following aspects:

- **Critical evaluation of alternatives** to compare multiple design or solution options by assessing trade-offs involving performance, cost, sustainability, feasibility and long-term implications.
- **Risk assessment and mitigation** to identify, analyse and mitigate technical and operational risks while considering safety, reliability and regulatory requirements.
- **Ethical and professional responsibility** by demonstrating integrity and accountability by considering the societal, environmental and legal impacts of engineering decisions.

Applicants must therefore demonstrate evidence of this professional judgement when evaluating the interactions between conflicting technical, engineering, social and other considerations, with careful attention to their broader impact on all affected stakeholders when formulating recommendations.

4.1.10 Outcome 10: Be responsible for making decisions on part or all of complex engineering activities (Responsibility level E)

In the field of aeronautical engineering, decision-making during complex engineering activities carries a high level of responsibility, as the outcomes directly influence the safety, performance and regulatory compliance of aerospace systems. Aeronautical engineers are entrusted with making informed decisions that account for a wide range of technical parameters, operational constraints and stakeholder expectations. This responsibility extends beyond technical proficiency to include ethical considerations, sustainability, cost-effectiveness and long-term system integrity. Sound decision-making requires a disciplined approach that integrates rigorous analysis, multidisciplinary collaboration and a commitment to professional standards to ensure that each choice contributes to the success and safety of the engineering solution.

4.1.11 Outcome 11: Undertake sufficient professional development activities to maintain, extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work (Responsibility level D)

Professional development is a critical aspect of an aeronautical engineer’s career, ensuring sustained competence in a rapidly evolving and highly technical field. It involves taking personal ownership of one’s growth by independently planning, selecting, undertaking and recording activities that enhance knowledge, skills and professional capability. Given the pace of technological advancements and the stringent safety and regulatory standards in aerospace, continuous learning is essential. By proactively engaging in professional development, aeronautical engineers not only maintain relevance in their discipline but also uphold the highest standards of engineering excellence and public trust.

Professional development is essential for engineers to continuously improve their skills and advance their careers. To facilitate this key professional development, Applicants can consider the following list of useful courses that present such learning activities:

- Aviation Law and Regulation
- Air Transport Management
- Aviation quality assurance
- Aircraft Maintenance planning
- Aircraft Certification
- Avionics and Electrical General
- Airframe General
- Civil Aviation Technical Standards and Civil Aviation Regulations (CATs & CARS)
- Crashworthiness and Survivability
- Project management
- Standards and Regulations development and writing
- Flight Control Systems
- Microsoft Office tools (MS Excel, MS Word, MS PowerPoint, MS Project, etc.)
- Professional skills such as report writing and presentations
- Gas Turbine & Engine General
- Occupational health and safety
- Guidance, Navigation and Control
- Software Certification (Airbourne).

Note: The above list is by no means extensive or comprehensive and may carry ECSA CPD points.

Competence in self-development is demonstrated through a proactive and strategic approach to continuous professional growth. This includes the following:

- **Articulating a clear awareness of the need for ongoing development**, along with a well-defined strategy for independently enhancing professional knowledge, skills and capabilities in alignment with evolving industry demands and personal career goals.

- **Providing verifiable evidence of sustained self-development**, both within the engineer's primary area of expertise and in new or emerging domains. This may include formal learning, practical experience, mentorship activities or engagement in professional networks, reflecting a commitment to lifelong learning and adaptability in a dynamic engineering environment.

NB: Refer to **APPENDIX C** for various levels development activities.

4.2 Training for registration as a Professional Engineering Technologist

An Aeronautical Engineering Technologist performs and supervises broadly defined (as defined under the abbreviations section) and **R-02-STA-PE/PT/PN** engineering work concerned with the design, development, manufacture, operation and maintenance of aircraft and spacecraft of all types based on the engineering sciences underlying flight dynamics, aerospace structures and propulsion systems.

Refer to **APPENDIX D** of this document for detailed information on specific, broadly defined activities within the Aeronautical Engineering Technologist profession that should align to the following Outcomes for Registration as an Aeronautical Engineering Technologist.

The following outcomes are to be read with the **R-02-STA-PE/PT/PN**, the Competency Standard for Registration, which provides key competency indicators for each outcome.

4.2.1 Outcome 1: Define, investigate and analyse broadly defined engineering problems (Responsibility level E)

This outcome defines the skills needed for an Aeronautical Engineering Technologist to address broadly defined engineering problems. These problems may arise from design requirements, Research and Development needs or issues in existing systems and must be solvable using known technologies.

Broadly defined engineering problems often demand in-depth technical expertise and a structured analytical approach to address them effectively. These problems are frequently ill-defined, requiring thorough interpretation and clarification before a viable solution can be developed. They may be embedded within complex systems or call for innovative adaptations to meet unique requirements. While such challenges can deviate from established standards, any proposed solution must be rigorously justified. Additionally, Aeronautical Engineering Technologists may need to navigate incomplete data, conflicting constraints and multidisciplinary impacts that influence the problem-solving process. The consequences of these challenges can be significant, sometimes extending beyond the immediate scope of the project. Furthermore, solutions must account for broader implications, as they may lead to multiple outcomes with far-reaching effects.

Essentially, the Aeronautical Engineering Technologist ensures that a systematic process can be adopted in solving broadly defined engineering problems with sound judgment.

4.2.2 Outcome 2: Design or develop solutions to broadly defined engineering problems (Responsibility levels C and D)

This outcome outlines the processing of a systematic approach that an Aeronautical Engineering Technologist may follow to develop and implement solutions for the broadly defined engineering problems, typically after initial analysis as performed in Outcome 1. Processing of a systematic approach to a broadly defined engineering problem may be typified by the following activities:

- **Processing of a systematic approach to a broadly defined engineering problem:** It is essential to develop multiple viable solutions, each supported by detailed costing, impact assessments and/or theoretical calculations. This approach ensures a comprehensive evaluation of different strategies, allowing for an optimal balance among feasibility, cost-effectiveness and performance. All proposed alternatives must meet the specified requirements, ensuring that no solution compromises its essential criteria (the main priority being safety).
- **Determination of the optimal solutions:** Each design must be rigorously analysed against key criteria, including technical requirements, cost implications and broader external impacts. In cases where full theoretical validation is unavailable, consultation with an experienced engineer ensures that assumptions are sound and solutions are feasible.
- **Detailing the required specifications:** For example, detailed engineering drawings and all necessary supporting documentation to ensure accurate execution. Every specification

of the chosen solution must be validated to confirm it fully meets the requirements such as safety, functionality and economic viability.

Essentially, Aeronautical Engineering Technologists ensure that the process followed ensures that solutions to the broadly defined engineering problems are well-researched, justified and ready for a realistic application in meeting the requirements.

4.2.3 Outcome 3: Comprehend and apply the knowledge embodied in widely accepted and applied engineering procedures, processes, systems and methodologies that is specific to the jurisdiction in which the Engineering Technologist practises (Responsibility level E)

This outcome outlines the essential knowledge area/s required for the Aeronautical Engineering Technologist to effectively practice, emphasise established and emerging technologies within a multidisciplinary team to ensure that the necessary regulatory framework can be complied with.

Applicable Knowledge areas may require the application of well-established engineering principles whilst adapting to local conditions (e.g. environmental) or specific unique factors that the designed solutions must account for. This knowledge area may also require the assessment of emerging, new technologies or materials that may require rigorous testing and validation before implementation. Decisions and justifications may be based on education, experience, and analysis of systems, materials, and client needs.

A working knowledge and understanding of the inter-related disciplines (e.g. civil, mechanical, electrical etc.) when forming part of a multidisciplinary team. It may be expected that the Aeronautical Engineering Technologist may also lead multidisciplinary teams, while taking responsibility for project outcomes.

Essentially, there must be a sound indication of knowledge, ensuring that the necessary legal, safety, and industry standards (e.g., OHS Act, environmental laws) are able to achieve regulatory compliance. Other regulatory knowledge areas may include, but not limited to, elements such as contract law, risk management, quality control, and Project/construction management.

4.2.4 Outcome 4: Manage part or all of one or more broadly defined engineering activities (Responsibility level D)

This outcome outlines the responsibilities for the Aeronautical Engineering Technologist to effectively ensure managing and application of management principles to the broadly defined engineering problem solution in terms of emphasising planning, organising, leading, and controlling activities.

Essentially, these key responsibilities may additionally emphasise on managing self, teams, processes and resources within providing the engineering solution/s, whilst adhering to required levels of quality, safety, and environmental standards.

4.2.5 Outcome 5: Communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities (Responsibility level C)

This outcome outlines the required professional communication that the Aeronautical Engineering Technologist is to be capable of ensuring precise information flow for successful execution to their broadly defined engineering solution/s.

This outcome ensures that the Aeronautical Engineering Technologist is adequately capable of combining essential technical knowledge with unique communication skills capable of bridging the gap between engineering concepts and realistic implementation. The key role will be indicated by the reported technical documentation, reporting, and stakeholder communication to ensure such key communication can facilitate the necessary decision-making, safety compliance, cost control, and continuous improvement around proposed engineering problem solution/s.

4.2.6 Outcome 6: Recognise the reasonably foreseeable economic, social, cultural, and environmental effects of broadly defined engineering activities seeking to achieve sustainability (Responsibility level B)

Engineering solution/s exists within a social and ecological context, requiring careful consideration of its broader implications beyond technical solution/s. The proposed engineering solution/s that their broadly defined engineering solution/s may negatively or positively affect the socially, environmentally and culturally spheres in which it may be implemented in. It is therefore necessary that the Aeronautical Engineering Technologist be capable to recognise and address these effects of their engineering solution/s with regard to:

- Social effects encompass all issues that affect people and their livelihood, directly or indirectly, positively and negatively. Engineering solution/s and activities may have affected people's way of life, political system, health and wellbeing, and personal and property rights.
- Environmental effects include people's environment, namely air and water quality, dust and exposure to noise and adequacy of sanitation as well as large ecosystems. This might include disruption of ecosystems, fauna and flora and increased land temperatures, and impact on historical buildings.
- Cultural effects include people's customary beliefs, religion, language and norms, for example ceremonies and customs of a particular group or society.

Essentially, their engineering solution/s should have a holistic approach that ensures such solutions provide value while respecting the social fabric and natural systems they may affect. Thus, a careful equilibrium between progress and preservation must be observed and analysed.

4.2.7 Outcome 7: Meet all legal, regulatory and cultural requirements and protect the health and safety of persons during all engineering activities (Responsibility level E)

This outcome requires that the Aeronautical Engineering Technologist identify legal and regulatory requirements, including health and safety standards, for their engineering activities. This should be achieved by demonstrating awareness in selecting safe (for example Occupational health and safety laws), sustainable materials, components, and systems while managing associated risks.

Application of the associated regulations with the particular aspects of the broadly defined engineering solution/s must be carefully identified and controlled by the Aeronautical Engineering Technologist. This can be done by attending a Risk Management course and/or adoption of the organisational safety processes and procedures. This awareness will ensure the Engineering Technologists is capable to identify, analyse, and manage long-term risks, of their broadly defined engineering solution/s.

Engineering Technologist are expected to have a working knowledge of the following regulations and Acts and of how the legislation affects their working environment.

Essentially, the Engineering Technologist is expected to have a working knowledge of the applicable Acts that are applicable to their area of practice. The list of International any Applicable Standards is provided under paragraph **4.1.7** of this document. This list is not exhaustive.

Other Acts not listed here may also be pertinent to an applicant's specific work environment. Candidates are expected to have a basic knowledge of the relevant Acts and to investigate whether any Acts are applicable to their particular work environment.

Note: International any Other Applicable Standards acceptable after proper justification.

4.2.8 Outcome 8: Conduct engineering activities ethically (Responsibility level E)

This outcome ensures that the Aeronautical Engineering Technologist when encountering any ethical challenges in conducting their engineering activities is firstly capable to identify such ethical issues and affected parties. Secondly is capable of appropriately addressing such ethical issues systematically (within legal compliance, fairness, and adherence to organisational policies) to ensure their integrity and accountability is upheld as well as their organisation.

Essentially, the Aeronautical Engineering Technologist must uphold professional codes of conduct and ensure that their actions align with ethical principles. They must ensure conversance and act in compliance with ECSA's Rules of Conduct for registered persons and also adhere to ECSA's Code of Conduct.

4.2.9 Outcome 9: Exercise sound judgement by evaluating the outcomes, impacts and alternatives in the course of broadly defined engineering activities (Responsibility level E)

Engineering practice demands interdisciplinary collaboration, where technical decisions must integrate with other fields of practise, while adhering to best professional standards. The Aeronautical Engineering Technologist will manage projects with broadly defined parameters, exercising judgment within their expertise but seeking guidance from the respective specialists when encountering complex or unfamiliar challenges.

This required judgement being exercised is to ensure critical aspects being encountered can be rigorously evaluated in terms of risk and consequence. This evaluation can be achieved through decisions making tools and analysis and must be supported by appropriate calculations, established standards, and/or thorough risk assessments.

Essentially, this process highlights the critical thinking, professional accountability, and adaptive problem-solving essential to the Aeronautical Engineering Technologist roles.

4.2.10 Outcome 10: Be responsible for making decisions on part or all of broadly defined engineering activities (Responsibility level E)

The Aeronautical Engineering Technologist should clearly demonstrate their accountability they discharged for significant parts of one or more of their engineering activities they have been involved with. This responsibility entails the legal and moral accountability of their broadly defined engineering solution/s being developed.

It requires holistic decision-making that balances technical, social, environmental, and sustainability factors. As part of this decision-making process respective codes, specifications, and industry best practices should be consulted with sound justification provided.

The Engineering Technologist must recognise their competency limits and consult experts for specialised issues while independently managing tasks within their scope. The Engineering Technologist must prioritise safety, sustainability, and ethical standards while managing their engineering activities.

Essentially, this framework of accountability, alignment with competence, and collaboration when needed, ensures reliable solution/s can be provided and upholds the profession's integrity.

4.2.11 Outcome 11: Undertake sufficient professional development activities to maintain, extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work (Responsibility level D)

Professional development is the continuous education and training that the Aeronautical Engineering Technologist undertakes to enhance skills, stay updated with industry trends, and advance their careers.

When applying for Professional registration, the Aeronautical Engineering Technologist should provide evidence of Initial Professional Development (IPD) achieved during training, including engineering, management, or computer courses.

Professional development is essential for engineers to continuously improve their skills, advance their careers; in order to facilitate this key Professional development, the Applicant can consider the following list of useful courses that will present such learning activities, Refer to paragraph 4.1.11 of this document on the list of courses.

For registered Professional Aeronautical Engineering Technologist, maintaining competency through Continuing Professional Development (CPD) is mandatory to retain registration. In order to ensure an effective professional development adopted before and after registration, this can be achieved with a personal strategy, selection of relevant development activities, as well as demonstrating independent learning and ensuring a maintained detailed record of such activities. It requires structured learning (including courses and postgraduate studies), personal initiative in planning development activities, and meticulous record-keeping. By taking ownership of their growth, while understanding employer policies, professionals ensure they stay current with industry trends and remain competent in their field. Essentially, continuous learning enables career progression and sustains technical relevance in a changing industry.

NB: Refer to **APPENDIX C** for various levels development activities.

4.3 Training for registration as a Professional Engineering Technician

4.3.1 Outcome 1: Define, investigate and analyse well-defined engineering problems (Responsibility level E)

During training, Applicant engineering technician should be exposed to the technical investigation of equipment, plant and product failure. The intent is for applicants to be able to clearly define the engineering problem and investigate and analyse well-defined engineering problems. For engineering technicians to solve well-defined engineering problems, it is imperative to understand the nature of the engineering problem. Inability to understand the engineering problem could lead to incorrect design or development of solutions. Defining an engineering problem requires in-depth knowledge and history of the system, other attempted or successful solutions, and how far-reaching a solution to the problem may be. Investigation of the engineering problem could be in a form of equipment failure in the electrical and/or electronic system, development of new products and provision of services to a greenfield area.

Engineering problems should be thoroughly investigated through site visits, collecting technical information and checking engineering drawings. No investigation can be completed using desktop information only. Sufficient technical and business information about a plant or systems should be collected, evaluated and analysed for accuracy and reliability. Analysis of the information assists applicants to review the instruction given in the initial engineering problem and assess if the work instruction was well understood. Engineering analysis involves applying scientific analytic principles and processes to reveal the properties and state of the system, device or mechanism under study. Applicants Aeronautical Engineering Technicians or persons willing to register as Professional Engineering Technicians should be able to demonstrate how well-defined engineering problem/s were defined and investigated.

4.3.2 Outcome 2: Design or develop solutions to well-defined engineering problems (Responsibility levels C and D)

Once the analysis of the engineering problem has been established, applicants are expected either to design or to develop engineering solutions to resolve well-defined engineering problems. Well-defined engineering problems can be solved in standardised or prescribed ways. They are encompassed by standards, codes, and documented procedures. Engineering

Technicians encounter various engineering problems and should provide solutions to return the plant or system to its normal functioning state. Designing or developing solutions for a well-defined engineering problem normally follows the steps presented below:

- List possible solutions
- Evaluate and rank the possible solutions
- Develop a detailed plan for the most attractive solutions
- Re-evaluate the plan to check desirability
- Check the result through calculations
- Implement the plan
- Communicate the results

Applicant Aeronautical Engineering Technicians should be able to demonstrate the application of calculations and engineering concepts in designing or developing solutions to a well-defined engineering problem. Engineering norms and standards should be applied in the process of developing well-defined engineering solutions.

Once the received task is fully understood and interpreted, a solution to the posed problem can be developed (designed). To synthesise a solution means, "the combination of separate parts, elements, substances, etc. into a whole or into a system" by the following:

- Design work for Applicant Aeronautical Engineering Technicians mainly involves the use and configuration of manufactured components and repetitive design work using an existing design as an example. Engineering Technicians apply existing codes and procedures in their design
- defined incidents, and condition monitoring and operations would be mainly on controlling, maintaining, and improving engineering systems and operations.
- The development (design) of more than one way to solve an engineering task or problem should always be done, including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the instruction that was received, and the theoretical calculations to support each alternative must be done and submitted as an attachment.

- The Applicant Aeronautical Engineering Technician will, in some cases, not be able to support proposals with the complete theoretical calculation to substantiate every aspect and must, in these cases, refer his/her alternatives to a supervisor or mentor for scrutiny and support. The alternatives and particularly the recommended alternative must be convincingly detailed to win customer support. The selection of alternatives might be based on tenders submitted with alternatives deviating from those specified.

4.3.3 Outcome 3: Comprehend and apply knowledge that is embodied in established engineering practices that is specific to the jurisdiction in which the Engineering Technician practises (Responsibility level E)

Applicant Aeronautical Engineering Technicians are required to apply engineering knowledge acquired during the accredited undergraduate programmes to resolve the well-defined engineering problems and subsequently provide solutions to such problems. During training, Applicant Engineering Technicians are expected to be introduced to engineering standards, procedures and different systems used in the process of engineering problem solving. It is imperative that Applicant Engineering Technicians are able to understand and demonstrate application of acceptable engineering theory, engineering standards, engineering procedures, systems and governing laws in solving well-defined engineering problems.

Engineering problem-solving of well-defined activities involves justifying the reasoning on why National Diploma theory is applied and, in most cases, requires the engineering technician to perform calculations to justify certain engineering decisions and assumptions.

Applicant Aeronautical Engineering Technicians are expected to work within prescribed engineering standards and codes in solving engineering problems or to justify operating outside these standards and codes. Engineering technicians may also rely on knowledge from the National Rationalised Specifications (NRS), South African Bureau of Standards (SABS), technical standards and specifications to develop solutions to well-defined engineering activities.

4.3.4 Outcome 4: Manage part or all of one or more well-defined engineering activities (Responsibility level D)

The areas in which Applicant Aeronautical Engineering Technicians work generally follow a conventional project or product development life cycle model.

Aeronautical Technicians may contribute to or participate in a project by managing one or more activities in the project life cycle. The key activities of project management involve time, cost and quality. Applicant Aeronautical Engineering Technicians should be able to manage their activities to minimise project delays or engineering work activities, either in operations and maintenance or capital projects. Sometimes work priorities need to be tracked using project management software tools to manage project activities' critical path.

Applicant Aeronautical Engineering Technicians must expose themselves to the tools/software used to manage well-defined engineering activities and understand their role within the team. Applicant Aeronautical Engineering Technicians or persons wishing to register with ECSA as a Professional Technicians must particate in and contribute to the work activities in the project life cycle. Applicant Aeronautical Engineering Technicians are not expected to change their places of employment to acquire all the skills in the project life cycle as listed above.

4.3.5 Outcome 5: Communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities (Responsibility level C)

While conducting engineering works, Applicant Aeronautical Engineering Technicians are expected to effectively communicate with their team members, supervisors, clients and contractors. Professional communication is a vital skill for Applicant Aeronautical Engineering Technicians to possess since all their decisions are communicated to different parties. Professional communication is important for Applicant Aeronautical Engineering Technicians to run effective meetings, work with people who are not technical, work with other cultures, issue and receive instructions, report on engineering works and share ideas.

The main type of professional communication includes oral, written and graphic techniques, or a combination thereof. During the execution of engineering work activities, Aeronautical

Technicians hold meetings, develop technical reports, develop tender document specification and develop bills of quantity. This should be clear and concise to convey the message to the recipients. Creating presentations using visual aids and supporting documents for the purpose of presenting to colleagues, team members, supervisors or clients is an important part of engineering problem solving. Oral and written communication skills are important for effective professional communication.

Applicants should develop effective communications skills during training and be able to demonstrate such skills to be registered as Professional Engineering Technicians.

4.3.6 Outcome 6: Recognise the reasonably foreseeable economic, social, cultural and environmental effects of well-defined engineering activities seeking to achieve sustainability (Responsibility level B)

Performing engineering work always means there will be impact socially, environmentally and culturally. This is because engineering work happens within the environment and are meant to improve services or products but not impact cultural beliefs and norms. Applicants should be able to recognise and address the impact of their well-defined engineering activities. It involves understanding and evaluating the potential consequences of these activities and taking measures to mitigate any adverse effects.

- **Social effects** encompass all issues that affect people and their livelihood, directly or indirectly. Engineering activities may have affected people’s way of life, political system, health and wellbeing, and personal and property rights.
- **Environmental effects** include people’s environment, namely air and water quality, dust and exposure to noise and adequacy of sanitation as well as large ecosystems. This might include disruption of ecosystems, fauna and flora and increased land temperatures and impact on historical buildings.
- **Cultural effects** include people’s customary beliefs, religion, language and norms, for example, ceremonies and customs of a particular group or society.

Applicants should always remember that these activities are mostly outward looking. Applicants must be able to describe the impact of engineering work on these items and be able to provide mitigation measures to affected parties. Stakeholder engagement is always important in mitigating impacts to a level acceptable to affected parties.

4.3.7 Outcome 7: Meet all legal, regulatory and cultural requirements and protect the health and safety of persons during all engineering activities (Responsibility level E)

Engineering work is performed under various legal and regulatory requirements that ensure the safety of personnel, protection of environment and continued service delivery to the public. Applicant Aeronautical Engineering Technicians should be familiar with major laws and regulations applicable in their area of operation. Regulations include standards and specifications that are there to provide safety and ensure continuation of service. Such knowledge ensures that work is done safely and no unnecessary risks are taken during such work.

Applicants are expected to have a working knowledge of the following regulations and Acts and of how the legislation affects their working environment. The list of International any Applicable Standards/Acts is provided under paragraph **4.1.7** of this document. This list is not exhaustive.

Other Acts not listed here may also be pertinent to an Applicant's specific work environment. Candidates are expected to have a basic knowledge of the relevant Acts and to investigate whether any Acts are applicable to their particular work environment.

Note: International and any other applicable standards acceptable after proper justification.

4.3.8 Outcome 8: Conduct engineering activities ethically (Responsibility level E)

Ethical problems arise during engineering activities, for example using unsustainable material for a solution or contravening other regulations in the process of developing solutions. Other general ethical problems may also arise while performing engineering activities. Engineering practitioners should be able to identify ethical issues arising during engineering activities and identify affected parties and how such issues may affect them. A solution to an ethical problem must take into consideration all affected parties.

Applicant Aeronautical Engineering Technicians must perform engineering work and make technical decisions while adhering to the *ECSA Code of Conduct* for registered persons. Engineering work should be performed taking into consideration the following factors:

- Make decisions within the limits of the practitioner's education, training and experience.
- Act with integrity and in accordance with the general norms of professional conduct.
- Strive to respect the interests of the public and health and safety and minimise environmental impact.

Where the scope of work falls outside the area of expertise, Applicant Aeronautical Engineering Technicians should seek guidance from relevant parties. Conflict of interest while conducting engineering activities should be avoided/declared so that decisions are made transparently and with the best interests at heart.

4.3.9 Outcome 9: Exercise sound judgement by evaluating the outcomes, impacts and alternatives in the course of well-defined engineering activities (Responsibility level E)

Sound judgement and decision-making can be defined as the ability to objectively assess situations or circumstances using all the relevant information and apply past experience to come to a conclusion. Applicant Aeronautical Engineering Technicians should be able to make a judgement towards a sustainable solution after ensuring that all factors, including consideration of other disciplines, have been taken into consideration.

It is essential to have a reliable analysis solution for technical-risk management to ensure early detection of problems. This prevents issues from occurring without warning and drastically decreases the effort required to alleviate sudden infrastructure or system problems. Applicant Aeronautical Engineering Technicians must familiarise themselves with organisational risk policies and standards. These risks may be identified or demonstrated in building services, product development or research and development related projects. Applicant Aeronautical Engineering Technicians should strive to acquire experience in all generic engineering competencies of problem-solving implementation, operation, risk and impact mitigation and management of engineering activities.

4.3.10 Outcome 10: Be responsible for making decisions on part or all of well-defined engineering activities (Responsibility level E)

Responsible decision-making includes applying engineering knowledge acquired from accredited engineering programmes. It includes using relevant calculations to justify why certain solutions are chosen to solve well-defined engineering problems. Where an Applicant Engineering Technician does not have the required knowledge, it is responsible to ask for advice from a relevant authority or those who have the information. This could be on matters within the engineering discipline or other disciplines but impacting the work of the Applicant Engineering Technician. Any decisions taken should be evaluated for shortcomings to ensure no surprises at the end of the project/activity.

4.3.11 Outcome 11: Undertake sufficient professional development activities to maintain, extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work (Responsibility level D)

Professional development refers to continuing education and career training after a person has entered the workforce. Professional development assists in developing new skills, broadening of knowledge, staying up to date on current trends and technologies, and advancing one’s career. A registered Professional Engineering Technician is required to maintain and extend the level of competency through CPD activities to retain registration.

When applying for registration, applicants should provide evidence of IPD that has been attained during the training period. These activities could include engineering courses, management courses and computer courses. Enrolling for a postgraduate engineering programme is considered part of development activities. Applicants must be able to demonstrate professional development by:

- adopting a strategy for own professional development
- selecting appropriate professional development activities
- keeping thorough records of professional development activities
- demonstrating independent learning ability through completing developmental activities.

Professional development is essential for engineers to continuously improve their skills, advance their careers; to facilitate this key professional development, Applicants can consider the list of useful courses that present such learning activities (see paragraph **4.1.11** of this document).

If possible, a specific field of the subdiscipline is chosen, available developmental alternatives are established, a programme is drawn up (in consultation with the employer if costs are involved) and options that are open to expand knowledge into additional fields are investigated. Record-keeping must not be left to the employer or anybody else. Trainees must manage their own training independently by taking initiative and being in charge of experiential development towards the level of Professional Engineering Technician. Knowledge of the employer's policy and procedures on training is essential.

NB: Refer to **APPENDIX C** for various levels of development activities.

5. FUNCTIONS PERFORMED

Aeronautical engineering professionals form an integral part of broader engineering and aviation systems and development and maintenance of infrastructure in technologically complex manufacturing, processing, construction and product development and research environments.

5.1 Degrees of Responsibility

Progression throughout the candidacy period is presented in document **R-04-T&M-Guide-PC** and read in conjunction with **R-02-COP-AER**. **Table 2** refers to the gradual increase in the degrees of responsibility (DoR) that the Applicant engineers are exposed to during professional training. Considering the nature of the work, specific examples and outcomes appropriate to training in aeronautical engineering are presented in **Table 2** below:

Table 2: Progression throughout the candidacy period

Degree of Responsibility	Nature of Work	Activities/duties to be undertaken during training
A: Being Exposed	The Candidate undergoes induction and observes processes and work of competent practitioners.	• Understand the business environment and the dynamics that shape the businesses and industries in which they operate. • Understand the business model, its key processes and critical outcomes. • Understand the value added by Aeronautical and other Engineering Professionals in the business.
B: Assisting	The Candidate performs specific processes under close supervision.	• Develop insight and understanding of the different processes and systems in transforming inputs into goods and services. • Develop an appreciation of the numerous resources at the disposal of Aeronautical Engineering practitioners. • Obtain experience in the day-to-day operations of the business to gain insight and understanding of the different processes and systems involved in transforming inputs into goods and services, with specific emphasis on productivity and quality measurements.
C: Participating	The Candidate performs specific processes as directed, with limited supervision.	• Gain first-hand experience of a broad range of Aeronautical engineering activities (e.g., process design and re-engineering, planning and control, work study, value engineering, materials and information management, people management skills, logistics, specialists' inputs, tools and equipment, and quality assurance). • Note the problems and limitations of particular philosophies, methods and techniques, with emphasis on cost/effort and relative benefit.
D: Contributing	The Candidate performs specific work with detailed approval of work outputs.	• Be involved in activities such as the planning of production, control of quality and costs, materials handling and workplace layout, activity-based costing, benchmarking, business case evaluation, process re-engineering, maintenance practice and procedures, and project management and

Degree of Responsibility	Nature of Work	Activities/duties to be undertaken during training
		system specification. Of particular importance is the economical use of people, materials and machines. • Give specific attention to human aspects concerning communication, interpersonal relationships and teamwork, training, cost analysis, cost control and profit accountability.
E: Performing	The Candidate works in a team without supervision, recommends work outputs and is responsible but not accountable.	• Assume escalating technical responsibility and increased co-ordination of the work of others. • Gain exposure to and develop skills in management areas such as labour relations, management accounting, business law and general business management, all of which are important for developing well-rounded Engineering Practitioners. • Seek assignments that require judgement, even if full information is unavailable, which provide opportunities of professional responsibility.

Special consideration in the discipline, subdiscipline or specialty must be given to the competencies specified in the following groups:

- Group A: Knowledge-based problem-solving (this should be a strong focus)
- Group B: Management and communication
- Group C: Identifying and mitigating the impacts of engineering activity
- Group D: Judgement and responsibility
- Group E: Independent learning.

It is useful to measure the progression of a Candidate's competency using the DoR, Problem-Solving and Engineering Activity scales as specified in document **R-02-STA-PE/PT/PN**.

5.2 Candidate training programmes

5.2.1 Best practice

There is no ideal training programme structure or unique sequencing that constitutes best practice. The training programme for each Applicant depends on the available work opportunities at the time that are assigned to Applicant by the employer.

It is suggested that Applicants work with the appointed mentors to determine appropriate projects to gain exposure to elements of the asset cycle and to ensure their designs are constructible and operable and are designed considering lifecycle costing and long-term sustainability.

The training programme should be such that Applicant progress through the levels of work capability described in document **R-04-T&M-GUIDE-PC** so that by the end of the training period, Applicants exhibit the DoR allocated during the particular period of training and are able to perform individually and as a team member at the level of problem-solving and engineering activity required for registration.

The mentor and the Applicant must identify the level of responsibility that is required for an activity to be compliant and demonstrate the various exit level outcomes (ELOs). Evidence of the Applicant's activities and their acceptance by the mentor must be recorded on the appropriate system in order to meet the requirements of the Training Elements Appendix.

5.2.2 Realities

As stated by ECSA, the minimum period for the Candidacy Phase is 3 years. The likelihood, however, is that the period of training will be longer. This time frame is determined by the availability of opportunities and the exposure to various functions in the actual work environment.

Each Applicant must undertake a unique programme in which the various activities carried out at the discipline-specific level are linked to the generic competency requirements stated in document **R-08-CS-GUIDE-PE/PT/PN**.

5.2.3 Moving into or changing candidacy training programme

This DSTG assumes that an Applicant enters a programme after graduation and continues with the programme until ready to apply for registration. It also assumes that the Applicant is supervised and mentored by persons who meet the requirements stated in document **R-04-T&M-GUIDE-PC**. In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

- The Applicant must complete the Training and Experience Summary (TES) and the Training and Experience Reports (TERs) for the previous programme or unstructured experience. In the latter case, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off by the relevant supervisor or mentor.
- On entering the new programme, the mentor and supervisor should review the Applicant's development while mindful of previous experience and the opportunities and requirements of the new programme. At minimum, the mentor and supervisor should plan the next phase of the Applicant's programme.

6. CONCLUSION

To attain registration as a Professional, Applicants should be able to meet the educational requirements for the category and demonstrate competency against prescribed standard for the registration category. Demonstrating competency is achieved by meeting requirements for the 11 outcomes. Applicants or persons willing to be registered as professionals must ensure, together with their mentors, that the training provided is geared towards achieving the ECSA competency outcomes. Focusing on one training aspect for the entire duration of training will not assist Applicants to achieve the necessary skills to demonstrate all the standard competency outcomes.

The development of training remains the Applicant's responsibility, and the Applicant must ensure that the training plan being provided covers all aspects of the outcomes. It has been common practice that in situations where a department or organisation is unable to provide training in certain areas, secondments are arranged with other departments or organisations so that the Applicant is able to develop all the competencies required for registration. These secondments are usually reciprocal in nature and benefit the employee and the employer. Secondments between consultants and contractors and between the public and private sectors should be possible to allow Applicants to acquire the necessary competencies.

REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev 0 Draft A	19 March 2025	The DSTG has been merged into one Discipline-specific Training Guide for Registration as a Professional Engineer, Technologist and Technician in Industrial Engineering and to ensure that the DSTG clearly details how each outcome can be achieved.	RDDR BU
Rev 0 Draft B	16 May 2025	The review has included an introduction section. The document further indicates the type of engineering work that the different categories should undertake. Section 4. Developing Competency: Document (**R-08-PE/PT/PN**) Under training for registration as a professional engineer, professional engineering technologist and professional engineering technician has been revised to ensure that each training element is aligned to each outcome, *4.1.1 Investigation & Analysis* The content under this section is aligned with Outcome 1 *4.1.2 Engineering Design & Development of solution* The content under this section is aligned with Outcome 2 *4.1.3 Contextual Knowledge* The content under this section is aligned with Outcome 3 *4.1.4 Engineering Project Management* The content under this section is aligned with Outcome 4 *4.1.5 Professional Communication*	Working group

Revision number	Revision date	Revision details	Approved by
		The content under this section is aligned with Outcome 5 *4.1.6 Impact of Engineering Activities & Risk Mitigation* The content under this section is aligned with Outcome 6 *4.1.7 Statutory & Regulatory Requirements* The content under this section is aligned with Outcome 7 *4.1.8 Ethics of Engineering* The content under this section is aligned with Outcome 8 *4.1.9 Exercising sound judgment* The content under this section is aligned with Outcome 9 *4.1.10 Responsibility in Decision-making* The content under this section is aligned with Outcome 10 *4.1.11 Professional Development* The content under this section is aligned with Outcome 11	
Rev 0 Draft C	22 May 2025	Document revised and_sent to Registration BU for inputs and comments	RI BU, Registration BU and WG
Rev 0 Draft D	17 June 2025	RID BU reviewed comments and inputs from Registration BU and sent the document to WG to effect comments	RID BU and WG
Rev 0 Draft E	1 September 2025	Document submitted to the IEA Task Team for alignment to the IEA changes	IEA Review Task Team
Rev 0	5 September 2025	Reviewed and checked	Acting Executive: RSIR

Revision number	Revision date	Revision details	Approved by
Rev 0	19 September 2025	Approval	RPSC

The Discipline-specific Training Guide for

Registration as a Professional Engineer, Technologist, and Technician in Aeronautical Engineering

Revision 0 dated 19 September 2025 and consisting of 83 pages reviewed for adequacy by the Business Unit Assistant Manager and is approved by the Acting Executive: Regulatory Services & International Relations **(ERSIR)**.

....	7 October 2025
Business Unit Assistant Manager	Date
....	7 October 2025
Acting Executive: RSIR	Date

This definitive version of this policy is available on our website

APPENDIX A: TRAINING ELEMENTS

Synopsis: Applicants should achieve specific competencies at the prescribed level during their development towards professional registration, at the same time accepting more and more responsibility as experience is gained. The outcomes achieved and established during the candidacy phase should form the template for all engineering work performed after professional registration regardless of the level of responsibility at any particular stage of an engineering career:

1. Confirm understanding of instructions received and clarify if necessary.
2. Use theoretical training to develop possible solutions: select the best and present to the recipient.
3. Apply theoretical knowledge to justify decisions taken and processes used.
4. Understand role in the work team and plan and schedule work accordingly.
5. Issue complete and clear instructions and report comprehensively on work progress.
6. Be sensitive about the impact of the engineering activity and take action to mitigate this impact.
7. Consider and adhere to legislation applicable to the task and the associated risk identification and management.
8. Adhere strictly to high ethical behavioural standards and ECSA's Code of Conduct.
9. Display sound judgement by considering all factors, their interrelationship, consequences and evaluation when all evidence is not available.
10. Accept responsibility for own work by using theory to support decisions, seeking advice when uncertain and evaluating shortcomings.
11. Become conversant with employer's training and development programme and develop own lifelong development programme within this framework.

Complex, broadly defined and well-defined engineering work is usually characterised by the application of engineering deviating from standard procedures, codes and systems, the deviation verified by research, modelling and/or substantiated design calculations.

Responsibility Levels: A = Being Exposed; B = Assisting; C = Participating; D = Contributing; E = Performing.

Competency Standards for Registration as a Professional Engineering Technologist	Explanation and Responsibility Level
1. Purpose This standard defines the competence required for registration as a **Professional Engineer, Technologist and Technician**. Definitions of terms having particular meaning within this standard is given in text in relevant section.	DSTGs give context to the purpose of the Competency Standards. The **Engineer, Technologist and Technician** operate within the 12 disciplines ECSA recognises. Each discipline can be further divided into sub-disciplines and finally into specific workplaces as given in section 4 of the specific DSTG. DSTGs are used to facilitate experiential development towards ECSA registration and assist in compiling the required portfolio of evidence (specifically the Engineering Report in the application form). **NOTE:** The training period must be used to develop the trainee's competence towards achieving the standards below at a Responsibility Level E, i.e., Performing. (Refer to the specific DSTG)
2. Demonstration of competence Competence must be demonstrated within Complex, broadly defined and Well-defined *engineering activities,* defined below, by integrated performance of the outcomes defined at the level defined for each outcome. Required contexts and functions may be specified in the applicable DSTG. **Level Descriptor:** Complex engineering activities (**CEA**), broadly defined engineering activities (**BDEA**), and well-defined engineering activities (**WDEA**) have several of the following characteristics: a) Scope of practice area is linked to technologies used and changes by adoption of new technology into current practice. b) Practice area is located within a wider, complex context,	Engineering activities can be divided into (approximately): 5% Complex (Professional Engineers) 5% Broadly defined (Professional Engineering Technologists) 10% Well-defined (Professional Engineering Technicians) 15% Narrowly well-defined (Registered Specified Categories) 20% Skilled workman (Engineering Artisan) 55% Unskilled workman (Artisan Assistants) Activities can be in-house or contracted out; evidence of integrated performance can be submitted irrespective of the situation. **Level Descriptor: CEA, *BDEA and WDEA*** in the various disciplines are characterised by several or all of the following: a) Scope of practice area does not cover the entire field of the discipline (exposure limited to the sub-discipline and specific workplace). Some technologies used are well established and adoption of new technologies needs investigation and evaluation. b) Practice area varies substantially with unlimited location possibilities and an additional responsibility to

requires teamwork, and has interfaces with other parties and disciplines. c) Involves a variety of resources, including people, money, equipment, materials and technologies. d) Requires resolution of occasional problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues. e) Are constrained by available technology, time, finance, infrastructure, resources, facilities, standards and codes and applicable laws. f) Have significant risks and consequences in the practice area and in related areas.	identify the need for advice on **CEA, *BDEA and WDEA*** activities and problems. **CEA, *BDEA and WDEA*** activities in the sub-discipline needs interfacing with professional engineers, professional technicians, artisans, architects, financial staff, etc. as part of the team. c) The bulk of the work involves familiar, defined range of resources, including people, money, equipment, materials, but new technologies are investigated and implemented. d) Most of the impacts in the sub discipline are on wider issues, but some arise from conflicting technical and engineering issues that have to be addressed by the application of broadly defined non-standard engineering principles. e) The work packages and associated parameters are constrained by operational context with variations limited to different locations only. (Cannot be covered by standards and codes.) f) Even locally important minor risks can have far reaching consequences.
Activities include but are not limited to design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; manufacture or construction; engineering operations; maintenance; project management; research; development and commercialisation.	**Activities** include but are not limited to design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; engineering operations; maintenance; project management. For **Engineers, Technologists and Technicians**, research, development and commercialisation happen more frequently in some disciplines but are seldom encountered in others.
3. Outcomes to be satisfied:	**Explanation and Responsibility Level**
Group A: Engineering Problem Solving	
Outcome 1: Define, investigate and analyse *Complex, broadly defined and Well-defined,* engineering problems	**Responsibility Level E** Analysis of an engineering problem means the 'separation into parts possibly with comment and judgement'. Complex, *Broadly, Well-defined* means: 'not minute or detailed' and 'not kept within narrow limits'.

Complex, broadly defined and well-defined engineering problems have the following characteristics. a) They require coherent and detailed engineering knowledge, underpinning the technology area; and one or more of the following:	a) Coherent and detailed engineering knowledge for **Engineer, Technologist and Technician** means the problem encountered cannot be solved without the combination of all the relevant detail including engineering principles applicable to the situation.
b) Are ill-posed, under- or over-specified, require identification and interpretation into the technology area.	b) The nature of the problem is not immediately obvious, and further investigation to identify and interpret the real nature of the problem is necessary.
c) Encompass systems within complex engineering systems;	c) The problem is not easily recognised as part of the larger engineering task, project or operation and may be obscured by the complexity of the larger system.
d) Belong to families of problems which are solved in well-accepted but innovative ways. *and one or more of:*	d) It is recognised that the problem can be classified as ~~a~~ falling within a typical solution requiring innovative adaptation to meet the specific situation.
e) Can be solved by structured analysis techniques	e) Solving the problem needs a step-by-step approach adhering to proven logic.
f) May be partially outside standards and codes; must provide justification to operate outside.	f) The standards, codes and documented procedures must be analysed to determine to what extent they are applicable to solve the problem and justification must be given to operate outside these.
g) Require information from practice area and sources interfacing with practice area that is complex and incomplete.	g) The responsibility lies with the **Engineer, Technologist and Technician** to verify that some information received as part of the problem encountered may remain incomplete and solutions to problems may need justified assumptions.
h) Involve a variety of issues which may impose conflicting constraints: technical, engineering and interested or affected parties. *and one or both of:*	h) The problem handled by **Engineer, Technologist and Technician** may be solved by alternatives that are unaffordable, detrimental to the environment, socially unacceptable, not maintainable, not sustainable, etc; the **Engineer, Technologist and Technician** will have to justify his/her recommendation.
i) Require judgement in decision-making in practice area, considering interfaces to other areas.	i) Practical solutions to problems include knowledge and judgement of the roles displayed by the multi-disciplinary team and impact of own work in the interactive environment.
j) Have significant consequences which are important in practice area but may extend more widely.	j) **The Engineer, Technologist and Technician** must realise that their actions might seem to be of local importance only but may develop into significant consequences extending beyond their own ability and practice area.

Assessment criteria: A structured analysis of broadly defined problems typified by the following performances is expected: 1.1 Performed or contributed to defining engineering problems leading to an agreed definition of the problems to be solved. 1.2 Performed or contributed to investigating engineering problems including collecting, organising and evaluating information. 1.3 Performed or contributed to analysis of engineering problems using conceptualisation, justified assumptions, limitations and evaluation of results.	To perform an engineering task an **Engineer, Technologist and Technician** will typically receive an instruction from a senior person (customer) to do a specific task, and must: 1.1 Ensure the instruction is complete, clear and within his/her capability and that the person who issued the instruction agrees with his/her interpretation. 1.2 Ensure the engineering problem and related information are segregated from the bulk of the information, investigated and evaluated. 1.3 Ensure that the instruction and information to do the work is fully understood and complete, including engineering theory needed to understand the task and acceptance criteria, and to carry out and/or check calculations. If needed supplementary information must be gathered, studied and understood. Concepts and assumptions must be justified by engineering theory and calculations, if applicable.
3. Outcomes to be satisfied:	**Explanation and Responsibility Level**
Range statement: The problem may be a design requirement, an applied research and development requirement or a problematic situation in an existing component, system or process. The problem is one amenable to solution by technologies known to the Candidate. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.	Please refer to section 4 of the specific DSTG.
Outcome 2: Design or develop solutions to **complex, broadly defined and well-defined** engineering problems	**Responsibility Levels C and D** Design means ‘drawing or outline from which something can be made’. Develop means ‘come or bring into a state in which it is active or visible’.
Assessment criteria: This outcome is normally demonstrated after a problem analysis as defined in Outcome 1. Working	After the task received is fully understood and interpreted, a solution to the problem posed can be developed (designed). To synthesise a solution is ‘the combination of separate parts, elements, substances, etc. into a whole or into a system’ by the following:

systematically to synthesise a solution to a broadly defined problem, typified by the following performances is expected: 2.1 Designed or developed solutions to **complex, broadly defined and well-defined** engineering problems. 2.2 Systematically synthesised solutions and alternative solutions or approaches to the problem by analysing designs against requirements, including costs and impacts on outside parameters. (requirements). 2.3 Drawing up of detailed specification requirements and design documentation for implementation to the satisfaction of the client.	2.1 The development (design) of more than one way to solve an engineering task or problem should always be done, including the costing and impact assessment for each alternative. All the alternatives must meet the requirements set out by the instruction received, and the theoretical calculations to support each alternative must be done and submitted as an attachment. 2.2 The **Engineer, Technologist and Technician** will in some cases be unable to support proposals with the complete theoretical calculation to substantiate every aspect and must in these cases refer his / her alternatives to an engineer for scrutiny and support. The alternatives and alternative recommended must be convincingly detailed to win customer support for the alternative recommended. Selection of alternatives might be based on tenders submitted with alternatives deviating from those specified. 2.3 The best complete and final solution selected must be followed up with a detailed technical specification, supporting drawings, bill of quantities, etc. for the execution of work to meet customer requirements.
Range Statement: Solutions are those enabled by the technologies in the Candidate's practice area.	Applying theory to do ***complex, broadly defined and well-defined*** *engineering* work is mostly done in a way that has been used before, probably developed by engineers in the past, and documented in written procedures, specifications, drawings, models, examples, etc. **The Engineer, Technologist and Technician** must seek approval for any deviation from these established methods but must also initiate and/or participate in the development and revision of these norms.
Outcome 3: Comprehend and apply the knowledge embodied in widely accepted and applied engineering procedures, processes, systems or methodologies and those specific to the jurisdiction in which they practise.	**Responsibility Level E** Comprehend means 'to understand fully'. The jurisdiction in which an **Engineer, Technologist and Technician** practises is given in section 4 of the specific DSTG.
Assessment criteria: This outcome is normally demonstrated in the course of design, investigation or operations.	Design work for **Engineer, Technologist and Technician** is based on B Eng, BTech, N Dip, theory and is mostly the utilisation and configuration of manufactured components and selected materials and associated

3.1 Apply engineering principles, practices, technologies, including the application of, B Eng, BTech or B Eng (Tech) and N Dip, theory in the practice area. 3.2 Indicate working knowledge of areas of practice that interact with practice area to underpin teamwork. 3.3 Apply related knowledge of finance, statutory, safety and management.	novel engineering. **Engineers, Technologists and Technicians** develop and apply codes and procedures in their design work. Investigation would be on broadly defined incidents and condition monitoring, and operations mostly on developing and improving engineering systems and operations. 3.1 Calculations at B Eng, BTech or B Eng (Tech) and/or NDip, theoretical level confirming the correct application and utilisation of equipment, materials and systems listed in section 4 of the specific DSTG must be done on broadly defined activities. 3.2 The understanding of **complex, broadly defined, well defined,** procedures and techniques must be based on fundamental mathematical, scientific and engineering knowledge, as part of personal contribution within the engineering team. 3.3 The ability to manage the resources within legal and financial constraints must be evident.
Range Statement: Applicable knowledge includes the following: a) Technological knowledge that is well-established and applicable to the practice area irrespective of location, supplemented by locally relevant knowledge, for example, established properties of local materials. Emerging technologies are adopted from formulations of others. b) A working knowledge of interacting disciplines (engineering and other) to underpin teamwork. c) Jurisdictional knowledge includes legal and regulatory requirements as well as locally relevant codes of practice. As required for practice area, a selection of law of contract, health and safety, environmental, intellectual property, contract administration, quality management, risk management, maintenance management, regulation, project and construction management.	a) The specific location of a task to be executed is the most important determining factor in the layout design and utilisation of equipment. A combination of educational knowledge and practical experience must be used to substantiate decisions taken including a comprehensive study of systems, materials, components and projected customer requirements and expectations. New ideas, materials, components and systems must be investigated, evaluated and applied accompanied by complex theoretical motivation. b) In spite of having a working knowledge of interacting disciplines, **Engineer, Technologist and Technician** take responsibility for the multidisciplinary team of specialists like Civil Engineers on structures and roads, Mechanical Engineers on fire protection equipment, architects on buildings, Electrical Engineers on communication equipment, etc. c) Jurisdictional in this instance means ‘having the authority’, and **Engineer, Technologist and Technician** must be aware of and decide on the relevant requirements applicable to each specific project that he/she is responsible for. They are usually appointed as the ‘responsible person’ for specific projects in terms of the OHS Act.

Group B: Managing Engineering Activities	Explanation and Responsibility Level
Outcome 4: Manage part or all of one or more ***Complex, Broadly-defined and Well-defined*** engineering activities.	**Responsibility Level D** Manage means 'control'.
Assessment criteria: The Candidate is expected to display personal and work process management abilities: 4.1 Managed self, people, work priorities, processes and resources in broadly defined engineering work. 4.2 Role in planning, organising, leading and controlling broadly defined engineering activities evident. 4.3 Knowledge of conditions and operation of contractors and the ability.	In Engineering operations **Engineers, Technologists and Technicians** are typically given the responsibility to carry out projects. 4.1 Resources are usually subdivided based on availability and controlled by a work breakdown structure and scheduling to meet deadlines. Quality, safety and environment management are important aspects. 4.2 The basic elements of managements must be applied to broadly defined engineering work. 4.3 Depending on the project, the **Engineer, Technologist and Technician** can be the team leader, a team member or can supervise appointed contractors. To achieve this, maintenance of relationships is important and must be demonstrated.
Outcome 5: Communicate clearly with others in the course of his/her broadly defined engineering activities.	**Responsibility Level C**
Assessment criteria: Demonstrates effective communication by: 5.1 Ability to write clear, concise, effective technical, legal and editorially correct reports shown. 5.2 Ability to issue clear instructions to stakeholders using appropriate language and communication skills evident. 5.3 Oral presentations made using structure, style, language, visual aids	Refer to Range Statement for Outcome 4 and 5 below. Presentation of point of view mostly occurs in meetings and discussions with immediate supervisor.

Range Statement for Outcomes 4 and 5: Management and communication in ***complex, broadly defined and well-defined*** *engineering* involves: a) Planning ***complex, broadly defined and well-defined*** activities b) Organising ***complex, broadly defined and well-defined*** activities c) Leading ***complex, broadly defined and well-defined*** activities d) Controlling ***complex, broadly defined and well-defined*** activities.	a) Planning means 'the arrangement for doing or using something, considered in advance' b) Organising means 'put into working order, arrange in a system, make preparations for' c) Leading means to 'guide the actions and opinions of, influence, persuade' d) Controlling means the 'means of regulating, restraining, keeping in order, check' **The Engineer, Technologist and Technician** write specifications for the purchase of materials and/or work to be done, recommendations on tenders received, place orders and variation orders, write work instructions, report on work done, draw, correct and revise drawings, compile test reports, use operation and maintenance manuals to write work procedures, write inspection and audit reports, write commissioning reports, prepare and present motivations for new projects, compile budget reports, report on studies done and calculations carried out, report on customer requirements, report on safety incidents and risk analysis, report on equipment failure, report on proposed system improvement and new techniques, report on cost control, etc.
Group C: Impacts of Engineering Activity	**Explanation and Responsibility Level**
Outcome 6: Recognise the foreseeable social, cultural and environmental effects of ***complex, broadly defined and well-defined*** engineering activities generally	**Responsibility level B** Social means 'people living in communities; of relations between persons and communities'. Cultural means 'all the arts, beliefs, social institutions, etc. characteristic of a community'. Environmental means 'surroundings, circumstances, influences'.
Assessment criteria: This outcome is normally displayed in the course of analysis and solution of problems. The candidate typically shows: 6.1 Ability to identify interested and affected parties and their	6.1 Engineering impacts heavily on the environment, e.g., servitudes, expropriation of land, excavation of

expectations in regard to interactions between technical, social, cultural and environmental considerations shown.	trenches with associated inconvenience, borrow pits, dust and obstruction, street and other crossings, power dips and interruptions, visual and noise pollution, malfunctions, oil and other leaks, electrocution of human beings, detrimental effect on animals and wildlife, dangerous rotating and other machines, demolishing of structures, etc.
6.2 Measures taken to mitigate the negative effects of engineering activities evident.	6.2 Mitigating measures taken may include environmental impact studies, environmental impact management, community involvement and communication, barricading and warning signs, temporary crossings, alternative supplies (ring feeders and bypass roads), press releases, compensation paid, etc.
Outcome 7: Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his/her broadly defined engineering activities.	**Responsibility level E**
Assessment criteria: 7.1 Identified applicable legal and regulatory requirements including health and safety requirements for the engineering activity. 7.2 Circumstances stated where applicant assisted in or demonstrated awareness of the selection of safe and sustainable materials, components and systems and have identified risk and applied risk management strategies.	7.1 The OHS Act is supplemented by a variety of parliamentary acts, regulations, local authority by-laws, standards and codes of practice. Places of work might have standard procedures, instructions, drawings and operation and maintenance manuals available. These documents, depending on the situation (emergency, breakdown, etc.) are consulted before work is commenced and during the activity. 7.2 It is essential to attend a Risk Management (Assessment) course, and to investigate and study the materials, components and systems used in the workplace. The **Engineer, Technologist and Technician** seeks advice from knowledgeable and experienced specialists if the slightest doubt exist that safety and sustainability cannot be guaranteed.
Range Statement for Outcomes 6 and 7: Impacts and regulatory requirements include the following: a) Requirements include both explicit regulated factors and those that arise in the course of particular work. b) Impacts considered extend over the lifecycle of the project and include the consequences of the technologies applied.	a) The impacts will vary substantially with the location of the task, e.g., the impact of laying a cable or pipe in the main street of town will be entirely different to construction in a rural area. The methods, techniques or procedures will differ accordingly and may be complex. It is identified and studied by the **Engineer, Technologist and Technician** before starting the work. b) The Safety Officer and/or the Responsible Person appointed in accordance with the OHS Act usually confirms or checks that the instructions are in line with regulations. The **Engineer, Technologist and Technician** is responsible to see that this is done, and if not, establish which regulations apply, and ensure that they are adhered to. Usually, the people working on site are strictly controlled.W.r.t. health

	and safety, but the **Engineer, Technologist and Technician** checks that this is done, but may authorise unavoidable deviation after setting conditions for such deviations. Projects are mostly carried out where contact with the public cannot be avoided, and safety measures like barricading and warning signs must be used and maintained.
c) Effects to be considered include direct and indirect, immediate and long-term related to the technology used.	c) Effects associated with risk management are mostly well known if not obvious, and methods used to address, clearly defined. Risks are mostly associated with elevated structures, subsidence of soil, electrocution of human beings and moving parts on machinery. The **Engineer, Technologist and Technician** needs to identify, analyse and manage any long-term risks and develop strategies to solve these by using alternative technologies.
d) Safe and sustainable materials, components and systems.	d) The safe and sustainable materials, components and systems must be selected and prescribed by the **Engineer, Technologist and Technician** or other professional specialists must be consulted. It is the responsibility of the **Engineer, Technologist and Technician** to use his/her knowledge and experience to confirm that prescriptions by others are correct and safe.
e) Regulatory requirements are explicit for the context in general.	e) Application of regulations associated with the particular aspects of the project must be carefully identified and controlled by the **Engineer, Technologist and Technician**.
Group D: Exercise judgment, take responsibility, and act ethically	**Explanation and Responsibility Level**
Outcome 8: Conduct engineering activities ethically.	**Responsibility level E** Ethically means 'science of morals; moral soundness'. Moral means 'moral habits; standards of behaviour; principles of right and wrong'.
Assessment Criteria: Sensitivity to ethical issues and the adoption of a systematic approach to resolving these issues is expected, typified by: 8.1 Conversance and operation in compliance with ECSA's Rules of Conduct for registered persons confirmed 8.2 How ethical problems and affected parties were identified,	Systematic means 'methodical; based on a system'. 8.1 ECSA's Code of Conduct, as per ECSA's website, is known and adhered to. 8.2 Ethical problems that can occur include tender fraud, payment bribery, alcohol abuse, sexual

and the best solution to resolve the problem selected.	harassment, absenteeism, favouritism, defamation, fraudulent overtime claims, fraudulent expenses claimed, fraudulent qualifications, misrepresentation of facts, etc.
Outcome 9: Exercise sound judgement in the course of ***complex, broadly defined and well-defined*** engineering activities	**Responsibility level E** Judgement means 'good sense: ability to judge'.
Assessment criteria: Judgement is displayed by the following performance: 9.1 Judgement exercised in arriving at a conclusion within the application of technologies and their interrelationship to other disciplines and technologies. 9.2 Factors taken into consideration given, bearing in mind, risk, consequences in technology application and affected parties.	9.1 The extent of a project given to a junior **Engineer, Technologist and Technician** is characterised by the several broadly defined and a few well-defined factors and their resulting interdependence. He/she will seek advice if educational and/or experiential limitations are exceeded. 9.2 Taking risky decisions will lead to equipment failure, excessive installation and maintenance cost, damage to persons and property, etc. Evaluation includes engineering calculations to substantiate decisions taken and assumptions made.
Range Statement for Outcomes 8 and 9*:* *Judgement* in decision-making involves: a) taking several risk factors into account; **or** b) significant consequences in technology application and related contexts; **or** c) ranges of interested and affected parties with widely varying needs.	In Engineering, about 5% of engineering activities can be classified as broadly defined where the **Engineer, Technologist and Technician** use standard procedures, codes of practice, specifications, etc, but develops variations and completely unique standards when needed. Judgement must be displayed to identify any activity falling inside the broadly defined range, as defined above: a) Getting the work done in spite of numerous risk factors needs good judgement and substantiated decision-making. b) Consequences are part of the project e.g., extra cost due to unforeseen conditions, incompetent contractors, long-term environmental damage, etc. c) Interested and affected parties with defined needs that may be in conflict, e.g., need for a service irrespective of environmental damage, local traditions and preferences, etc. needs sound management and judgement.

Outcome 10: Be responsible for making decisions on part or all of one or more ***complex, broadly defined and well-defined*** engineering activities	**Responsibility level E** Responsible means 'legally or morally liable for carrying out a duty; for the care of something or somebody in a position where one may be blamed for loss, failure, etc.'.
Assessment criteria: Responsibility is displayed by the following performance: 10.1 Engineering, social, environment and sustainable development taken into consideration in discharging responsibilities for significant parts of one or more activities. 10.2 Advice sought from a responsible authority on matters outside your area of competence. 10.3 Academic knowledge of at least B Eng, BTech N Dip, level combined with past experience used in formulating decisions.[1]	10.1 All interrelated factors taken considered are indicative of professional responsibility accepted working on broadly defined activities. 10.2 The **Engineer, Technologist and Technician** does not operate on tasks at a higher level than, complex, broadly defined, well defined and consults professionals at engineer level if elements of the project to be done are beyond his/her education and experience, e.g., power system stability. 10.3 This is in the first instance continuous self-evaluation to ascertain that the task given is done correctly, on time and within budget. Continuous feedback to the originator of the task instruction and corrective action, if necessary, forms an important element. The calculations, for example fault levels, load calculations, losses, etc. are done to ensure that the correct material and components are utilised.
Range Statement: Responsibility must be discharged for significant parts of one or more ***complex, broadly defined and well-defined*** engineering activity.	The responsibility is mostly allocated within a team environment with an increasing designation as experience is gathered.
Note 1: Demonstrating responsibility is under supervision of a competent engineering practitioner but is expected to perform as if he/she is in a responsible position.	
Group E: Initial Professional Development (IPD)	**Explanation and Responsibility Level**
Outcome 11: Undertake independent learning activities sufficient to maintain and extend his or her competence.	**Responsibility level D**
Assessment criteria: Self-development managed typically: 11.1 Strategy independently adopted to enhance	11.1 If possible, a specific field of the sub-discipline is chosen, available developmental alternatives

professional development evident. 11.2 Awareness of philosophy of employer regarding professional development evident.	established, a programme drawn up (in consultation with employer if costs are involved), and options open to expand knowledge into additional fields investigated. 11.2 Record keeping must not be left to the employer or anybody else. The trainee must manage his/her own training independently, taking initiative and being in charge of experiential development towards **Engineer, Technologist and Technician** engineering**.**
Range Statement: Professional development involves: a) planning own professional development strategy b) selecting appropriate professional development activities c) recording professional development strategy and activities, while displaying independent learning ability.	a) In most places of work training is seldom organised by a training department. It is up to the **Engineer, Technologist and Technician** to manage his/her own experiential development. **Engineer, Technologist and Technician** frequently end up in a 'dead-end street' being left behind doing repetitive work. If self-development is not driven by him/herself, success is unlikely. b) Preference must be given to engineering development rather than developing soft skills. c) Developing a learning culture in the workplace environment of the **Engineer, Technologist and Technician** is vital to his/her success

APPENDIX B: TRAINING ELEMENTS SCOPE

1	**Introduction**
1.1	*Induction programme* (typically 1–5 days)
1.1.1	Company structure
1.1.2	Company policies
1.1.3	Company Code of Conduct
1.1.4	Company safety regulations
1.1.5	Company staff code
1.1.6	Company regulations
1.2	*Exposure to Practical Aspects of Engineering* (typically 6–12 months) *and covers how things are:* (Responsibility Levels A–B)
Experience in one or more of these sectors but not all:	
1.2.1.	Manufacturing
1.2.2	Construction
1.2.3	Erection
1.2.4	Field installation
1.2.5	Testing
1.2.6	Commissioning
1.2.7	Operation
1.2.8	Maintenance
1.2.9	Fault location
1.2.10	Problem investigation
2	**Design or develop solution**
2.1	*Experience in design and application of design knowledge (Typically 12–18 months) Focus is on planning, design and application* (Responsibility Levels C–D)
In one or more of the above sectors:	
2.1.1	Analysis of data and systems
2.1.2	System modelling and integration
2.1.3	System design
2.1.4	Component/product design
2.1.5	Research and investigation
2.1.6	Configuration Management

2.1.7	Application of quality systems
2.1.8	Development of standards
2.1.9	Preparation of specifications and associated documentation
2.1.10	Preparation of contract documents and associated documentation
3	**Engineering tasks**
3.1	*Experience in the execution of engineering tasks* (rest of training period). *Focus should be on projects and project management* (Responsibility Level E)
Working in one or more of these sectors but not all:	
3.1.1.	Design or develop solution
3.1.2	Manufacture
3.1.3	Modifications
3.1.4	Maintenance
3.1.5	Installation
3.1.6	Simulation
3.1.7	Testing
3.2	*Organising for implementation of 3.1* (Responsibility Level E)
3.2.1	Manage resources
3.2.2	Optimisation of resources and processes
3.3	*Controlling for implementation or operation of 3.1* (Responsibility Level E)
3.3.1	Monitor progress and delivery
3.3.2	Monitor quality
3.4	*Completion of 3.1* (Responsibility Level E)
3.4.1	Testing completion
3.4.2	Documentation completion
3.4.3	Documentation handover
3.5	*Maintenance and repair of 3.1* (Responsibility Level E)
3.5.1	Planning and scheduling maintenance
3.5.2	Monitor quality
3.5.3	Oversee maintenance and repair
4	**Risk and impact mitigation**
4.1	*Impact and risk assessments* (Responsibility Level E)
4.1.1	Risk assessments

4.2	*Regulatory compliance* (Responsibility Level E)
4.2.1	Health and safety
4.2.2	Codes and standards
4.2.3	Legal and regulatory
5	**Managing engineering activities**
5.1	*Self-management* (Responsibility Levels C–D)
5.1.1	Manages own activities
5.1.2	Communicates effectively
5.2	*Team environment* (Responsibility Levels C–D)
5.2.1	Participates in and contributes to team planning activities
5.2.2	Manages people
5.3	*Professional communication and relationships (networking)* (Responsibility Levels C–D)
5.3.1	Establishes and maintains professional and business relationships
5.3.2	Communicates effectively
5.4	*Exercising judgement and taking responsibility* (Responsibility Level E)
5.4.1	Ethical practices
5.4.2	Code of Conduct
5.4.3	Exercises sound judgement in the course of complex engineering activities
5.4.4	Is responsible for decision-making in some or all engineering activities
5.5	*Competency development* (Responsibility Level D)
5.5.1	Plans own development programme
5.5.2	Constructs initial professional development record

APPENDIX C: PROFESSIONAL DEVELOPMENT (OUTCOME 11)

Level	Professional Development Activity
Entry	• General Aviation Regulations • Occupational health and safety and regulations • Introduction to System Engineering Management • Basic conditions of employment • Introduction Labour Industrial Relations • Management principles and ethics • Basic Project and Finance Management • Negotiation skills • Public speaking and presentation skills • Technical report writing • Development of technical specifications • Introduction to Risk Management • Quality Management Systems • Environmental Management aspects
Intermediate	• Civil and/or military aviation regulations • Occupational health and safety and regulations • Preparation of standards and specifications • Intermediate project and finance management • Systems Engineering Management • Contract Management • Risk assessment, analysis and management • Quality Management Systems • Aircraft Maintenance Engineering • Environmental management • Technical and business report writing • Business presentation skills. • Attend aeronautical conferences and courses
Advanced	• Sustainability and ESG • Advanced business and project management • Advanced safety, health and environmental / sustainable development • Post-graduate qualification in aviation-related subjects, finance, marketing or business administration • Advanced systems engineering • Digitalisation and digital technologies • ECSA working groups to write or update governing documents • Advanced industrial relations and public relations.

APPENDIX D: DETAILED AERONAUTICAL ENGINEERING PROFESSIONS

1. Design Aeronautical Engineers, Technologists and Technicians

Aeronautical Design Engineers, Technologists and Engineering Technicians are those involved with the broadly defined aspects of design of aircraft and aircraft systems and who perform actual design such as preliminary design, performance predictions, aerodynamic design, structural design, power plant trade-off studies and control system design. Specific investigations could include literature studies, process evaluation, defect or failure investigations, product/system performance evaluation and manufacturing or production baseline studies. Information thus gathered may be used in design improvement, process optimisation, performance enhancement and product, system and plant efficiency upgrades. These are activities in which aerospace products and systems are designed to meet needs, specifications and standards.

The activities in the table below are recommended for Aeronautical Design Engineers, Technologists and Technicians in training.

Type of experience	Specific complex, broadly defined, well-defined activities
Problem/Requirements definition	• Formulation of user requirement statements (URS) • Generate performance specifications (Specs) • Qualification/verification matrix design *(Use standards/specifications/handbooks to guide in preparation of above documents.)*
Project planning (for design)	• Resource planning (computing/drafting/manufacturing, etc.) • Timescales, critical path, identification of bottlenecks/critical milestones, etc.
Examination of alternatives	• Literature study • Identifying potential techniques/technologies/materials • Generation of concepts • Elimination of unsuitable alternatives • Preliminary performance prediction
Trade-off studies	• Using decision-making tools to select between viable alternatives • Examining impacts of alternatives on ability to meet URS/Specs

Type of experience	Specific complex, broadly defined, well-defined activities
	• Negotiate with customers in regard to. requirement trade-offs and reformulation of URS/Specs
Detailed design	• Material selection • Aerofoil and high lift devices selection • Selection of components/sub-systems • Structural/aerodynamic/mechanical design • Performance prediction • Stress analysis • Aerodynamic analysis • Stability and control analysis and design • Hazard and operability (HAZOP) studies • Failure modes effects and criticality analysis (FMECA) • Updating of specifications • Maintenance requirements design
Design documentation	• Generation of drawings • Generation of design reports • Updating of documents/specifications as design progresses • Configuration control
Supervision of production	• Design of processes/tests • Handling of engineering queries/concessions/deviations • Design and implementation of quality control methods • Handling of materials • Handling of scrap/rework able items, etc.
Verification testing	• Qualification/verification test planning • Qualification/verification testing • Test report writing • Commissioning of plants/equipment
Product support	• Support during production testing • Support during operational testing and evaluation • Management of upgrades/repairs

2. Aeronautical Systems Engineers, Technologists and Technicians

Aeronautical Systems Engineers, Technologists and Technicians are those involved with the specification, in-service management and fleet engineering of aircraft or aircraft systems. These would typically be Engineering Technicians in organisations that operate fleets of aircraft and that are responsible for ensuring the continued airworthiness of the fleet and addressing obsolescence issues. These Engineering Technicians operate subject to regulations and regulating bodies such as the South Africa Civil Aviation Authority.

The following types of activities are recommended for Aeronautical Systems Engineers, Technologists and Technicians training:

Type of experience	Specific complex, broadly defined, well-defined activities
Maintaining airworthiness	• Identification and implementation of relevant service bulletins • Implementation of airworthiness directives • Implementation of ageing aircraft programmes • Health and utilisation monitoring • Failure reporting and corrective action (e.g., FMECA/FRACAS)
Maintenance optimisation	• Staggering (fleet utilisation & maintenance scheduling) • Negotiation with Original Equipment Manufacturers (OEMs) to adapt servicing for fleet specific requirements • Trend monitoring and maintenance adaptation
Fleet optimisation	• Fleet redesign and adaptation • Route planning for optimal fleet utilisation
Maintaining fleet currency	• Aircraft configuration currency analysis • Trade-off studies between cost and return of upgrades/retrofits vs fleet replacements • Aircraft configuration control

Type of experience	Specific complex, broadly defined, well-defined activities
Acquisition/Procurement projects	• Requirements definition for new products and systems • Integration of new weapons/equipment on existing aircraft • Design review activities • Selection and implementation of upgrades (typically such as would be covered under Supplemental Type Certificates) • Management of flight test and other acceptance testing activities • Oversight of suppliers during development activities (e.g. weapons development) • Monitoring compliance with certification compliance matrices • Commissioning of ground systems and support equipment (simulators, new maintenance equipment, etc.)

3. Aeronautical Certification Engineers, Technologists and Technicians

Certification Engineers, Technologists and Technicians are those involved with ensuring that aircraft systems meet the requirements of Airworthiness Regulations. These would typically be Engineering Technicians employed by the South African Civil Aviation Authority or within companies requesting certification of their products and whose responsibility is to ensure compliance with certification requirements.

The following types of activities are recommended for Certification Engineers, Technologists and Technicians training:

Type of experience	Specific complex, broadly defined, well-defined activities
Compliance testing	• Consultation with clients and other aviation authorities with regards to airworthiness requirements and regulations • Setting up compliance matrices • Oversight of flight test and other acceptance testing activities • Oversight of suppliers during development activities (e.g., weapons development)
Systems background	• Training in systems on one or more aircraft types • Troubleshooting and fault analysis • Use of design specifications during design or certification planning

Type of experience	Specific complex, broadly defined, well-defined activities
	• Floor level exposure to all aspects of aircraft maintenance • Participation in software development and certification
System safety analysis	• Training in and application of the system safety process • Application of fault tree, HAZOP, FMEA / FMECA and equivalent safety procedures
Organisational audits	• Advising organisations in creating and implementing their manuals of procedures • Quality systems and special process audits • Periodic auditing of approved manufacturing and maintenance organisations
Monitoring compliance with airworthiness directives, etc.	• Ensuring approved organisations and fleet operators implement applicable airworthiness directives • Auditing/monitoring correct implementation of Service Bulletins/ Ageing Aircraft Programmes
Accident investigations	• Serving as part of accident investigation teams • Overseeing accident investigations • Reviewing and analysing previous accident investigation reports for similarities/trends • Writing accident investigation reports
Generation of regulations	• Reviewing existing regulations • Generating or updating regulations

4. Flight Test Engineers, Technologists and Technicians

Flight Test engineering is a specialist field requiring an engineering qualification and then additional training as Flight Test Engineers, Technologists and Technicians at one of the Test Pilot/Engineering schools. Flight testing forms part of product development as well as verification testing towards certification of aircraft and systems.

The following types of activities are recommended for Flight Test Engineers, Technologists and Technicians training:

Type of experience	Specific complex, broadly defined, well-defined activities
Flight testing and ground testing	• Determination of relevant and necessary tests • Compilation of test objectives and test plans • Development of new testing techniques and equipment • Modifications to test aircraft • Performance testing and data analysis • Flutter clearance testing and data analysis • Cockpit evaluation • Electromagnetic interference/compatibility tests
Client liaison	• Negotiations with regards to flight testing • Writing of flight test report • Presentation of test results

5. Research and Development Engineers, Technologists, Technicians and Academics

Research and Development Engineers, Technologists and Technicians are those employed by universities and research organisations. Their focus is the development of new knowledge, techniques and technologies, and teaching students.

The following types of activities are recommended for Aeronautical Research and Development Engineers, Technologists and Technicians' training:

Type of experience	Specific complex, broadly defined, well-defined activities
Teaching	• Reading in applicable fields of knowledge • Curriculum development • Selection and development of teaching materials • Compilation of lecture notes • Compilation of examination papers • Demonstration of application of theory in practice • Serve as supervisor for student projects
Study and research	• Literature study • Obtaining higher qualifications • Advancement of the current state of the art of technology

Type of experience	Specific complex, broadly defined, well-defined activities
	• Theoretical research/development of analytical techniques • Practical/experimental research • Participating in international collaborative research
Consulting	• Consulting services for the industry to solve real problems encountered in engineering practice • Design of products, components and systems for clients

6. Design Aeronautical Engineers, Technologists and Technicians

Aeronautical Design Engineers, Technologists and Engineering Technicians are those involved with the broadly defined aspects of design of aircraft and aircraft systems and who perform actual design such as preliminary design, performance predictions, aerodynamic design, structural design, power plant trade-off studies and control system design. Specific investigations could include literature studies, process evaluation, defect or failure investigations, product/system performance evaluation and manufacturing or production baseline studies. Information thus gathered may be used in design improvement, process optimisation, performance enhancement and product, system and plant efficiency upgrades. These are activities in which aerospace products and systems are designed to meet needs, specifications and standards.

The activities in the table below are recommended for Aeronautical Design Engineers, Technologists and Technicians training.

Type of experience	Specific complex, broadly defined, well-defined activities
Problem/Requirements definition	• Formulation of user requirement statements (URS) • Generate performance specifications (Specs) • Qualification/verification matrix design *(Use standards/specifications/handbooks to guide in preparation of above documents.)*
Project planning (for design)	• Resource planning (computing/drafting/manufacturing, etc.) • Timescales, critical path, identification of bottlenecks/critical milestones, etc.
Examination of alternatives	• Literature study

Type of experience	Specific complex, broadly defined, well-defined activities
	• Identifying potential techniques/technologies/materials • Generation of concepts • Elimination of unsuitable alternatives • Preliminary performance prediction
Trade-off studies	• Using decision-making tools to select between viable alternatives • Examining impacts of alternatives on ability to meet URS/Specs • Negotiate with customers in regard to. requirement trade-offs and reformulation of URS/Specs
Detailed design	• Material selection • Aerofoil and high lift devices selection • Selection of components/sub-systems • Structural/aerodynamic/mechanical design • Performance prediction • Stress analysis • Aerodynamic analysis • Stability and control analysis and design • Hazard and operability (HAZOP) studies • Failure modes effects and criticality analysis (FMECA) • Updating of specifications • Maintenance requirements design
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Supervision of production	• Design of processes/tests • Handling of engineering queries/concessions/deviations • Design and implementation of quality control methods • Handling of materials • Handling of scrap/rework able items, etc.
Verification testing	• Qualification/verification test planning • Qualification/verification testing • Test report writing • Commissioning of plants/equipment
Product support	• Support during production testing • Support during operational testing and evaluation • Management of upgrades/repairs

7. Aeronautical Systems Engineers, Technologists and Technicians

Aeronautical Systems Engineers, Technologists and Technicians are those involved with the specification, in-service management and fleet engineering of aircraft or aircraft systems. These would typically be Engineering Technicians in organisations that operate fleets of aircraft and that are responsible for ensuring the continued airworthiness of the fleet and addressing obsolescence issues. These Engineering Technicians operate subject to regulations and regulating bodies such as the South Africa Civil Aviation Authority.

The following types of activities are recommended for Aeronautical Systems Engineers, Technologists and Technicians training:

Type of experience	Specific complex, broadly defined, well-defined activities
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Maintenance optimisation	• Staggering (fleet utilisation & maintenance scheduling) • Negotiation with OEMs to adapt servicing for fleet specific requirements • Trend monitoring and maintenance adaptation • Engineering management of suppliers and sub-contractors
Fleet optimisation	• Fleet redesign and adaptation • Route planning for optimal fleet utilisation
Maintaining fleet currency	• Aircraft configuration currency analysis • Trade-off studies between cost and return of upgrades/retrofits vs fleet replacements • Aircraft configuration control

Type of experience	Specific complex, broadly defined, well-defined activities
Acquisition/Procurement projects	• Requirements definition for new products and systems • Integration of new weapons/equipment on existing aircraft • Design review activities • Selection and implementation of upgrades (typically such as would be covered under Supplemental Type Certificates) • Management of flight test and other acceptance testing activities • Oversight of suppliers during development activities (e.g. weapons development) • Monitoring compliance with certification compliance matrices • Commissioning of ground systems and support equipment (simulators, new maintenance equipment, etc.)