APPENDIX A TO CAAP 5.23-1(1)

GENERIC RANGE OF VARIABLES

Table 1: Generic Range of Variables

Range of Variables
• Performance standards are to be demonstrated, in flight, in an aircraft of the appropriate category equipped with dual flight controls and electronic intercommunication between the trainee and the instructor or examiner. • Consistency of performance is achieved when competency is demonstrated on more than one flight. • Flight accuracy tolerances specified in the standards apply under flight conditions from smooth air up to, and including, light turbulence. • Where flight conditions exceed light turbulence appropriate allowances as determined by the assessor may be applied to the tolerances specified. • Infrequent temporary divergence from specified tolerances is acceptable if the pilot applies controlled corrective action. • Units and elements may be assessed separately or in combination with other units and elements that form part of the job function. • Assessment of an aircraft-operating standard also includes assessment of the threat and error management and human factors standards applicable to the unit or element. • Standards are to be demonstrated while complying with approved checklists, placards, aircraft flight manuals, operations manuals, standard operating procedures and applicable aviation regulations. • Performance of emergency procedures is demonstrated in flight following simulation of the emergency by the instructor or examiner, except where simulation of the emergency cannot be conducted safely or is impractical. • Assessment should not involve simulation of more than one emergency at a time. • Recreational and private pilots should demonstrate that control of the aircraft or procedure is maintained at all times but, if the successful outcome is in doubt corrective action is taken promptly to recover to safe flight. • Commercial and airline transport pilots should demonstrate that control of the aircraft or procedure is maintained at all times so that the successful outcome is assured. • The following evidence is used to make the assessment: – The trainee's licence and medical certificate as evidence of identity and authorisation to pilot the aircraft; – For all standards, the essential evidence for assessment of a standard is direct observation by an instructor or examiner of the trainee's performance in the specified units and elements, including aircraft operation and threat and error management (TEM); – Oral and written questioning of underpinning knowledge standards; – Completed flight plan, aircraft airworthiness documentation, appropriate maps and charts and aeronautical information; – Aircraft operator's completed flight records to support records of direct observation; – Completed achievement records for evidence of consistent achievement of all specified units and elements of competency; – The trainee's flight training records, including details of training flights and instructors comments, to support assessment of consistent achievement; and – The trainee's logbook for evidence of flight training completed.

Range of Variables
For licence and rating issue: – Completed application form, including, licence or rating sought, aeronautical experience, Chief Flying Instructor (CFI) recommendation and the result of the flight test; – Completed flight test report indicating units and elements completed; and – Examination results and completed knowledge deficiency reports.

Unit: Multi-Engine Aeroplane (Land) – Flight Standard

Unit Description: Skills, knowledge and behaviour to extract and interpret required performance information to calculate aeroplane weight and balance; to calculate take-off, climb, cruise, descent, landing and emergency flight performance; and to control a multi-engine aeroplane and operate all aeroplane systems in normal and abnormal flight in accordance with Flight Manual/pilot operating handbook (POH).

Element	Performance Criteria
1.1 Extract, interpret, calculate and apply normal and abnormal flight performance information.	• Extracts approved flight performance information from Flight Manual/POH, interprets and applies the information to calculate aircraft take-off and landing weight, centre of gravity and take-off and landing performance. • Extracts flight performance information from Flight Manual/POH, interprets and applies the information to the phase of flight and calculates aircraft performance during normal flight operations. • Applies performance information to calculate fuel requirements. • Extracts flight performance information from Flight Manual/POH, interprets and applies the information to failed engine(s) operations during any phase of flight.
1.2 Plan for asymmetric operations after take-off, during cruise and approach phases of flight.	*Engine failure after take-off* • Assesses weather and traffic conditions and terrain and formulates a plan that can be implemented following an engine failure after take-off to achieve the safest outcome. *Engine failure during cruise* • Determines asymmetric performance for the cruise phase of flight, analyses weather and terrain conditions, and formulates a plan that can be implemented following and engine failure during any stage of cruise flight to achieve the safest outcome. *Engine failure during visual and instrument approach* • Maintains situation awareness of aircraft position, altitude, configuration and weather during approach, and formulates a plan that includes actions before and after visual committal height that can be implemented following and engine failure on approach to achieve the safest outcome.
1.3 Operate multi-engine aeroplane (land) in all phases of flight.	• Controls multi-engine aircraft in all phases of normal flight to the appropriate standards specified for a private or commercial aeroplane pilot in the Day Visual Flight Rules (VFR) (Aeroplane) Syllabus. • Operates all aircraft systems, equipment and engines in accordance with Flight Manual/POH.
1.4 Manage abnormal or emergency situations in multi-engine aeroplane (land).	• Controls aeroplane. • Identifies and confirms abnormal or emergency situation. • Performs appropriate abnormal or emergency procedures in accordance with Flight Manual/POH and published procedures. • Advises Air Traffic Service (ATS) or another agency capable of assistance of situation and intentions.

1.5 Manage engine failure in multi-engine aeroplane (land).	• Self-briefs or briefs crew members, stating a plan of action that will ensure the safest outcome in the event of an engine failure. • Maintains control of aeroplane, identifies and confirms failed engine(s) and shuts down failed engine(s) following engine failure during any phase of flight, in accordance with Flight Manual/POH. • Operates aircraft in accordance with Flight Manual/POH during flight with failed engine(s). *Engine failure in flight (sequence of actions may be varied)* • Controls aircraft. • Sets power on serviceable engine(s) to ensure desired aircraft performance. • Shuts down failed engine(s) in accordance with Flight Manual/POH. • Configures aircraft to achieve minimum drag. • Controls aircraft without sideslip (1/2 ball out towards the lowered wing) or balances aircraft when applicable. • Maintains indicated airspeed at or above minimum control speed. • Climbs aircraft at V_{YSE} (+5-0kts) if applicable. • Lands aircraft at nearest appropriate landing area. *Rejected take-off* • Recognises and identifies cause for rejecting take-off. • Decides to reject take-off. • Controls aircraft and maintains aircraft on runway. • Closes throttle(s) on all engine(s). • Applies braking and other fitted retardation devices and stops aircraft in runway distance available. • Performs engine shutdown or abnormal procedures in accordance with Flight Manual/POH or Company Operations Manual. *Engine failure after take-off (EFATO)* • Controls aircraft. • Ensures maximum take-off power is applied to serviceable engine(s). • Identifies failed engines and confirms failure. • Feathers propeller (as applicable) and shuts down failed engine(s) in accordance with Flight Manual/POH. • Configures aircraft to achieve minimum drag. • Controls aircraft without sideslip (1/2 ball out towards the lowered wing) or balances aircraft when applicable. • Maintains aircraft at or above minimum control speed. • Climbs aircraft at V_{YSE} (+5-0 kts). • Lands aircraft at nearest appropriate landing area. *Manage engine failure after take-off below take of safety speed (V_{TOSS}) – aircraft will not accelerate or climb* • Sets power as required to manoeuvre aircraft to most suitable area to land.

	Perform overshoot from visual committal height • Determines visual committal height (consider 300 ft above ground level (AGL). • Initiates go-around at or above visual committal height. • Controls aircraft. • Applies maximum take-off power. • Configures aircraft to achieve minimum drag. • Maintains V_{YSE} (+5-0 kts). • Climbs to circuit height. • Reassesses situation for landing. *Manage engine failure below visual committal height* • Controls aircraft. • Lands aircraft.

Range of Variables

- Day VFR. or IFR
- Approved multi-engine aeroplane with dual controls, electronic intercom and dual control brakes.
- Aerodromes.
- Sealed, gravel or grass surfaces.
- Simulated emergencies.
- Simulated hazardous weather.

Underpinning Knowledge

General aircraft data

- Recall make, type and model of aircraft, designation of engines, take-off and rated power.
- Explain the relationship between take-off distance available and aircraft weight to accelerate stop distance.

Airspeed and load limitations

- Recall and apply all stated airspeed limitations including: V_{NO}, $V_{A,}$ V_X and V_Y, V_{NE}, V_{FE}, V_{LO}, V_{LE}, V_{LO2} (landing gear operations down), maximum crosswind, turbulence penetration speed and maximum load factor.
- Determine and apply accelerate/stop distance.

Emergency procedures

- Recall from memory and apply all stated emergency airspeeds including: V_{MCA}, V_{SSE}, engine(s) inoperative climb, approach and final speed, emergency descent and best glide range speeds.
- List applicable emergency procedures for: engine failure after take-off, engine fire on the ground and airborne, engine failure in the cruise, electrical fire on the ground and airborne, cabin fire in flight, rapid depressurisation, waste gate failure (if applicable) and propeller over-speed.
- Recall from memory all warnings stated in the Flight Manual.

Normal procedures

Fuel system

- Use a schematic diagram of the fuel system to explain layout and normal operating procedures
  - Explain operation of fuel selector panel;
  - Explain use of cross-feed;
  - Explain fuel-dumping procedures if applicable;
  - Recall full fuel capacity and fuel grade; and
  - State normal, minimum and maximum fuel pressures.

Hydraulic system

- Use a schematic diagram of the hydraulic system to explain layout and normal operating procedures:
  - Explain likely faults that may affect hydraulic system;
  - Explain emergency operating procedures;
  - Detail units or services operated by hydraulics; and
  - Recall type of hydraulic fluid, operating pressure and capacity of reservoir.

Electrical system

- Use a schematic diagram of the electrical system to:
  - Explain type(s) of electrical system alternating current/direct current (AC/DC);
  - State voltage and amperage of battery;
  - State number and output of generators;
  - Explain methods of circuit protection;
  - Locate fuses and circuit breakers;
  - Specify precautions to be taken when operating electrical service; and
  - Specify instruments operated by electrics.

Oil system

- Use a schematic diagram of the oil system to:
  - Explain function of the oil system;
  - State number of tanks, capacity and oil grade;
  - State oil source of constant speed unit (CSU) and propeller feathering;
  - State normal, minimum and maximum oil pressure and temperature; and
  - Explain operation of oil cooler shutters.

Autopilot

- Explain the principles of operation.
- Identify power sources, voltage or pressure.
- Explain procedure to determine gyros are operating normally.
- Explain procedure to engage autopilot.
- Explain normal and emergency procedure to disengage autopilot.
- Explain the conditions that will automatically disengage the autopilot.
- State the limits of gyro units.
- Explain pre-flight serviceability checks for autopilot.

Anti-icing and de-icing systems

- Explain method of de-icing aerofoils, propeller and carburettor.
- Explain heat or power source of de-icing/anti-icing equipment.
- Explain any system limitations.
- Explain operation and control of systems.

Heating, ventilation and pressurisation systems

- Explain normal procedures to operate and control system.
- Explain emergency operation of system.
- Recall all precautions to be complied with.

Pitot/static system

- Use a schematic diagram of the pitot/static system to:
  - Explain heating source of pitot system if applicable;
  - Explain operating procedure for pitot/static system;
  - Explain methods of detecting pitot/static system problems;
  - Explain procedures to rectify static system problems;
  - Identify location of pitot and static pressure source;
  - Locate alternate static source; and
  - Locate static drain points if applicable.

Gyro suction pressure system

- Use a schematic diagram of the suction system to:
  - Explain the function of the suction pressure system;
  - Identify source of suction or pressure;
  - State normal operating pressure;
  - List instruments operated by suction or pressure; and
  - Explain warning system to indicate suction pump failure.

Oxygen system

- Use a schematic diagram of the oxygen system to:
  - Explain type and principles of operation of system; and
  - Explain method of operation, flow and warning indicators, and characteristics of system.

Fire extinguisher system

- Use a schematic diagram of the fire extinguishing system to:
  - Explain what areas of aircraft are serviced by extinguishers;
  - Explain method of activation of fire extinguishers;
  - Explain method of cross-selection of fire bottles if applicable;
  - Explain fire warning indications;
  - State number of fire bottles fitted and identify contents;
  - Detail position, number and type of hand-held extinguishers; and
  - Explain precautions for the operation of fire extinguishers.

Engines

- Explain starting order and any starter limitations.
- State normal, minimum and maximum engine and oil temperatures and pressures.
- State all power limitations.
- State power combinations for take-off, climb, cruise and descent.
- Explain the use of supercharger on the ground and airborne.
- State all supercharger limitations.
- Interpret all engine instrument readings.
- Interpret and apply fuel flow indications.
- State revolutions per minute (RPM) settings for approach and landing.
- State maximum permitted RPM drop on magneto test.
- State engine idling speed.
- Explain precautions to be observed when unfeathering propeller on cold engines.
- State any appropriate engine limitations.

Weight, balance and performance

- Calculate take-off weight.
- State maximum take-off weight.
- State maximum take-off weight, landing weight, ramp weight and zero fuel weight.
- Demonstrate use of the Approved Loading System.
- Apply calculated centre of gravity position and confirm it is within limits.
- Relate mean aerodynamic chord to loading, fuel used and retraction or extension of undercarriage, reference point and turning moment in mm/kg.
- Calculate take-off distance for any specified conditions.
- Calculate landing distance for any specified conditions.
- Explain the procedures for landing on a wet or contaminated runway.

Failed engine operations - Multi-engine aeroplane less than 5700 kg

- Define V_{MCA}.
- Explain the relationship between minimum control speed (V_{MC}) and V_{MCA} and describe potential hazards with operation at low airspeeds with one engine failed or at low power.
- State the minimum control speed airborne (V_{MCA}) for the aircraft type flown.
- Explain the safety implications of asymmetric flight below minimum control speed.
- Explain the power, flight and configuration requirements that apply to V_{MCA}.
- Identify the critical engine (if there is one).
- Explain the methods of regaining control of an aircraft with a failed engine that is flying at a speed less than minimum control speed.
- Explain the relationship between minimum control speed at altitude and V_{S1} (clean stall speed), and the potential dangers of this condition of flight.
- Explain why asymmetric stalling and asymmetric stall recoveries should never be practiced.
- Explain the primary reason for V_{YSE}.
- Explain the performance implications of flying below or above V_{YSE} following an engine failure.
- Explain the parameters that apply to V_{SSE} and the factors that are taken into account in calculating this speed.
- Explain why simulated engine failures after take-off are not conducted below V_{SSE}
- Calculate initial rate of climb and climb gradient for one engine inoperative after take-off for specified conditions.
- Explain markings on the airspeed indicator that applies to asymmetric engine operations.
- Calculate fuel flow and true airspeed during cruise with one engine inoperative.
- Determine if the range of the aircraft increases or decreases following an engine failure.
- Calculate point of no return (PNR) for one engine inoperative with maximum fuel (Commercial Transport Pilot Licence [CPL] and Airline Transport Pilot Licence [ATPL]).
- Calculate equi time point (ETP) for one engine inoperative with maximum fuel (CPL and ATPL).

Multi-engine aeroplane with Large Aeroplane Performance

- Calculate V_1 for any specified take-off conditions.
- State the conditions that would increase V_1.
- Explain the function of V_2.
- Explain what performance the aircraft can achieve after reaching V_2 during asymmetric flight.

MULTI-ENGINE AEROPLANE (LAND) – ACHIEVEMENT RECORD

NAME: ..... ARN:.....

The standard for certification of each element is that all performance criteria for that element are met.

Unit	Element	Instructor/ARN /Date	Student/Date
1.1 Multi-engine aeroplane (land)	• Extract, interpret, calculate and apply normal and abnormal flight performance information		
	• Plan for asymmetric operations after take-off, during cruise and approach phases of flight		
	• Operate multi-engine aeroplane (land) in all phases of flight		
	• Manage abnormal or emergency situations in multi-engine aeroplane (land)		
	• Manage engine failure in multi-engine aeroplane (land)		

I have completed the training specified in the elements, which have been certified on this achievement record.

.....(Signature) Date .....

Attach this achievement record to the candidate's training records to be retained at the office of the flight training organisation. (FTO).