CHAPTER 3
LICENSING OF CREW MEMBERS OTHER THAN LICENCES FOR PILOTS

3.1 General rules concerning flight navigator and flight engineer licences

3.1.1 An applicant shall, before being issued with a flight navigator licence or a flight engineer licence, meet such requirements in respect of age, knowledge, experience, skill and medical fitness as are specified for those licences.

3.1.1.1 An applicant for a flight navigator licence or a flight engineer licence shall demonstrate such requirements for knowledge and skill as are specified for those licences, in a manner determined by MCAA.

3.2 Flight navigator licence

3.2.1 Requirements for the issue of the licence

3.2.1.1 *Age*
The applicant shall be not less than 18 years of age.

3.2.1.2 *Knowledge*
The applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a flight navigator licence, in at least the following subjects:

Air law

a) rules and regulations relevant to the holder of a flight navigator licence; appropriate air traffic services practices and procedures;

Flight performance, planning and loading

b) effects of loading and mass distribution on aircraft performance;
c) use of take-off, landing and other performance data including procedures for cruise control;
d) pre-flight and en-route operational flight planning; preparation and filing of air traffic services flightplans; appropriate air traffic services procedures; altimeter setting procedures;

Human performance

e) human performance relevant to the flight navigator including principles of threat and error management;

Note. *Guidance material to design training programmes on human performance, including threat and error management, can be found in the* Human Factors Training Manual *(Doc 9683).*

Meteorology

f) interpretation and practical application of aeronautical meteorological reports, charts and forecasts; codes and abbreviations; use of, and procedures for obtaining, meteorological information, pre-flight and in-flight; altimetry;
g) aeronautical meteorology; climatology of relevant areas in respect of the elements having an effect upon aviation; the movement of pressure systems; the structure of fronts, and the origin and characteristics of significant weather phenomena which affect take-off, en-route and landing conditions;

Navigation

h) dead-reckoning, pressure-pattern and celestial navigation procedures; the use of aeronautical charts, radio navigation aids and area navigation systems; specific navigation requirements for long-range flights;
i) use, limitation and serviceability of avionics and instruments necessary for the navigation of the aircraft;
j) use, accuracy and reliability of navigation systems used in departure, en-route and approach phases of flight; identification of radio navigation aids;

k) principles, characteristics and use of self-contained and external-referenced navigation systems; operation of airborne equipment;
l) the celestial sphere including the movement of heavenly bodies and their selection and identification for the purpose of observation and reduction of sights; calibration of sextants; the completion of navigation documentation;
m) definitions, units and formulae used in air navigation;

Operational procedures
n) interpretation and use of aeronautical documentation such as AIP, NOTAM, aeronautical codes, abbreviations, and instrument procedure charts for departure, en-route, descent and approach;

Principles of flight
o) principles of flight;

Radiotelephony
p) communication procedures and phraseology.

3.2.1.3 *Experience*

3.2.1.3.1 The applicant shall have completed in the performance of the duties of a flight navigator, not less than200 hours of flight time acceptable to MCAA, in aircraft engaged in cross-country flights, including not less than 30 hours by night.

3.2.1.3.1.1 When the applicant has flight time as a pilot, MCAA will determine whether such experience is acceptable and, if so, the extent to which the flight time requirements of 3.2.1.3.1 can be reduced accordingly.

3.2.1.3.2 The applicant shall produce evidence of having satisfactorily determined the aircraft's position in flight, and used that information to navigate the aircraft, as follows:

a) by night — not less than 25 times by celestial observations; and
b) by day — not less than 25 times by celestial observations in conjunction with self-contained or external-referenced navigation systems.

3.2.1.4 *Skill*
The applicant shall have demonstrated the ability to perform as flight navigator of an aircraft with a degree of competency appropriate to the privileges granted to the holder of a flight navigator licence, and to:
a) recognize and manage threats and errors;

Note. *Guidance material on the application of threat and error management is found in the* Procedures for Air Navigation Services — Training *(PANS-TRG, Doc 9868), Chapter 3, Attachment C, and in Part II, Chapter 2, of the* Human Factors Training Manual *(Doc 9683).*

b) exercise good judgement and airmanship;
c) apply aeronautical knowledge;
d) perform all duties as part of an integrated crew; and
e) communicate effectively with the other flight crew members.

3.2.1.5 *Medical fitness*
The applicant shall hold a current Class 2 Medical Assessment.

3.2.2 Privileges of the holder of the licence and the conditions to be observed in exercising such privileges Subject to compliance with the requirements specified in 1.2.5, 1.2.6 and 1.2.7.1, the privileges of the holder of a flight navigator licence shall be to act as flight navigator of any aircraft. If the privileges include radiotelephony communication, the licence holder shall comply with the requirements specified in 1.2.9.2.

3.3 Flight engineer licence

3.3.1 Requirements for the issue of the licence

3.3.1.1 *Age*
The applicant shall be not less than 18 years of age.

3.3.1.2 *Knowledge*

3.3.1.2.1 The applicant shall have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a flight engineer licence, in at least the following subjects:

Air law
a) rules and regulations relevant to the holder of a flight engineer licence; rules and regulations governing the operation of civil aircraft pertinent to the duties of a flight engineer;

Aircraft general knowledge
b) basic principles of powerplants, gas turbines and/or piston engines; characteristics of fuels, fuel systems including fuel control; lubricants and lubrication systems; afterburners and injection systems, function and operation of engine ignition and starter systems;
c) principles of operation, handling procedures and operating limitations of aircraft powerplants; effects of atmospheric conditions on engine performance;
d) airframes, flight controls, structures, wheel assemblies, brakes and anti-skid units, corrosion and fatigue life; identification of structural damage and defects;
e) ice and rain protection systems;
f) pressurization and air-conditioning systems, oxygen systems;
g) hydraulic and pneumatic systems;
h) basic electrical theory, electric systems (AC and DC), aircraft wiring systems, bonding and screening;
i) principles of operation of instruments, compasses, autopilots, radio communication equipment, radio and radar navigation aids, flight management systems, displays and avionics;
j) limitations of appropriate aircraft;
k) fire protection, detection, suppression and extinguishing systems;
l) use and serviceability checks of equipment and systems of appropriate aircraft;

Flight performance, planning and loading
m) effects of loading and mass distribution on aircraft handling, flight characteristics and performance; mass and balance calculations;
n) use and practical application of performance data including procedures for cruise control;

Human performance
o) human performance relevant to the flight engineer including principles of threat and error management;

Note. *Guidance material to design training programmes on human performance, including threat and error management, can be found in the* Human Factors Training Manual *(Doc 9683).*

Operational procedures
p) principles of maintenance, procedures for the maintenance of airworthiness, defect reporting, pre-flight inspections, precautionary procedures for fuelling and use of external power; installed equipment and cabin systems;
q) normal, abnormal and emergency procedures;
r) operational procedures for carriage of freight and dangerous goods;

Principles of flight
s) fundamentals of aerodynamics;
Radiotelephony
t) communication procedures and phraseology.

3.3.1.2.2 The applicant should have demonstrated a level of knowledge appropriate to the privileges granted to the holder of a flight engineer licence in at least the following subjects:

a) fundamentals of navigation; principles and operation of self-contained systems; and
b) operational aspects of meteorology.

3.3.1.3 *Experience*

3.3.1.3.1 The applicant shall have completed, under the supervision of a person accepted by MCAA for that purpose, not less than 100 hours of flight time in the performance of the duties of a flight engineer. MCAA will determine whether experience as a flight engineer in a flight simulator, which it has approved, is acceptable as part of the total flight time of 100 hours. Credit for such experience will be limited to a maximum of 50 hours.

3.3.1.3.1.1 When the applicant has flight time as a pilot, MCAA will determine whether such experience is acceptable and, if so, the extent to which the flight time requirements of 3.3.1.3.1 can be reduced accordingly.

3.3.1.3.2 The applicant shall have operational experience in the performance of the duties of a flight engineer, under the supervision of a flight engineer accepted by MCAA for that purpose, in at least the following areas:

a) *Normal procedures*
   — pre-flight inspections
   — fuelling procedures, fuel management
   — inspection of maintenance documents
   — normal flight deck procedures during all phases of flight
   — crew coordination and procedures in case of crew incapacitation
   — defect reporting
b) *Abnormal and alternate (standby) procedures*
   — recognition of abnormal functioning of aircraft systems
   — use of abnormal and alternate (standby) procedures
c) *Emergency procedures*
   — recognition of emergency conditions
   — use of appropriate emergency procedures

3.3.1.4 *Skill*

3.3.1.4.1 The applicant shall have demonstrated the ability to perform as flight engineer of an aircraft, the duties and procedures described in 3.3.1.3.2 with a degree of competency appropriate to the privileges granted to the holder of a flight engineer licence, and to:

a) recognize and manage threats and errors;

Note. *Guidance material on the application of threat and error management is found in the* Procedures for Air Navigation Services — Training *(PANS-TRG, Doc 9868), Chapter 3, Attachment C, and in Part II, Chapter 2, of the* Human Factors Training Manual *(Doc 9683).*

b) use aircraft systems within the aircraft's capabilities and limitations;
c) exercise good judgement and airmanship;
d) apply aeronautical knowledge;
e) perform all the duties as part of an integrated crew with the successful outcome assured; and
f) communicate effectively with the other flight crew members.

3.3.1.4.2 The use of a flight simulation training device for performing any of the procedures required during the demonstration of skill described in 3.3.1.4.1 will be approved by MCAA, which shall ensure that the flight simulation training device is appropriate to the task.

3.3.1.5 *Medical fitness*
The applicant shall hold a current Class 2 Medical Assessment.

3.3.2 Privileges of the holder of the licence and the conditions to be observed in exercising such privileges

3.3.2.1 Subject to compliance with the requirements specified in 1.2.5, 1.2.6 and 1.2.7.1, the privileges of the holder of a flight engineer licence shall be to act as flight engineer of any type of aircraft on which the holder has demonstrated a level of knowledge and skill, as determined by MCAA on the basis of those requirements specified in 3.3.1.2 and 3.3.1.4 which are applicable to the safe operation of that type of aircraft.

3.3.2.2 The types of aircraft on which the holder of a flight engineer licence is authorized to exercise the privileges of that licence, shall be either entered on the licence or recorded elsewhere in a manner acceptable to MCAA.

3.4 Flight radiotelephone operator

An applicant having attained an aeroplane, airship, helicopter or powered-lift pilot licences will deem to have attained a flight radio operator licence. No endorsements are required on the above categories of licences to exercise the privileges of flight radio telephone operator

Note *Skill and knowledge requirements on radiotelephony procedures and phraseology have been developed as an integral part of all aeroplane, airship, helicopter and powered-lift pilot licences*