Study and Reference Guide
for written examinations
for the

Commercial Pilot Licence
Aeroplane

Sixth Edition
November 2009
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GENERAL INFORMATION

EXAMINATION PREREQUISITES
CAR 401.13(1)
Prior to taking a written examination, an applicant for a flight crew permit, licence or rating shall meet the prerequisites for the examination set out in the personnel licensing standards with respect to

a) medical fitness;
b) identification;
c) a recommendation from the flight instructor who is responsible for the training of the applicant; and
d) experience.

KNOWLEDGE REQUIREMENTS
Applicants for the Commercial Pilot Licence in the Aeroplane Category shall demonstrate their knowledge by writing a Transport Canada multiple choice examination on the subjects contained in this guide. Applicants must be able to read the examination questions in either English or French without assistance.

All subjects in this guide are considered to be important to applicants for the Commercial Pilot Licence - Aeroplane. Some of the subjects appeared in the Private Pilot study guide. Additional subjects, and those where more depth of understanding is required at the commercial level, are shaded (this paragraph is an example). Subjects marked with a bullet (†) are considered essential knowledge for the commercial applicant.

EXAMINATION RULES
CAR 400.02
(1) Except as authorized by an invigilator, no person shall, or shall attempt to, in respect of a written examination,

a) copy or remove from any place all or any portion of the text of the examination;
b) give to or accept from any person a copy of all or any portion of the text of the examination;
c) give help to or accept help from any person during the examination;
d) complete all or any portion of the examination on behalf of any other person; or
e) use any aid or written material during the examination.

(2) A person who commits an act prohibited under subsection (1) fails the examination and may not take any other examination for a period of one year.

MATERIALS REQUIRED
A pencil is required for rough work. Electronic calculators are useful and are permitted if their memory is cleared before and after the examination. Computers capable of storing text are not approved. Navigation tools (rulerSCALE, protractor, flight computer) are required for the navigation questions. A list of approved electronic navigation computers is available at: http://www.tc.gc.ca/civilaviation/general/exams/computers.htm

TIME LIMITS
Examinations, including all sections of a sectionalized examination, that are required for the issuance of a permit or licence or for the endorsement of a permit or licence with a rating shall
be completed during the 24-month period immediately preceding the date of the application for
the permit, licence or rating.

**REWRITING OF EXAMINATIONS**

**CAR 400.04(1)**

Subject to subsections (2) and (6), a person who fails an examination or a section of a
sectionalized examination required for the issuance of a flight crew permit, licence, rating or
foreign licence validation certificate is ineligible to rewrite the examination or the failed section
for a period of

a) in the case of a first failure, 14 days;
b) in the case of a second failure, 30 days; and
c) in the case of a third or subsequent failure, 30 days plus an additional 30 days for
each failure in excess of two failures, up to a maximum of 180 days.

**EXAMINATION FEEDBACK**

Feedback statements on the results letter will inform the candidate where questions were
answered incorrectly.

**Example of Feedback Statement**

Identify the atmospheric conditions favourable to thunderstorm formation.
EXAMINATIONS

FULL EXAMINATION

<table>
<thead>
<tr>
<th>Examination</th>
<th>Questions</th>
<th>Time Limit</th>
<th>Pass Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Pilot – Aeroplanes (CPAER)</td>
<td>100</td>
<td>3½ hours</td>
<td>60%</td>
</tr>
</tbody>
</table>

This examination is sectionalized into four mandatory subject areas and requires an overall pass mark of 60%. As well, the candidate must achieve 60% in each of the four mandatory subject areas. They are:

<table>
<thead>
<tr>
<th>Mandatory Subjects</th>
<th>Related Study and Reference Guide</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR LAW</td>
<td>Air Law and Procedures – Section 1</td>
<td>5</td>
</tr>
<tr>
<td>NAVIGATION</td>
<td>Navigation and Radio Aids – Section 2</td>
<td>14</td>
</tr>
<tr>
<td>METEOROLOGY</td>
<td>Meteorology – Section 3</td>
<td>16</td>
</tr>
<tr>
<td>AERONAUTICS - GENERAL KNOWLEDGE</td>
<td>Airframes, Engines, and Systems–Section 4</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Theory of Flight – Section 5</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Flight Instruments – Section 6</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Flight Operations – Section 7</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Human Factors – Section 8</td>
<td>23</td>
</tr>
</tbody>
</table>

Applicants who obtain less than 60% on the overall examination will, for licensing purposes, be required to rewrite the complete paper. The rewrite provisions detailed in the CARs, Part IV, apply.

SUPPLEMENTARY EXAMINATIONS

Applicants who obtain 60% or more on the overall examination (CPAER), but who fail one or more mandatory subject areas will be assessed a partial pass. During one sitting, they will be required to write supplementary examinations for each subject area failed. Details on the mandatory subject area supplementary examinations are as follows:

<table>
<thead>
<tr>
<th>Examination</th>
<th>Questions</th>
<th>Time Limit</th>
<th>Pass Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR LAW (CALAW)</td>
<td>20</td>
<td>1 hour</td>
<td>60%</td>
</tr>
<tr>
<td>NAVIGATION (CANAV)</td>
<td>25</td>
<td>2 hours</td>
<td>60%</td>
</tr>
<tr>
<td>METEOROLOGY (CAMET)</td>
<td>25</td>
<td>1½ hours</td>
<td>60%</td>
</tr>
<tr>
<td>AERONAUTICS– GENERAL KNOWLEDGE</td>
<td>35</td>
<td>1½ hours</td>
<td>60%</td>
</tr>
</tbody>
</table>

**NOTE:** When writing more than one supplementary examination, the maximum time allowed shall be the sum of the times indicated for each examination, not to exceed 3½ hours.

Although the overall and supplementary examinations contain questions related mostly to the sections shown under the above four mandatory subject areas, there may be occasions where knowledge from another subject area is required to arrive at the correct response. For example, a practical question on fuel calculations under Navigation and Radio Aids – Section 2 may require knowledge of VFR fuel requirements under Air Law and Procedures – Section 1.
HELCOPTER TO AEROPLANE EXAMINATION
Pilots who hold a valid Canadian Commercial or Airline Transport Pilot Licence in the Helicopter Category and who wish to apply for a Commercial Pilot Licence, Aeroplane Category, shall demonstrate their knowledge by writing the following Transport Canada multiple choice examination:

<table>
<thead>
<tr>
<th>Examination</th>
<th>Questions</th>
<th>Time Limit</th>
<th>Pass Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Pilot Aeroplane Rating – Alternate Category (CARAC)</td>
<td>35</td>
<td>1½ hours</td>
<td>60%</td>
</tr>
</tbody>
</table>

The CARAC examination is based on subjects contained in the following sections of this Guide: Air Law and Procedures; Meteorology – Upper Air Charts; Airframes, Engines and Systems; Theory of Flight; Flight Instruments; Flight Operations; and Human Factors.

CANADIAN FORCES PILOTS
Canadian Forces pilots who are qualified to wings standards shall demonstrate their knowledge by writing the following Transport Canada multiple choice examination:

<table>
<thead>
<tr>
<th>Examination</th>
<th>Questions</th>
<th>Time Limit</th>
<th>Pass Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Law, Air Traffic Rules and Procedures (ARPCO)</td>
<td>30</td>
<td>1 hour</td>
<td>60%</td>
</tr>
</tbody>
</table>

The ARPCO examination is based on subjects contained in the following sections of this Guide: Air Law and Procedures; Navigation and Radio Aids – Pre-Flight Preparation; Navigation and Radio Aids – Other Radio and Radar Aids; Flight Operations – General; and Flight Operations – Aircraft Critical Surface Contamination.

UNITED STATES OF AMERICA PILOT CERTIFICATE TO CANADIAN COMMERCIAL PILOT LICENCE – AEROPLANE
Pilots who hold a United States of America FAA Commercial Pilot Certificate, or Airline Transport Pilot Certificate – Aeroplane, that has not been “Issued on the basis...” of another foreign licence, shall demonstrate their knowledge by writing the following Transport Canada multiple choice examination:

<table>
<thead>
<tr>
<th>Examination</th>
<th>Questions</th>
<th>Time Limit</th>
<th>Pass Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Pilot Licence - Aeroplane for conversion from a United States of America Pilot Certificate (FAACA)</td>
<td>20</td>
<td>1 hour</td>
<td>60%</td>
</tr>
</tbody>
</table>

The FAACA examination is based on the differences between FAA and TC air law and communication procedures. Candidates should read the recommended references on pages 25 and 26 as they apply to aeroplanes in VFR operations.
AIR LAW

SECTION 1: AIR LAW AND PROCEDURES
CARs
Some Canadian Aviation Regulations (CARs) refer to their associated standards. Questions from the CARs may test knowledge from the regulation or the standard.

PART I – GENERAL PROVISIONS
101 – INTERPRETATION

101.01 Interpretation (Definitions)

103 – ADMINISTRATION AND COMPLIANCE

COMPLIANCE

103.02 Inspection of Aircraft, Requests for Production of Documents and Prohibitions
103.03 Return of Canadian Aviation Documents
103.04 Record Keeping

PART II – AIRCRAFT IDENTIFICATION AND REGISTRATION
202 – AIRCRAFT MARKING AND REGISTRATION

AIRCRAFT MARKS

202.01 Requirements for Marks on Aircraft

CERTIFICATES OF REGISTRATION

202.26 Carrying Certificate of Registration on Board

TRANSFER OF LEGAL CUSTODY AND CONTROL

202.35 General

203 – OPERATION OF A LEASED AIRCRAFT BY A NON-REGISTERED OWNER

203.02 Application
203.03 Leasing Operations - General
PART III – AERODROMES AND AIRPORTS
300 – INTERPRETATION

300.01 Interpretation

301 – AERODROMES

301.01 Application
301.04 Markers and Markings
301.07 Lighting
301.08 Prohibitions
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302 – AIRPORTS

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400 – GENERAL

400.01 Interpretation

401 – FLIGHT CREW PERMITS, LICENCES AND RATINGS

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401.03 Requirement to Hold a Flight Crew Permit, Licence or Rating
401.04 Flight Crew Members of Aircraft Registered in Contracting States Other Than Canada
401.05 Recency Requirements
401.08 Personal Logs

COMMERCIAL PILOT LICENCE - AEROPLANE

401.30 Privileges

404 – MEDICAL REQUIREMENTS

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404.03 Requirement to Hold a Medical Certificate (MC)
404.04 Issuance, Renewal and Validity Period of MC
404.06 Prohibition Regarding Exercise of Privileges

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406.02 Application
406.03 Requirement to Hold a Flight Training Unit Operating Certificate
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600 – INTERPRETATION

600.01 Interpretation

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AIRSPACE STRUCTURE, CLASSIFICATION AND USE
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601.02 Airspace Classification
601.03 Transponder Airspace
601.04 IFR or VFR Flight in Class F Special Use Restricted Airspace or Class F Special Use Advisory Airspace
601.06 Visual Flight Rules (VFR) Flight in Class A Airspace
601.07 VFR Flight in Class B Airspace
601.08 VFR Flight in Class C Airspace
601.09 VFR Flight in Class D Airspace

AIRCRAFT OPERATING RESTRICTIONS AND HAZARDS TO AVIATION SAFETY
601.14 Interpretation
601.15 Forest Fire Aircraft Operating Restrictions
601.16 Issuance of NOTAM for Forest Fire
601.17 Exceptions
601.20 Projection of Directed Bright Light Source at an Aircraft

602 – OPERATING AND FLIGHT RULES

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602.01 Reckless or Negligent Operation of Aircraft
602.02 Fitness of Flight Crew Members
602.03 Alcohol or Drugs – Crew Members
602.04 Alcohol or Drugs – Passengers
602.05 Compliance with Instructions
602.06 Smoking
602.07 Aircraft Operating Limitations
602.08 Portable Electronic Devices
602.09 Fuelling with Engines Running
602.10 Starting and Ground Running of Aircraft Engines
602.11 Aircraft Icing
602.12 Overflight of Built-up Areas or Open-air Assemblies of Persons during Take-offs, Approaches and Landings
602.13 Take-offs, Approaches and Landing within Built-up Areas of Cities and Towns
602.14 Minimum Altitudes and Distances
602.15 Permissible Low Altitude Flight
602.19 Right-of-Way – General
602.20 Right-of-Way – Aircraft Manoeuvring on Water
602.21 Avoidance of Collision
602.22 Towing
602.23 Dropping of Objects
602.24 Formation Flight
602.25 Entering or Leaving an Aircraft in Flight
602.26 Parachute Descents
602.27 Aerobatic Manoeuvres – Prohibited Areas and Flight Conditions
602.28 Aerobatic Manoeuvres with Passengers
VISUAL FLIGHT RULES
- 602.114 Minimum Visual Meteorological Conditions for VFR Flight in Controlled Airspace
- 602.115 Minimum Visual Meteorological Conditions for VFR Flight in Uncontrolled Airspace
- 602.116 VFR Over-the-Top
- 602.117 Special VFR Flight

RADIOCOMMUNICATIONS
- 602.136 Continuous Listening Watch
- 602.138 Two-way Radiocommunication Failure in VFR Flight

EMERGENCY COMMUNICATIONS AND SECURITY
- 602.143 Emergency Radio Frequency Capability
- 602.144 Interception Signals, Interception of Aircraft and Instructions to Land
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- 602.146 ESCAT Plan

603 – SPECIAL FLIGHT OPERATIONS

SPECIAL AVIATION EVENTS
- 603.01 Certification Requirements for Special Aviation Events

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- 603.36 Application
- 603.37 Certification Requirements for Parachute Operations

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- 604.03 Certificate

605 – AIRCRAFT REQUIREMENTS

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- 605.04 Availability of Aircraft Flight Manual
- 605.05 Markings and Placards
- 605.06 Aircraft Equipment Standards and Serviceability
- 605.07 Minimum Equipment List
- 605.08 Unserviceable and Removed Equipment – General
- 605.09 Unserviceable and Removed Equipment – Aircraft with a Minimum Equipment List
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  605.16 Power-driven Aircraft – Night VFR
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  605.22 Seat and Safety Belt Requirements
  605.23 Restraint System Requirements
  605.24 Shoulder Harness Requirements
  605.25 General Use of Safety Belts and Restraint Systems
  605.26 Use of Passenger Safety Belts and Restraint System
  605.27 Use of Crew Member Safety Belts
  605.28 Child Restraint System
  605.29 Flight Control Locks
  605.30 De-icing or Anti-icing Equipment
  605.31 Oxygen Equipment and Supply
  605.32 Use of Oxygen
  605.35 Transponder and Automatic Pressure Altitude Reporting Equipment
  605.38 ELT – Sub-sections (1), (2) and 3(d), (e) and (g)
  605.39 Use of ELTs
  605.40 ELT Activation

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  605.85 Maintenance Release and Elementary Work
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  605.88 Inspection After Abnormal Occurrences

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  605.92 Requirement to Keep Technical Records – Sub-section (1) and (2)
  605.93 Technical Records – General
  605.94 Journey Log Requirements
  605.95 Journey Log – Carrying on Board
  605.97 Transfer of Records

606 – MISCELLANEOUS
  606.01 Munitions of War
  606.03 Synthetic Flight Training Equipment
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700.02 Requirements for Air Operator Certificates

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700.14 Monitoring System – Sub-section (2)
700.15 Flight Time Limitations – Sub-sections (1) (a), (b), (c) and (e)
700.16 Flight Duty Time Limitations and Rest Periods – Sub-section (1), (3) and (4)
700.17 Unforeseen Operational Circumstances

702 – AERIAL WORK OPERATIONS

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702.01 Application

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702.11 Operating Instructions – Sub-section (2)
702.13 Flight Authorization
702.14 Operational Flight Plan
702.16 Carriage of Persons
702.17 VFR Flight Minimum Flight Visibility – Uncontrolled Airspace
702.18 Night VFR OTT and IFR Operations
702.20 Aircraft Operating over Water
702.23 Briefing of Persons other than Flight Crew Members
702.24 Operation of Aircraft in Icing Conditions

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702.44 Shoulder Harness
702.45 External Load Equipment

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702.65 Flight Crew Member Qualifications – Sub-sections (a), (c) and (d)
702.67 Validity Period – Sub-sections (1) and (2)

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702.76 Training Program – Sub-sections (1) and (2)

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702.83 Distribution of Company Operations Manual
702.84 Standard Operating Procedures
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    703.14 Operating Instructions – Sub-section (2)
    703.17 Flight Authorization
    703.18 Operational Flight Plan
    703.22 Transport of Passengers in Single-Engined Aircraft
    703.23 Aircraft Operating over Water
    703.24 Number of Passengers in Single-Engined Aircraft
    703.25 Carriage of External Loads
    703.26 Simulation of Emergency Situations
    703.27 VFR Flight Obstacle Clearance Requirements
    703.28 VFR Flight Minimum Flight Visibility – Uncontrolled Airspace
    703.29 VFR Flight Weather Conditions
    703.33 VFR OTT Flight
    703.34 Routes in Uncontrolled Airspace
    703.37 Weight and Balance Control – Sub-section (1)
    703.39 Briefing of Passengers
    703.42 Operation of Aircraft in Icing Conditions

AIRCRAFT EQUIPMENT REQUIREMENTS
    703.64 General Requirements – Sub-section (2)
    703.69 Shoulder Harness

PERSONNEL REQUIREMENTS
    703.87 Designation of Pilot-in-command and Second-in-command
    703.88 Flight Crew Member Qualifications – Sub-sections (1) and (3)
    703.91 Validity Period – Sub-section (1)

TRAINING
    703.98 Training Program – Sub-sections (1) and (2)

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    703.106 Distribution of Company Operations Manual
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    706.02 Maintenance Control System
    706.09 Maintenance Arrangements
    706.10 Elementary Work
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1 Air Traffic and Advisory Services
2 Flight Service Stations, Flight Information Centres
3 Communication Procedures
4 Radar Service – Clock Position System
5 ATC Clearances/Instructions/ Mandatory Readback Procedures
6 Wake Turbulence Separation
7 Aerodrome Operations – Controlled
8 Aerodrome Operations – Uncontrolled
9 Mandatory and Aerodrome Traffic Frequencies
10 VFR En Route Procedures
11 Procedures for the Prevention of Runway Incursions

INTERNATIONAL FLIGHT PROCEDURES
1 Entry, Transit and Departure of Aircraft (TC AIM - FAL 2.0)

OTHER LEGISLATION
1 Canada Transportation Act Part II - Air Transportation Licences, Prohibitions (section 57); Air Transportation Regulations (sections 3 and 7)
2 Canada Labour Code Part II - Occupational Safety & Health, Employee Rights & Duties (sections 126, 127 and 128)
3 Transportation of Dangerous Goods by Air (TC AIM - RAC Annex 3.0)
NAVIGATION

SECTION 2: NAVIGATION AND RADIO AIDS

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1 Meridian
2 Prime Meridian
3 Longitude
4 Equator
5 Latitude
6 Great Circle
7 Rhumb Line
8 Variation
9 Isogonial
10 Agonic Line
11 Deviation
12 Track
13 Heading
14 Airspeed
15 Ground Speed
16 Air Position
17 Ground Position
18 Bearing
19 Wind Velocity
20 Drift

MAPS AND CHARTS
1 Characteristics of Projections
2 VTA – Transverse Mercator Projection
3 VNC – Lambert Conformal Conic Projection
4 WAC – Lambert Conformal Conic Projection
5 Topographical Symbols
6 Elevation andContours (Relief)
7 Aeronautical Information
8 Scale and Units of Measurement
9 Locating Position by Latitude and Longitude
➔ 10 Navigation Aids
➔ 11 Enroute Low Altitude Charts

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1 24 Hour System
2 Time Zones and Relation to Longitude
3 Conversion of UTC to Local and Vice Versa
➔ 4 Morning and Evening Twilight Charts

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1 Use of Aeronautical Charts
2 Measurement of Track and Distance
3 Map Reading
4 Setting Heading – Visual Angle of Departure
5 Check-points and Pin-points
➔ 6 Use of Position Lines to Obtain a Fix
7 Ground Speed Checks and E.T.A.
8 Track Made Good
9 Determining Drift by 10° Lines
10 1 in 60 rule
➔ 11 Double Track Error Method to Regain Track
➔ 12 Sum of Opening and Closing Angles to Destination
13 Visual Alteration Method of Correcting to Track
14 Diversion to Alternate
15 Return to Departure Point (Reciprocal Track)
16 Low Level Navigation
17 Deduced (Dead) Reckoning (DR Navigation)
18 In-flight Log and Mental Calculations
19 Procedures When Lost
20 Air and Ground Position
21 Variation/Deviation
22 True Track/Magnetic Track
23 True/Magnetic/Compass Headings
24 Indicated/Calibrated Airspeed (IAS/CAS)
25 True Airspeed/Ground Speed (TAS, G/S)
26 Compass Errors
27 Radio Communications (as per Section 1.)

TRIANGLE OF VELOCITIES
1 True Airspeed and Heading
2 Wind Velocity
3 Ground Speed and Track
### NAVIGATION COMPUTERS
- 1. Heading and True Airspeed
- 2. Applying the Wind
- 3. True Track and Ground Speed
- 4. Magnetic Heading and Magnetic Track
- 5. Pressure/Density and True Altitudes
- 6. Indicated/Calibrated/True Airspeed
- 7. Time/Ground Speed/Distance
- 8. Fuel Consumption and Conversions
- 9. Climbs/Descents

### PRE-FLIGHT PREPARATION
- 1. Factors Affecting Choice of Route
- 2. Map Preparation
- 3. Meteorological Information
- 4. NOTAM
- 5. Selection of Check-points
- 6. Fuel Requirements
- 7. Weight and Balance
- 8. Use of Canada Flight Supplement
- 10. Flight Log Forms
- 11. Documents to be Carried in Aircraft
- 12. Aircraft Serviceability

### RADIO THEORY
- 1. Characteristics of Low/High and Very High Frequency Radio Waves
- 2. Frequency Bands Used in Navigation and Communication
- 3. Operational Limitations

### VHF OMNIDIRECTION RANGE (VOR)
- 1. Principles of Operation
- 2. Aircraft Equipment
- 3. Tuning and Identifying
- 4. Serviceability Check
- 5. Interpretation/Orientation/Homing
- 6. Intercepting Predetermined Radials and Tracking
- 7. Position Lines and Fixes
- 8. Time and Distance Formula
- 9. VHF (VOR) Airways and Air Routes

### AUTOMATIC DIRECTION FINDER
- 1. Principles of Operation
- 2. Aircraft Equipment
- 3. Tuning and Identifying
- 4. Serviceability Check
- 5. Interpretation/Orientation/Homing
- 6. Intercepting Predetermined Tracks and Tracking
- 7. Position Lines and Fixes
- 8. Relative Bearings/Conversion to Magnetic/True Bearings
- 9. Time and Distance Formula
- 10. Inaccuracies/Limitations
- 11. LF/MF (NDB) Airways and Air Routes

### RADIO MAGNETIC INDICATOR (RMI)
- 1. Basic Principles, Uses and Limitations

### GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS/GPS)
- 1. Principles of Operation
- 2. Aircraft Equipment
- 3. Serviceability Checks
- 4. Interpretation, Orientation and Tracking

### OTHER RADIO AND RADAR AIDS – BASIC PRINCIPLES AND USE
- 1. Distance Measuring Equipment (DME)
- 2. Transponder
- 3. Emergency Locator Transmitter
- 4. VHF Direction Finding (DF) Assistance
- 5. Surveillance Radar – Primary/Secondary
- 6. Precision Approach Radar (PAR)
## METEOROLOGY

### SECTION 3: METEOROLOGY

#### THE EARTH’S ATMOSPHERE
- 1 Composition and Physical Properties
- 2 Vertical Structures
- 3 The Standard Atmosphere
- 4 Density and Pressure
- 5 Mobility
- 6 Expansion and Compression

#### ATMOSPHERIC PRESSURE
- 1 Pressure Measurements
- 2 Station Pressure
- 3 Sea Level Pressure
- 4 Pressure System and their Variations
- 5 Effects of Temperature
- 6 Isobars
- 7 Horizontal Pressure Differences

#### METEOROLOGICAL ASPECTS OF ALTIMETRY
- 1 Pressure Altitude
- 2 Density Altitude
- 3 Altimeter Settings
- 4 Considerations when Flying from High to Low Pressure and Temperature Areas, and vice versa

#### TEMPERATURE
- 1 Temperature Scale – Fahrenheit/Celsius
- 2 Heating/Cooling of the Atmosphere – Convection/Advection/Radiation
- 3 Horizontal Differences
- 4 Temperature Variations with Altitude
- 5 Inversions
- 6 Isothermal Layers

#### MOISTURE
- 1 Relative Humidity/Dewpoint
- 2 Change of State
- 3 Sublimation/Condensation
- 4 Cloud Formation
- 5 Precipitation
- 6 Saturated/Dry Adiabatic Lapse Rate

#### STABILITY AND INSTABILITY
- 1 Lapse Rate and Stability
- 2 Modification of Stability
- 3 Characteristics of Stable/Unstable Air
- 4 Surface Heating/Cooling
- 5 Lifting Processes
- 6 Subsidence/Convergence

#### CLOUDS
- 1 Classification
- 2 Formation and Structure
- 3 Types and Recognition
- 4 Associated Precipitation and Turbulence

#### SURFACE BASED LAYERS
- 1 Fog Formation
- 2 Fog Types (Including Mist)
- 3 Haze/Smoke
- 4 Blowing Obstruction to Vision

#### TURBULENCE
- 1 Convection
- 2 Mechanical
- 3 Orographic
- 4 Wind Shear
- 5 Clear Air Turbulence
- 6 Reporting Criteria

#### WIND
- 1 Definition
- 2 Pressure Gradient
- 3 Deflection Caused by the Earth’s Rotation
- 4 Low Level Winds – Variation in Surface Wind
- 5 Friction
- 6 Centrifugal Force
- 7 Veer/Back
- 8 Squall/Gusts
- 9 Diurnal Effects
- 10 Land/Sea Breezes
- 11 Katabatic/Anabatic Effects
- 12 Topographical Effects
- 13 Wind Shear – Types/Causes
- 14 Jet Stream – Composition/Altitude/Seasonal Variance
## AIR MASSES
- **1** Definition and Characteristics
- **2** Formation/Classification
- **3** Modification
- **4** Factors that Determine Weather
- **5** Seasonal/Geographic Effects
- **6** Air Masses Affecting North America

## FRONTS AND FRONTAL WEATHER
- **1** Structure
- **2** Types
- **3** Formation
- **4** Cross-sections
- **5** Frontogenesis/Frontolysis
- **6** Cold Front
- **7** Warm Front
- **8** TROWAL and Upper Fronts

## AIRCRAFT ICING
- **1** Formation
- **2** In-flight – Freezing Rain
- **3** Hoar Frost

## THUNDERSTORMS
- **1** Requirements for Development
- **2** Structure/Development
- **3** Types – Air Mass/Frontal
- **4** Hazards – Updrafts/
  Downdrafts/Gust Fronts/
  Downbursts/Microbursts/Hail/
  Lightning
- **5** Squall Lines

## HURRICANES AND TORNADOES
- **1** Hazards

## METEOROLOGICAL SERVICES AVAILABLE TO PILOTS
- **1** Flight Information Centres (FIC)
- **2** Aviation Weather Web Site
- **3** Pilot's Automatic Telephone Weather Answering Service (PATWAS)
- **4** Automatic Terminal Information Service (ATIS)
- **5** VOLMET (HF) Broadcast

## AVIATION WEATHER REPORTS
- **1** Decoding
- **2** Aviation Routine Weather Report (METAR)
- **3** Automated Weather Observation Station (AWOS)
- **4** Limited Weather Information System (LWIS)

## AVIATION FORECASTS
- **1** Times Issued and Validity Periods
- **2** Decoding
- **3** Graphic Area Forecasts (GFA)
- **4** Aerodrome Forecasts (TAF)
- **5** Upper Wind and Temperature Forecasts (FD)
- **6** Airman's Meteorological Advisory (AIRMET)
- **7** Significant In-flight Weather Warning Messages (SIGMET)

## WEATHER MAPS AND PROGNOSTIC CHARTS
- **1** Times Issued and Validity Period
- **2** Symbols and Decoding
- **3** Surface Weather Charts (Analysis & Prognostic)
- **4** Upper Air Charts – Weather Information to 500 mb Level
- **5** Significant Weather Prognostic Chart (Upper Air) 700-400 mb

## PILOT REPORTS
- **1** Pilot Reports (PIREP)
AERONAUTICS - GENERAL KNOWLEDGE

SECTION 4: AIRFRAMES, ENGINES AND SYSTEMS

AIRFRAMES
1 Types of Construction
2 Handling/Care/Securing

LANDBED GEAR, BRAKES AND FLAPS
1 Mechanical
2 Hydraulic
3 Electrical

ENGINES
1 Two/Four Stroke Cycle
2 Methods of Cooling
3 Principle of the Magneto
4 Dual Ignition
5 Exhaust System
6 Ancillary Controls
7 Turbo-charging
8 Effects of Density Altitude/Humidity
9 Limitations and Operations
10 Instruments
11 Principles of Diesel Engines
12 Principles of Turbine Engines
13 Engine Handling/Care
14 Full Authority Digital Engine Control (FADEC)

CARBURATION
1 Theory of Operation
2 Fuel-Air Mixture/Mixture Controls
3 Carburetor Icing
4 Use of Carb Heat and Its Effects on Mixture

FUEL INJECTION
1 Principle and Operation
2 Icing
3 Alternate Air

ELECTRICAL SYSTEM
1 Generator/Alternator/Battery
2 Lighting
3 Master/Alternator/Generator Switches
4 Ammeter/Load Meter
5 Bus Bars
6 Circuit Breakers/Fuses
7 Grounding/Bonding

LUBRICATING SYSTEMS AND OILS
1 Types – Viscosity/Grades/Seasonal Use
2 Purposes
3 Methods of Lubrication
4 Venting
5 Filters
6 Pressure Relief
7 Oil Cooler

FUEL SYSTEMS AND FUELS
1 Types – Colour/Properties
2 Density/Weight
3 Additives
4 Contamination and Deterioration
5 Tank Location
6 Venting/Baffling
7 Fuel Line – Filters/Drains
8 Induction Manifold
9 Detonation/Pre-ignition – Causes/Effects
10 Vapour Lock
11 Fuel Heater
12 Primers
13 Fuel Management – Ground/Air
14 Fuel Handling – Fuelling Aircraft
15 Grounding/Bonding

OTHER AIRCRAFT SYSTEMS
1 Oxygen
2 Vacuum
3 Pressurization
4 De-icing/Anti-Icing Systems
5 Environmental Systems
SECTION 5: THEORY OF FLIGHT

PRINCIPLES OF FLIGHT
1 Bernoulli’s Principle
2 Newton’s Laws

FORCES ACTING ON AN AEROPLANE
1 Lift
2 Drag– Induced/Parasite/Profile
3 Relationship of Lift and Drag to Angle of Attack
4 Thrust
5 Weight
6 Equilibrium
7 Centre of Pressure (C of P)
8 Centrifugal/Centripetal Forces
9 Forces Acting on an Aircraft during Manoeuvres

AERFOILS
1 Pressure Distribution about an Aerofoil
2 Relative Airflow and Angle of Attack
3 Downwash
4 Wing Tip Vortices
5 Angle of Incidence

PROPELLERS
1 Propeller Efficiency at Various Speeds
2 Fixed/Variable Pitch Propellers
3 Torque/Slipstream/Gyroscopic Effect/Asymmetric Thrust
4 Propellor Handling/Care

DESIGN OF THE WING
1 Wing Planform
2 Area/Span/Chord
3 Aspect Ratio
4 Camber
5 Laminar Flow
6 Sweepback
7 Dihedral/Anhedral
8 Wash In/Wash Out
9 Slots/Slats
10 Wing Fences/Stall Strips
11 Spoilers
12 Flaps
13 Vortex Generators
14 Winglets
15 Canards

LOAD FACTOR
1 Centrifugal Force/Weight
2 Load Factor – Linear/Turns
3 Relationship of Load Factor to Stalling Speed
4 Structural Limitations
5 Gust Loads

STABILITY
1 Longitudinal, Lateral, Directional Stability
2 Inherent Stability
3 Methods of Achieving Stability, Effect of C of G Position

FLIGHT CONTROLS
1 Aeroplane Axes and Planes of Movement
2 Functions of Controls
3 Relationship Between Effects of Yaw and Roll
4 Adverse Yaw/Aileron Drag
5 Static/Dynamic Balancing of Controls
6 Trim/Trimming Devices
SECTION 6: FLIGHT INSTRUMENTS

PITOT STATIC SYSTEM
1 Pitot
2 Static
3 Anti-Icing
4 Alternate Static – Source/Errors

AIRSPEED INDICATOR
1 Principles of Operation
➔ 2 Errors/Malfunctions
3 Markings
4 Definitions – IAS/CAS/TAS

VERTICAL SPEED INDICATOR
1 Principles of Operation
➔ 2 Errors/Malfunctions
3 Lag

ALTIMETER/ENCODING ALTIMETER
1 Principles of Operation
➔ 2 Errors/Malfunctions

RADIO/RADAR ALTIMETER
1 Principles of Operation
2 Limitations

DIRECT READING MAGNETIC COMPASS
1 Principles of Operation
2 Magnetic Dip
3 Variation
4 Factors Adversely Affecting Compass Operation
5 Reading the Compass
6 Deviation
7 Compass Correction Card
8 Turning and Acceleration Errors
9 Compass Serviceability Checks
10 Compass Swinging – Frequency/Basic Methods
11 Checking Compass Heading on the Ground and in Flight

GYROSCOPE
1 Principles of Operation
2 Inertia
3 Precession

HEADING INDICATOR
1 Principles of Operation
➔ 2 Errors/Malfunctions
3 Limitations
4 Power Sources
5 Slaved Compass System/Slaved HSI/RMI

ATTITUDE INDICATOR
1 Principles of Operation
➔ 2 Errors/Malfunctions
3 Limitations
4 Power Sources

TURN AND BANK INDICATOR/TURN CO-ORDINATOR
➔ 1 Principles of Operation
➔ 2 Errors/Malfunctions
3 Limitations
4 Power Sources

INSTRUMENT FLYING
1 Loss of Visual Reference
2 The Control and Performance Instruments
3 Instrument Scan/Interpretation
4 Aircraft Control
5 Partial Panel
6 Unusual Attitudes/Recoveries
SECTION 7: FLIGHT OPERATIONS

GENERAL
1 Pilot-In-Command Responsibilities
2 Aircraft Defects/Minimum Equipment List
3 Winter Operations
4 Thunderstorm Avoidance
5 Mountain Flying Operations
6 Wildlife Hazards
7 Wildlife Conservation
8 Collision Avoidance – Use of Landing Lights
9 Canadian Runway Friction Index (CRFI)
10 Runway Numbering
11 VASIS/PAPI
12 Approach, Runway and Aerodrome Markings/Lighting
13 Obstruction Marking/Lighting
14 Units of Measurement and Conversion
15 Radio Communications (as per Section 1)
16 Aerodrome Operations (Including Marshalling Signals and Procedures for the Prevention of Runway Incursions)
17 Wheelbarrowing
18 Hydro-planing
19 Taxiing
20 Effects of Wind/Wind Shear
21 Side-slips
22 Radio/Electronic Interference, Portable Electronic Devices

AIRCRAFT PERFORMANCE
1 Lift/Drag Ratio
2 Effects of Density Altitude/ Humidity
3 Attitude Plus Power Equals Performance – Climb/ Descent/Level Flight
4 Normal/Short/Soft and Rough Field Take-offs and Landings
5 Ground Effect
6 Best Angle of Climb (Vₐ)
7 Best Rate of Climb (Vᵧ)
8 Manoeuvring Speed (Vₐ)
9 Maximum Normal Operating Speed (Vₙ₀)
10 Never Exceed Speed (Vₑ)
11 Maximum Flap Speed (Vₑ)
12 Maximum Gear Operating Speed (Vₑ)
13 Gliding for Range

14 Flying for Range
15 Flying for Endurance
16 Slow Flight
17 Stalls
18 Indicated and True Stalling Speed
19 Stall Speed vs Altitude
20 Spins
21 Spirals
22 Bank/Speed vs Rate/Radius of Turn
23 Effects of Change of Weight or Centre of Gravity (CG) on Performance
24 Use of Aircraft Flight Manual (Including Approved and Unapproved Operational Information)

USE OF PERFORMANCE CHARTS
1 Take-off Charts
2 Cross-wind Charts
3 Climb/Descent Charts
4 Cruise Charts
5 Fuel Burn Charts
6 Landing Charts
7 Performance (V) Speeds – Vₐ, Vₙ₀, Vₑ, Vₑ, Vₑ, Vₛ, Vₓ, Vᵧ
8 Effect of Ice/Snow/Frost/Slush/ Water on Take-off and Landing Run
9 Effect of Various Runway Surfaces on Take-off and Landing Run
10 Upslope/Downslope Runway
11 CFRI Performance Tables and Charts

WEIGHT AND BALANCE
1 Terms – e.g. Datum/Arm/ Moment/MAC
2 Locating CG
3 CG Limits
4 Weights – e.g. Empty/Gross
5 Load Adjustment
6 Cargo Tie-down/Passenger Loading
7 Normal/Utility Category
WAKE TURBULENCE
1 Causes
2 Effects
3 Avoidance

SEARCH AND RESCUE (SAR)
(TC AIM – SAR)
1 Service Available, Request for Assistance, Aiding Persons in Distress
→ 2 ELT (Exclude Categories)
3 Aircraft Emergency Assistance
4 Survival – Basic Techniques

AIRCRAFT CRITICAL SURFACE CONTAMINATION
→ 1 Effects of Aircraft Critical Surface Contamination on Performance
→ 2 Clean Aircraft Concept
3 Frozen Contaminants
4 Cold Soaking Phenomenon
→ 5 Practices for Pilots to Ensure a Clean Aircraft
→ 6 Pre-Take-Off Inspection
SECTION 8: HUMAN FACTORS

AVIATION PHYSIOLOGY
1. Hypoxia/Hyperventilation
2. Gas Expansion/Trapped Gasses, Effects
3. Decompression (Including SCUBA diving)
4. Vision/Visual Scanning Techniques
5. Hearing
6. Orientation/Disorientation (Including Visual/Vestibular Illusions)
7. Positive and Negative “G”
8. Airsickness
10. Sleep/Fatigue
11. Anaesthetics/Blood Donations
12. Effects of Smoking

THE PILOT AND THE OPERATING ENVIRONMENT
1. Personal Health/Fitness
2. Diet/Nutrition
3. Medications (Prescribed and Over-the-counter)
4. Substance Abuse (Alcohol/Drugs)
5. Pregnancy
6. Heat/Cold
7. Noise/Vibration
8. Toxic Hazards (Including Carbon Monoxide)

AVIATION PSYCHOLOGY
1. The Decision-Making Process
2. Factors That Influence Decision-Making
3. Situational Awareness
4. Stress
5. Managing Risk
6. Attitudes
7. Workload – Attention and Information Processing

PILOT – EQUIPMENT/MATERIALS RELATIONSHIP
1. Controls and Displays – Errors in Interpretation and Control
2. Standard Operating Procedures – Rationale/Benefits
3. Errors in the Interpretation and Use of Maps/Charts
4. Correct Use of Check-lists and Manuals
5. Automation and complacency

INTERPERSONAL RELATIONS
1. Communications with Flight Crew/Maintenance Personnel/Air Traffic Services/Passengers
2. Operating Pressures – Family Relationships/Peer Group
3. Operating Pressures – Employer
ENQUIRIES

Information concerning the location of pilot training organizations and matters pertaining to flight crew licensing may be obtained by contacting the appropriate Regional Offices. A complete listing may be found at: http://www.tc.gc.ca/CivilAviation/General/Exams/Centres.htm.

RECOMMENDED STUDY MATERIAL

- When in Doubt… Small and Large Aircraft - Aircraft Critical Surface Contamination Training Booklet (TP 10643)
- Aircraft Critical Surface Contamination Examination Questions (TP 10615).
- Air Command Weather Manual (TP 9352)
- Air Command Weather Manual (Supplement) (TP 9353)
- Human Factors for Aviation - Basic Handbook (TP 12863), and Advanced Handbook (TP 12864)
- Canadian Aviation Regulations (CARs) http://www.tc.gc.ca/civilaviation/regserv/affairs/cars/menu.htm
- VFR Navigation Charts (VNC)/VFR Terminal Area Charts (VTA)/World Aeronautical Charts (WAC)
- Canada Flight Supplement
- Enroute Low Altitude Charts

Transport Canada publications (TP) may be purchased from retailers, or at the following website: http://shop.tc.gc.ca/TChtml/ibeCZzpHome.jsp?language=US


Information on the Transportation of Dangerous Goods is available from Transport Canada. (http://www.tc.gc.ca/tdg/clear/menu.htm)

Information on Air Transportation Licences is available from the Canadian Transportation Agency (http://www.cta-otc.gc.ca/).

Information on Customs Requirements is available from the Canada Border Services Agency (http://www.cbsa-asfc.gc.ca/).

Information on the Canada Labour Code is available from Social Development Canada (http://www.sdc.gc.ca/).

Information on text books and other publications produced by commercial publishers can be obtained through local flying training organization, bookstores and similar sources.

RECOMMENDED STUDY MATERIAL FOR THE FAA CONVERSION EXAMINATION

Candidates attempting the examination for conversion from an FAA certificate to a Canadian Commercial Pilot Licence (FAACA examination) are encouraged to review the following references as they apply to aeroplanes in VFR operations:

CARs Part I, Subpart 1  GENERAL PROVISIONS
101.01 – Interpretation (definitions as needed)

CARs Part IV, Subpart 1  FLIGHT CREW PERMITS, LICENCES AND RATINGS
401.05 – Recency Requirements
401.30 – Commercial Pilot Licence, Aeroplanes - Privileges

CARs Part IV, Subpart 4  MEDICAL REQUIREMENTS
404.04 – Issuance, Renewal, Validity Period and Extension of a Medical Certificate

CARs Part VI, Subpart 1  AIRSPACE
Division I – Airspace Structure, Classification and Use
Division II – Aircraft Operating Restrictions and Hazards to Aviation Safety

CARs Part VI, Subpart 2  OPERATING AND FLIGHT RULES
Division I – General
Division II – Operational and Emergency Equipment Requirements
Division III – Flight Preparation, Flight Plans and Flight Itineraries
Division IV – Pre-flight and Fuel Requirements
Division V – Operations at or in the Vicinity of an Aerodrome
Division VI – Visual Flight Rules
Division VIII – Radiocommunications
Division IX – Emergency Communications and Security

CARs Part VI, Subpart 5  AIRCRAFT REQUIREMENTS
Division I – Aircraft Requirements - General
Division II – Aircraft Equipment Requirements

CARs Part VII, Subpart 0  COMMERCIAL AIR SERVICES, GENERAL
Division III – Flight Time and Flight Duty Time Limitations and Rest Periods

CARs Part VII, Subpart 2  AERIAL WORK OPERATIONS
Division I – General
Division III – Flight Operations
Division V – Aircraft Equipment Requirements
Division VII – Personnel Requirements
Division IX – Manuals

CARs Part VII, Subpart 3  AIR TAXI OPERATIONS
Division I – General
Division III – Flight Operations
Division V – Aircraft Equipment Requirements
Division VII – Personnel Requirements
Division IX – Manuals

TC AIM - GEN  GENERAL
1.0 – General Information
3.0 – Transportation Safety Board of Canada

TC AIM - AGA  AERODROMES
7.19 – Aerodrome Lighting – Aircraft Radio Control of Aerodrome Lighting (ARCAL)
The above documents can be located on the Transport Canada web pages:
http://www.tc.gc.ca/civilaviation/regserv/affairs/cars/menu.htm
and
http://www.tc.gc.ca/civilaviation/publications/tp14371/menu.htm