



Transport
Canada

Transports
Canada

TP 12881E
(revised 10/2004)

Study and Reference Guide

Commercial Pilot Licence including Helicopter to
Aeroplane Pilot Licence

Aeroplane

Third Edition

April 2001

Canada

You may reproduce this guide as required, it can be found at
<http://www.tc.gc.ca/CivilAviation/General/Exams/Guides.htm>

GENERAL

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.

EXAM 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

Applicants for the Commercial Pilot Licence in the Aeroplane Category shall demonstrate their knowledge by writing a Transport Canada multiple choice examination on subjects contained in this guide.

FULL EXAMINATION

Examination	Questions	Time Limit	Pass Mark
Commercial Pilot – Aeroplanes (CPAER)	100	3½ hours	60%

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 subject areas.

They are:

Mandatory Subjects	Related Study and Reference Guide	Page
AIR LAW.....	Air Law and Procedures – Section 1	3
NAVIGATION.....	Navigation and Radio Aids – Section 2	11
METEOROLOGY.....	Meteorology – Section 3	13
AERONAUTICS AND GENERAL KNOWLEDGE..	Airframes, Engines, and Systems–Section 4	15
	Theory of Flight – Section 5	16
	Flight Instruments – Section 6	17
	Flight Operations – Section 7	18
	Human Factors – Section 8	20

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:

Examination	Questions	Time Limit	Pass Mark
AIR LAW (CALAW)	20	1 hour	60%
NAVIGATION (CANAV)	25	2 hours	60%
METEOROLOGY (CAMET)	25	1½ hours	60%
AERONAUTICS– GENERAL KNOWLEDGE (CAGEN)	35	1½ hours	60%

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.

HELICOPTER TO AEROPLANE EXAMINATION

Pilots who hold a valid Commercial or Airline Transport Pilot Licence in the Helicopter Category and who wish to apply for a Commercial Pilot Licence, Aeroplane Category, may demonstrate their knowledge by writing the following Transport Canada multiple choice examination.

Examination	Questions	Time Limit	Pass Mark
Commercial Pilot Aeroplane Rating – Alternate Category (CARAC)	35	1½ hours	60%

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 may demonstrate their knowledge by writing the following Transport Canada multiple choice examination.

Examination	Questions	Time Limit	Pass Mark
Air Law, Air Traffic Rules and Procedures (ARPCO)	30	1 hour	60%

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.

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

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

301.09 Fire Prevention

302 – AIRPORTS

302.10 Prohibitions

302.11 Fire Prevention

PART IV – PERSONNEL LICENSING AND TRAINING**400 – GENERAL**

400.01 Interpretation

401 – FLIGHT CREW PERMITS, LICENCES AND RATINGS**GENERAL**

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**MEDICAL CERTIFICATE**

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

MEDICAL EXAMINERS

404.18 Permission to Continue to Exercise the Privileges of a Licence or Rating

406 – FLIGHT TRAINING UNITS

406.02 Application

406.03 Requirement to Hold a Flight Training Unit Operating Certificate

PART VI – GENERAL OPERATING AND FLIGHT RULES**600 – INTERPRETATION**

600.01 Interpretation

601 – AIRSPACE**AIRSPACE STRUCTURE, CLASSIFICATION AND USE**

601.01 Airspace Structure

→ 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

- 601.15 Forest Fire Aircraft Operating Restrictions
- 601.16 Issuance of NOTAM for Forest Fire
- 601.17 Exceptions

602 – OPERATING AND FLIGHT RULES

GENERAL

- 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
- 602.30 Fuel Dumping
- 602.31 Compliance with Air Traffic Control Instructions and Clearances
- 602.32 Airspeed Limitations
- 602.34 Cruising Altitudes and Cruising Flight Levels
- 602.35 Altimeter Setting and Operating Procedures in the Altimeter-setting Region
- 602.36 Altimeter Setting and Operating Procedures in the Standard Pressure Region
- 602.37 Altimeter Setting and Operating Procedures in Transition Between Regions
- 602.40 Landing at or Take-off from an Aerodrome at Night

OPERATIONAL AND EMERGENCY EQUIPMENT REQUIREMENTS

- 602.58 Prohibition
- 602.59 Equipment Standards
- 602.60 Requirements for Power-driven Aircraft
- 602.61 Survival Equipment – Flights over Land
- 602.62 Life Preservers and Flotation Devices
- 602.63 Life Rafts and Survival Equipment – Flight over Water

FLIGHT PREPARATION, FLIGHT PLANS & FLIGHT ITINERARIES

- 602.70 Interpretation – Definitions
- 602.71 Pre-flight Information
- 602.72 Weather Information
- 602.73 Requirements to File a Flight Plan or a Flight Itinerary
- 602.74 Contents of a Flight Plan or Flight Itinerary
- 602.75 Filing of a Flight Plan or Flight Itinerary
- 602.76 Changes in the Flight Plan – Sub-sections (3) and (4)
- 602.77 Requirements to File an Arrival Report
- 602.78 Contents of an Arrival Report
- 602.79 Overdue Aircraft Reports

PRE-FLIGHT AND FUEL REQUIREMENTS

- 602.86 Carry-on Baggage, Equipment and Cargo
- 602.87 Crew Member Instructions
- 602.88 Fuel Requirements – Sub-sections (1), (2), (3) and (5)
- 602.89 Passenger Briefings

OPERATION AT OR IN THE VICINITY OF AN AERODROME

- 602.96 General
- 602.97 VFR and IFR Aircraft Operations at Uncontrolled Aerodromes within a Mandatory Frequency (MF) Area
- 602.98 General MF Reporting Procedures
- 602.99 MF Reporting Procedures before Entering Manoeuvring Area
- 602.100 MF Reporting Procedures on Departure
- 602.101 MF Reporting Procedures on Arrival
- 602.102 MF Reporting Procedures when Flying Continuous Circuits
- 602.103 Reporting Procedures when Flying Through an MF Area
- 602.105 Noise Operating Criteria
- 602.106 Noise Restricted Runways

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
- 602.145 ADIZ
- 602.146 SCATANA Plan

604 – PRIVATE OPERATOR PASSENGER TRANSPORTATION

GENERAL

- 604.01 Application
- 604.02 Aircraft Operation

605 – AIRCRAFT REQUIREMENTS

GENERAL

- 605.03 Flight Authority
- 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
- 605.10 Unserviceable and Removed Equipment – Aircraft without a Minimum Equipment List

AIRCRAFT EQUIPMENT REQUIREMENTS

- 605.14 Power-driven Aircraft – Day VFR
- 605.15 Power-driven Aircraft – VFR OTT
- 605.16 Power-driven Aircraft – Night VFR
- 605.17 Use of Position and Anti-collision Lights
- 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

AIRCRAFT MAINTENANCE REQUIREMENTS

- 605.84 Aircraft Maintenance - General
- 605.85 Maintenance Release and Elementary Work
- 605.86 Maintenance Schedule – Sub-sections (1)(a), (2) and (3)
- 605.88 Inspection After Abnormal Occurrences

TECHNICAL RECORDS

- 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

PART VII – COMMERCIAL AIR SERVICES**700 – GENERAL**

- 700.02 Requirements for Air Operator Certificates

FLIGHT TIME AND FLIGHT DUTY TIME LIMITATIONS AND REST PERIODS

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

702 – AERIAL WORK OPERATIONS**GENERAL**

- 702.01 Application

FLIGHT OPERATIONS

- 702.11 Operating Instructions – Sub-section (2)
- 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

AIRCRAFT EQUIPMENT REQUIREMENTS

- 702.42 Night and IMC Flights – Sub-section (1)
- 702.44 Shoulder Harness
- 702.45 External Load Equipment

PERSONNEL REQUIREMENTS

- 702.64 Designation of Pilot-in-command and Second-in-command
- 702.65 Flight Crew Member Qualifications – Sub-sections (a), (c) and (d)
- 702.67 Validity Period – Sub-sections (1) and (2)

TRAINING

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

MANUALS

- 702.83 Distribution of Company Operations Manual
- 702.84 Standard Operating Procedures

703 – AIR TAXI OPERATIONS

GENERAL

703.01 Application

FLIGHT OPERATIONS

- 703.14 Operating Instructions – Sub-section (2)
- 703.17 Flight Authorization
- 703.22 Transport of Passengers in Single-Engine Aircraft
- 703.23 Aircraft Operating over Water
- 703.24 Number of Passengers in Single-Engine 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 – Sub-section (1), (2), (4) and (5)

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)

MANUALS

- 703.106 Distribution of Company Operations Manual
- 703.107 Standard Operating Procedures

706 – AIRCRAFT MAINTENANCE REQUIREMENTS FOR AIR OPERATORS

- 706.02 Maintenance Control System
- 706.09 Maintenance Arrangements
- 706.10 Elementary Work
- 706.11 Servicing

TRANSPORTATION SAFETY BOARD OF CANADA (TSB) – (A.I.P. CANADA, GEN 3.0)

AIR TRAFFIC SERVICES AND PROCEDURES

- 1 Air Traffic and Advisory Services
- 2 Flight Service Stations
- 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 VFR Holding Procedures
- 12 VFR/IFR Traffic Mix at Uncontrolled Aerodromes Operations (SIRO)
- 14 Procedures for the Prevention of Runway Incursions

INTERNATIONAL FLIGHT PROCEDURES

- 1 Entry, Transit and Departure of Aircraft (AIP-FAL 2.0)

OTHER LEGISLATION

- 1 Canada Transportation Act Part II - Air Transportation Licences, Prohibitions (section 57)
- 2 Canada Labour Code Part II - Occupational Safety & Health, Employee Rights & Duties (sections 126, 127, 128)
- 3 Transportation of Dangerous Goods by Air (AIP-RAC Annex 3.0)

SECTION 2: NAVIGATION AND RADIO AIDS**DEFINITIONS**

- 1 Meridian
- 2 Prime Meridian
- 3 Longitude
- 4 Equator
- 5 Latitude
- 6 Great Circle
- 7 Rhumb Line
- 8 Variation
- 9 Isogonal
- 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 and Contours (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

TIME AND LONGITUDE

- 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
- 5 Finding the Sun's True Bearing by Pre-computed tables

PILOT NAVIGATION

- 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. Revisions
- 8 Track Made Good
- 9 Determining Drift by 10° Lines
- 10 Double Track Error Method to Regain Track
- 11 Sum of Opening and Closing Angles to Destination
- 12 Visual Alteration Method of Correcting to Track
- 13 Diversion to Alternate
- 14 Return to Departure Point (Reciprocal Track)
- 15 Low Level Navigation
- 16 Deduced (Dead) Reckoning (DR Navigation)
- 17 In-flight Log and Mental Calculations
- 18 Procedures When Lost
- 19 Air and Ground Position
- 20 Variation/Deviation
- 21 True Track/Magnetic Track
- 22 True/Magnetic/Compass Headings
- 23 Indicated/Calibrated Airspeed (IAS/CAS)
- 24 True Airspeed/Ground Speed (TAS, G/S)
- 25 Compass Errors
- 26 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
- 9 Flight Plans/Itineraries
- 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

LONG RANGE AREA NAVIGATION (LORAN C)

- 1 Principles of Operation
- 2 Inaccuracies and Reception 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)

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

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

SQUALL LINES**HURRICANES AND TORNADOES****SURFACE BASED LAYERS**

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

METEOROLOGICAL SERVICES**AVAILABLE TO PILOTS**

- 1 Aviation Weather Information Services (AWIS)
- 2 Aviation Weather Briefing Service (AWBS)
- 3 Flight Service Stations (FSS)/Flight Information Centres (FIC)
- 4 Aviation Weather Web Site
- 5 Pilot's Automatic Telephone Weather Answering Service (PATWAS)
- 6 Automatic Terminal Information Service (ATIS)
- 7 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 Graphical Area Forecasts (GFA)
- 4 Terminal Area Forecasts (TAF)
- 5 Upper Winds 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 Map
- 4 Upper Air Charts – Weather Information to 500 mb Level
- 5 Prognostic Surface Charts
- 6 Significant Weather Prognostic Chart (Upper Air) 700-400 mb

PILOT REPORTS

- 1 Pilot Reports (PIREP)

SECTION 4: AIRFRAMES, ENGINES AND SYSTEMS

AIRFRAMES

- 1 Types of Construction
- 2 Handling/Care/Securing

LANDING 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 Turbine Engines
- 12 Engine Handling/Care

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 Oil Dilution
- 6 Filters
- 7 Pressure Relief
- 8 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 Theorem
- 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
- 9 Forces Acting on an Aircraft during Manoeuvres

AEROFOILS

- 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 Propeller 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

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 (V_x)
- 7 Best Rate of Climb (V_y)
- 8 Manoeuvring Speed (V_a)
- 9 Maximum Normal Operating Speed (V_{no})
- 10 Never Exceed Speed (V_{ne})
- 11 Maximum Flap Speed (V_{fe})

- 12 Maximum Gear Operating Speed (V_{lo})
- 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 (C of G) 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 – V_a , V_{no} , V_{fe} , V_{lo} , V_{ne} , V_s , V_x , V_y
- 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 C of G
- 3 C of G 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)

(A.I.P. Canada – 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
- 9 Body Rhythms/Jet Lag
- 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

INTERPERSONAL RELATIONS

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

RECOMMENDED STUDY MATERIAL

- When in Doubt... Small and Large Aircraft - Aircraft Critical Surface Contamination Training Booklet (TP 10643E)
- Aircraft Critical Surface Contamination Examination Questions (TP 10615E).
- Finding the Sun's True Bearing (TP 784E)
- Air Command Weather Manual (TP 9352E)
- Air Command Weather Manual (Supplement) (TP 9353E)
- Human Factors for Aviation - Basic Handbook (TP 12863E), and Advanced Handbook (TP 12864E)
- When in Doubt... Small and Large Aircraft - Aircraft Critical Surface Contamination Training Video (TP 10643E)
- Aeronautical Information Publication (A.I.P. Canada) (TP 2300E)
- *Canadian Aviation Regulations* (CARs)
- VFR Navigation Charts (VNC)/VFR Terminal Area Charts (VTA)/World Aeronautical Charts (WAC)
- Canada Flight Supplement
- Enroute Low Altitude Charts

The Study Guide For The Radiotelephone Operator's Restricted Certificate (Aeronautical) is available free of charge from district offices of Industry Canada - Examinations and Radio Licensing (<http://www.strategis.gc.ca>).

Information on the Transportation of Dangerous Goods is available from Transport Canada.

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

Customs Requirements is available from the Canada Customs and Revenue Agency (<http://www.cbsa-asfc.gc.ca/menu-e.html>).

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.

Publications used in pilot training in the United States are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (<http://www.access.gpo.gov/index.html>).

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>