



Transport  
Canada

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Canada

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# **Study and Reference Guide**

Private and Commercial Pilot Licence  
including Aeroplane to Helicopter  
Pilot Licences

## **Helicopter**

Fifth Edition  
June 2004

**Canada**

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<http://www.tc.gc.ca/CivilAviation/General/Exams/Guides.htm>

## **GENERAL**

### **KNOWLEDGE REQUIREMENTS**

**NOTE:** The new Canadian Aviation Regulations (CARs) replace the Air Regulations, Air Navigation Orders, Air Regulation Series and the Personnel Licensing Handbook. While the implementation date for some of the CARs may be delayed, candidates are required to have a sound understanding of the appropriate CARs and will be examined on them from December 10, 1996 onward.

Applicants for Private and Commercial Pilot Licences in the Helicopter Category shall thoroughly understand the operational provisions of the CARs and Air Traffic Rules and Procedures that are appropriate to the licence, and in accordance with flight under the Visual Flight Rules (VFR).

Applicants for the Private Pilot Licence shall have a basic understanding of the remaining subjects in this guide. As well, they must have the ability to apply these subjects practically where required.

Applicants for the Commercial Pilot Licence shall have a good understanding of the remaining subjects in this guide with the ability to apply them practically where required. They shall also know those sections presented in this guide related to Part VII of the CARs – Commercial Air Services, applicable to the duties and responsibilities of a Commercial Pilot employed in a commercial air service operating VFR.

All applicants must also be able to read the examination questions in either English or French without assistance.

Subjects marked with a bullet (→) are considered essential knowledge for the Commercial Pilot Licence candidates.

## EXAMINATIONS

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

<b>Examination</b>	<b>Questions</b>	<b>Time Limit</b>	<b>Pass Mark</b>
Private Pilot – Helicopter (PPHEL)	100	3 hours	60%

<b>Examination</b>	<b>Questions</b>	<b>Time Limit</b>	<b>Pass Mark</b>
Commercial Pilot – Helicopter (CPHEL)	100	3½ hours	60%

These examinations are sectionalized into four mandatory subject areas and require an overall pass mark of 60%. As well, the candidate must achieve 60% in each of the four subject areas. They are:

<b>Mandatory Subjects</b>	<b>Study and Reference Guide Sections</b>
<b>AIR LAW</b> .....	Air Law and Procedures – Section 1
<b>NAVIGATION</b> .....	Navigation - General – Section 6 Navigation and Radio Aids – Section 7
<b>METEOROLOGY</b> .....	Meteorology – Section 4
<b>AERONAUTICS AND GENERAL KNOWLEDGE</b> .....	Airframes, Engines and Systems – Section 2  Theory of Flight – Section 3 Instruments – Section 5 Flight Operations – Section 8 Human Factors – Section 9

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 an unrelated section is required to arrive at the correct response. For example, a practical question on fuel calculations under Navigation – Section 6 may require knowledge of VFR fuel requirements under Air Law – Section 1.

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 main examination (PPHEL or CPHEL), 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:

### Private Pilot Licence

<b>Examination</b>	<b>Questions</b>	<b>Time Limit</b>	<b>Pass Mark</b>
AIR LAW (PHLAW)	20	1 hour	60%
NAVIGATION (PHNAV)	25	2 hours	60%
METEOROLOGY (PHMET)	25	1½ hours	60%
AERONAUTICS – GENERAL KNOWLEDGE (PHGEN)	35	1½ hours	60%

### Commercial Pilot Licence

<b>Examination</b>	<b>Questions</b>	<b>Time Limit</b>	<b>Pass Mark</b>
AIR LAW (CHLAW)	20	1 hour	60%
NAVIGATION (CHNAV)	25	2 hours	60%
METEOROLOGY (CHMET)	25	1½ hours	60%
AERONAUTICS – GENERAL KNOWLEDGE (CHGEN)	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 3 hours for the Private Pilot supplementary examinations and 3½ hours for the Commercial Pilot supplementary examinations.

## AEROPLANE TO HELICOPTER LICENCE EXAMINATIONS

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

<b>Examination</b>	<b>Questions</b>	<b>Time Limit</b>	<b>Pass Mark</b>
Private Pilot Helicopter Rating – Alternate Category (PHRAC)	35	1½ hours	60%

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

<b>Examination</b>	<b>Questions</b>	<b>Time Limit</b>	<b>Pass Mark</b>
Commercial Pilot Helicopter Rating – Alternate Category (CHRAC)	35	1½ hours	60%

The PHRAC and CHRAC examinations are based on subjects contained in Sections 1.0, 2.0, 3.0, 4.0, 7.0 and 8.0 of this study guide.

**SECTION 1: AIR LAW AND PROCEDURES****PART I – GENERAL PROVISIONS**

## 101 – INTERPRETATION

101.01 Interpretation

## 103 – ADMINISTRATION AND 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 III – AERODROMES AND AIRPORTS**

## 300– INTERPRETATION

300.01 Interpretation

## 301– AERODROMES

301.01 Application

301.04 Markers and Markings

301.06 Wind Direction Indicator

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

401.03 Requirements 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

401.10 Crediting of Flight Time Acquired by a Co-pilot

→ 401.35 ATPL Privileges – Helicopter

401.44 VFR Over-The-Top Rating

401.61 Flight Instructor Ratings

→ 404– MEDICAL REQUIREMENTS

- 404.03 Requirement to Hold a Medical Certificate (MC)
- 404.04 Issuance and Validity Period of MC
- 404.06 Prohibitions regarding Exercise of Privileges
- 404.10 MC Requirements for Personnel Licences
- 404.18 Permission to Continue to Exercise the Privileges of a Licence or Rating

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

600 – INTERPRETATION

600.01 Interpretation

→ 601– 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 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

FOREST FIRE FLIGHT RESTRICTIONS

- 601.14 Interpretation
- 601.15 Forest Fire Aircraft Operating Restrictions
- 601.16 Issuance of NOTAM for a Forest Fire Aircraft Operating Restrictions
- 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
- 602.06 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 Landings within Built-up Areas of Cities and Towns

- 602.14 Minimum Altitudes and Distances
- 602.15 Permissible Low Altitude Flight
- 602.16 Flights over Open-Air Assemblies of Persons or Built-up Areas – Helicopters with External Loads
- 602.17 Carriage of Persons during Low Altitude Flight
- 602.19 Right-of-Way – General
- 602.20 Right-of-Way – Aircraft Manoeuvring on Water
- 602.21 Avoidance of Collision
- 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
- 602.34 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
- 602.38 Flight over the High Seas
- 602.39 Transoceanic Flight
- 602.40 Landing at or Take-off from an Aerodrome at Night

#### OPERATIONAL AND EMERGENCY EQUIPMENT REQUIREMENTS

- 602.57 Application
- 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 Personal Flotation Devices
- 602.63 Life Rafts and Survival Equipment – Flights over Water

#### FLIGHT PREPARATION, FLIGHT PLANS AND FLIGHT ITINERARIES

- 602.70 Interpretation
- 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
- 602.77 Requirement 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
- 602.89 Passenger Briefings

## OPERATIONS AT OR IN THE VICINITY OF AN AERODROME

- 602.96 General
- 602.97 VFR and IFR Aircraft Operations at Uncontrolled Aerodromes within an MF Area
- 602.98 General MF Reporting Requirements
- 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

## 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 ESCAT

## 604 – PRIVATE OPERATOR PASSENGER TRANSPORTATION

### GENERAL

- 604.01 Application

### FLIGHT OPERATIONS

- 604.10 Checklist
- 604.11 Operational Flight Data Sheet
- 604.16 Flight Attendant Requirement
- 604.17 Cabin Safety Procedures
- 604.18 Briefing of Passengers

## FLIGHT TIME AND FLIGHT DUTY TIME LIMITATIONS AND REST PERIODS

- 604.26 Flight Time Limitations
- 604.27 Flight Duty Time Limitations and Rest Periods
- 604.28 Split Flight Duty Time
- 604.29 Extension of Flight Duty Time
- 604.30 Unforeseen Operational Circumstances
- 604.31 Delayed Reporting Time
- 604.32 Requirements for Time Free from Flight Duty
- 604.33 Flight Crew Positioning

## EMERGENCY EQUIPMENT

- 604.38 Survival Equipment
- 604.39 First Aid Kits
- 604.41 Hand-Held Fire Extinguishers

## PERSONNEL REQUIREMENTS

- 604.65 Designation of Pilot-in-command and Second-in-command
- 604.66 Crew Member Qualifications
- 604.68 Validity Period
- 604.73 Training Program

## MANUALS

- 604.80 Requirements relating to Operations Manual
- 604.81 Contents of Operational Manual
- 604.82 Distribution of Operations Manual
- 604.83 Aircraft Operating Manual
- 604.84 Standard Operating Procedures

## 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 Lists
- 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 Systems
- 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
- 605.33 Flight Data Recorders and Cockpit Voice Recorders
- 605.34 Use of Flight Data Recorders and Cockpit Voice Recorders
- 605.35 Transponder and Automatic Pressure Altitude Reporting Equipment
- 605.38 ELT
- 605.39 Use of ELT
- 605.40 ELT Activation
- 605.41 Standby Attitude Indicator

## AIRCRAFT MAINTENANCE REQUIREMENTS

- 605.84 Aircraft Maintenance – General
- 605.85 Maintenance Release and Elementary Work
- 605.86 Maintenance Schedule
- 605.87 Transfer of Aeronautical Products between Maintenance Schedules
- 605.88 Inspection after Abnormal Occurrences

## TECHNICAL RECORDS

- 605.93 Technical Records – General
- 605.94 Journey Log Requirements
- 605.95 Journey Log – Carrying on Board
- 605.96 Requirements for Technical Records other than the Journey Log
- 605.97 Transfer of Records

## 606 – MISCELLANEOUS

- 606.01 Munitions of War
- 606.03 Synthetic Flight Trainer

## **PART VII – COMMERCIAL AIR SERVICES**

### → 700 – COMMERCIAL AIR SERVICES

#### GENERAL

#### → 700.01 Definitions

#### FLIGHT TIME AND DUTY TIME LIMITATIONS AND REST PERIODS

- 700.15 Flight Time Limitations
- 700.16 Flight Duty Time Limitations and Rest Periods
- 700.17 Unforeseen Operational Circumstances
- 700.18 Delayed Reporting Time
- 700.19 Requirements for Time Free from Duty
- 700.20 Flight Crew Positioning
- 700.21 Flight Crew Members on Reserve

#### → 702 – AERIAL WORK

#### GENERAL

#### 702.01 Application

#### FLIGHT OPERATIONS

- 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
- 702.19 Entering or Leaving a Helicopter in Flight
- 702.20 Aircraft Operating over Water
- 702.21 Helicopter Class D External Loads
- 702.22 Built-up Area and Aerial Work Zone
- 702.23 Briefing of Persons other than Flight Crew Members

#### AIRCRAFT EQUIPMENT REQUIREMENTS

- 702.42 Night and IMC Flights
- 702.43 Additional Equipment for Single-pilot Operations
- 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
- 702.67 Validity Period

## MANUALS

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

## → 703 – AIR TAXI OPERATIONS

### GENERAL

- 703.01 Application

### FLIGHT OPERATIONS

- 703.17 Flight Authorization
- 703.18 Operational Flight Plan – Subsection (2)
- 703.20 Fuel Requirements – Paragraph (b)
- 703.21 Admission to Pilot's Compartment
- 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
- 703.32 Enroute Limitations
- 703.33 VFR OTT Flight
- 703.34 Routes in Uncontrolled Airspace
- 703.36 Minimum Altitudes and Distances
- 703.37 Weight and Balance Control
- 703.38 Passenger and Cabin Safety Procedures
- 703.39 Briefing of Passengers

### AIRCRAFT EQUIPMENT REQUIREMENTS

- 703.64 General Requirements
- 703.69 Shoulder Harness

### EMERGENCY EQUIPMENT

- 703.82 Equipment Standards and Inspection

### PERSONNEL REQUIREMENTS

- 703.86 Minimum Crew
- 703.87 Designation of Pilot-in-command and Second-in-command
- 703.88 Flight Crew Member Qualifications
- 703.91 Validity Period
- 703.98 Training Program

## MANUALS

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

## 704 – COMMUTER OPERATIONS

- 704.01 Application

## FLIGHT OPERATIONS

- 704.12 Operating Instructions
- 704.13 General Operational Information
- 704.16 Flight Authorization
- 704.17 Operational Flight Plan – Subsection (2)
- 704.19 Checklist
- 704.20 Fuel Requirements – Paragraph (b)
- 704.22 Simulation of Emergency Situations
- 704.23 VFR Flight Obstacle Clearance Requirements
- 704.24 VFR Flight Minimum Flight Visibility – Uncontrolled Airspace
- 704.25 VFR Flight Weather Conditions
- 704.28 VFR OTT Flight
- 704.29 Routes in Uncontrolled airspace
- 704.31 Minimum Altitudes and Distances
- 704.32 Weight and Balance Control
- 704.33 Apron and Cabin Safety Procedures
- 704.34 Briefing of Passengers

## AIRCRAFT PERFORMANCE OPERATION LIMITATIONS

- 704.46 Take-off Weight Limitations
- 704.48 Enroute Limitations with One Engine Inoperative

## AIRCRAFT EQUIPMENT REQUIREMENTS

- 704.62 General Requirements
- 704.63 Operation of Aircraft in Icing Conditions
- 704.68 Shoulder Harnesses

## EMERGENCY EQUIPMENT

- 704.83 Hand-held Fire Extinguisher

## PERSONNEL REQUIREMENTS

- 704.107 Designation of Pilot-in-command and Second-in-command
- 704.108 Flight Crew Member Qualifications
- 704.111 Validity Period
- 704.115 Training Program

MANUALS

704.122 Distribution of Company Operations Manual

704.123 Aircraft Operating Manual

704.124 Standard Operating Procedures

**NOTAM****A.I.P. CANADA**

- 1 A.I.P. CANADA
- 2 Supplements
- 3 Aeronautical Information Circulars
- 4 Aviation Notices and AIRAC Canada

**TRANSPORTATION SAFETY BOARD OF CANADA (TSB) – (A.I.P. GEN 3.0)****AIR TRAFFIC SERVICES AND PROCEDURES**

- 1 Air Traffic and Advisory Services
- 2 Flight Service Stations
- 3 Communications Procedures
- 4 Radar Service
- 5 ATC Clearances and Instructions
- 6 Wake Turbulence Separation
- 7 Airport/Aerodrome Operations – Uncontrolled
- 8 Airport/Aerodrome Operations – Controlled
- 9 Mandatory and Aerodrome Traffic Frequencies
- 10 VFR En Route Procedures
- 11 VFR Holding Procedures
- 12 Simultaneous Intersecting Runway Operations (SIRO)

**OPERATIONS IN DOMESTIC AIRSPACE**

- 1 Altimeter Setting Procedures
- 2 Cruising Altitudes
- 3 Profile Descent
- 4 Leaving or Entering Uncontrolled Airspace
- 5 Uncontrolled Airspace Procedures

## SECTION 2: AIRFRAMES, ENGINES AND SYSTEMS

### AIRFRAMES

- 1 Types of Construction

### LANDING GEAR

- 1 Types

### ENGINES-RECIPROCATING

- 1 Types
- 2 Four Stroke Cycle
- 3 Methods of Cooling
- 4 Principles of the Magneto
- 5 Dual Ignition
- 6 Exhaust System
- 7 Ancillary Controls
- 8 Turbo-charging
- 9 Effect of Density Altitude/Humidity
- 10 Limitations and Operation
- 11 Instruments

### ENGINES-TURBINE

- 1 Types
- 2 Principles of Operation
- 3 Methods of Cooling
- 4 Particle Separators
- 5 Power Turbine Governor
- 6 Bleed Air System
- 7 Accessory Drives
- 8 Turbine Temperature Measurement
- 9 Torque Sensing
- 10 Instruments
- 11 Ignition and Auto-relight System
- 12 Effects of Density Altitude/Humidity
- 13 Limitations

### CARBURATION

- 1 Theory of Operation
- 2 Fuel-Air Mixture
- 3 Mixture Controls
- 4 Carburettor Icing
- 5 Use of Carburettor Heat and Its Effect on Mixture

### FUEL INJECTION

- 1 Principle of Operation
- 2 Icing
- 3 Alternate Air

### ELECTRICAL SYSTEM

- 1 Battery/Starter- Generator/Alternator
- 2 Lighting
- 3 Ammeter , Load Meter and Warning/Caution Systems
- 4 Bus Bars
- 5 Circuit Breakers/Fuses
- 6 Grounding/Bonding

### LUBRICATING SYSTEMS AND OILS

- 1 Types/Viscosity/Grades and Seasonal Use
- 2 Purposes
- 3 Methods of Lubrication
- 4 Venting
- 5 Chip Detectors
- 6 Filters
- 7 Pressure Relief
- 8 Oil Cooler

### FUEL SYSTEM AND FUELS

- 1 Types/Colour/Properties
- 2 Density/Weight
- 3 Additives
- 4 Contamination and Deterioration
- 5 Venting and Baffling
- 6 Fuel Pumps, Lines, Filters and Drains
- 7 Induction Manifold / Fuel Control Unit
- 8 Detonation/Pre-ignition Causes and Effects
- 9 Vapour Lock
- 10 Fuel Heater
- 11 Primers
- 12 Fuel Management -Ground and Air
- 13 Fuel Handling Fuelling Aircraft
- 14 Grounding/Bonding

**TRANSMISSIONS AND GEARBOXES**

- 1 Types
- 2 Main Rotor
- 3 Tail Rotor
- 4 Intermediate
- 5 Drive Shafts
- 6 Mounting System
- 7 Clutches/Free-Wheeling Unit
- 8 Accessory Gearbox
- 9 Instruments

**HYDRAULICS**

- 1 Pump
- 2 Reservoir
- 3 Servo Actuators
- 4 Filters
- 5 Valves/Switches/Gauges

**OTHER AIRCRAFT SYSTEMS**

- 1 Heating
- 2 Fire Detection and Protection
- 3 Ant-Ice/De-Ice
- 4 Cargo Hook/Personnel Hoisting
- 5 Emergency Floatation
- 6 Rotor Brakes

## SECTION 3: THEORY OF FLIGHT

### PRINCIPLES OF FLIGHT

- 1 Bernoulli's Theorem
- 2 Newton's Laws

### DEFINITIONS

- 1 Aerofoil
- 2 Relative Airflow and Angle of Attack
- 3 Chord Line
- 4 Camber
- 5 Lift
- 6 Weight
- 7 Drag
- 8 Thrust
- 9 Pitch Angle/Angle of Incidence
- 10 Rotor Disc
- 11 Tip Path Plane
- 12 Coning
- 13 Feathering
- 14 Flapping
- 15 Dragging, Leading and Lagging
- 16 Phase Lag/Advance Angle
- 17 Coriolis Effect
- 18 Induced Flow
- 19 Dissymmetry of Lift

### AERODYNAMICS

- 1 Four Basic Forces
- 2 Blade Design
- 3 Pressure Distribution about an Aerofoil
- 4 Rotor Systems (Main/Tail)
- 5 Velocities Affecting Rotor Systems
- 6 Translational Lift/Flight
- 7 Transitions
- 8 Tail Rotor Drift/Roll
- 9 Theory of Autorotation and Flare
- 10 Reverse Flow
- 11 Blade Stall
- 12 Over Pitching
- 13 Settling with Power
- 14 Recirculation
- 15 Vortex Ring State
- 16 Ground Resonance

### LOAD FACTOR

- 1 Centrifugal Force/Weight
- 2 Linear/Turns
- 3 Structural Limitations
- 4 Gust Loads

### FLIGHT CONTROLS

- 1 Cyclic
- 2 Collective
- 3 Control Orbits
- 4 Throttle/Governor
- 5 Tail Rotor Pedals
- 6 Aids to Stability

### FORCES ACTING ON A HELICOPTER

- 1 Load Factor
- 2 Stability
- 3 Lift / Weight / Thrust / Drag

### ROTOR DESIGN

- 1 Number / Speed of Blades
- 2 Rotor Blade Vortices
- 3 Limitations to Forward Speed and Vibrations
- 4 Autorotations
- 5 Tail Rotor
- 6 Ground Resonance

## SECTION 4: METEOROLOGY

### THE EARTH'S ATMOSPHERE

- 1 Properties
- 2 Vertical Structure
- 3 ICAO Standard Atmosphere

### ATMOSPHERIC PRESSURE

- 1 Pressure Measurements
- 2 Station Pressure
- 3 Mean Sea Level Pressure
- 4 Pressure Systems and their Variations
- 5 Effects of Temperature
- 6 Horizontal Pressure Differences

### METEOROLOGICAL ASPECTS OF ALTIMETRY

- 1 Pressure Altitude
- 2 Density Altitude
- 3 True Altitude
- 4 Altimeter Settings
- 5 Effects of both Pressure and Temperature

### TEMPERATURE

- 1 Heating and Cooling of the Atmosphere – Convection / Advection / Radiation
- 2 Horizontal Differences
- 3 Temperature Variations with Altitude
- 4 Inversions
- 5 Isothermal Layers

### MOISTURE

- 1 Relative Humidity / Dewpoint
- 2 Sublimation and Condensation
- 3 Cloud Formation
- 4 Precipitation
- 5 Saturated and Dry Adiabatic Lapse Rates

### STABILITY AND INSTABILITY

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

### CLOUDS

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

### TURBULENCE

- 1 Convection
- 2 Mechanical
- 3 Orographic
- 4 Clear Air Turbulence
- 5 VIRGA – Evaporation Cooling
- 6 Reporting Criteria
- 7 Mountain Waves

### WIND

- 1 Pressure Gradient
- 2 Deflection caused by the Earth's Rotation
- 3 Low Level Winds – Variation in Surface Wind
- 4 Friction
- 5 Centrifugal Force
- 6 Veer and Back
- 7 Squalls and Gusts
- 8 Diurnal Effects
- 9 Land and Sea Breezes
- 10 Katabatic / Anabatic Effects
- 11 Topographical Effects
- 12 Wind Shear, Types and Causes

**AIR MASSES**

- 1 Definition and Characteristics
- 2 Formation
- 3 Classification
- 4 Modification
- 5 Factors that Determine Weather
- 6 Seasonal and Geographic Effects
- 7 Air Masses affecting North America

**FRONTS**

- 1 Structure
- 2 Types
- 3 Formation
- 4 Cross-sections
- 5 Discontinuities Across Fronts
- 6 Frontal Waves and Occlusions
- 7 Frontogenesis and Frontolysis

**FRONTAL WEATHER**

- 1 Warm Front
- 2 Cold Front
- 3 Stationary Front
- 4 TROWAL and Upper Fronts

**AIRCRAFT ICING**

- 1 Formation
- 2 Types of Ice
- 3 Reporting Criteria
- 4 Cloud Types and Icing
- 5 Freezing Rain and Drizzle
- 6 Icing in Clear Air (Hoar Frost)
- 7 Collection Efficiency
- 8 Aerodynamic Heating

**THUNDERSTORMS**

- 1 Requirements for Development
- 2 Life Cycle
- 3 Classification – Air mass, Frontal, Squall Line, Convective, Orographic and Nocturnal
- 4 Tornadoes and Hurricanes
- 5 Hazards – Turbulence, Hail, Rain, Icing, Altimetry, Lightning, Gust Fronts, Downbursts and Microbursts

**SURFACE BASED LAYERS**

- 1 Fog Formation
- 2 Fog Types (including mist)
- 3 Haze and Smoke
- 4 Blowing Obstructions to Vision

**METEOROLOGICAL SERVICES AVAILABLE TO PILOTS**

- 1 Aviation Weather Briefing Service (AWBS)
- 2 Aviation Weather Information Service (AWIS)
- 3 Flight Service Stations (FSS)
- 4 Weather Broadcasts by FSS
- 5 Atmospheric Environment Service Weather Briefing
- 6 Transcribed Weather Broadcasts (TWB)
- 7 DUATS – Commercial Weather Service
- 8 Automatic Terminal Information Service (ATIS)
- 9 VOLMET (HF) Broadcast
- 10 Pilots Automatic Telephone Weather Answering Service (PATWAS)

**AVIATION WEATHER REPORTS**

- 1 Aviation Routine Weather Report (METAR)
- 2 SPECI
- 3 Decoding
- 4 AWOS
- 5 Pilot Reports (PIREP/AIREP)

**AVIATION FORECASTS**

- 1 Times Issued and Validity Periods
- 2 Decoding
- 3 Graphical Area Forecasts (GFA) and AIRMET
- 4 Aerodrome Forecasts (TAF)
- 5 Upper Level Winds and Temperature Forecasts (FD)
- 6 Significant In-flight Weather Warning Messages (SIGMET)

**WEATHER MAPS AND PROGNOSTIC CHARTS**

- 1 Times Issued and Validity Periods
- 2 Symbols and Decoding
- 3 Surface Weather Map
- 4 Prognostic Surface Chart
- 5 Upper Level Chart – ANAL (850 – 700 mb)
- 6 Significant Weather Prognostic Chart FL100 – 250 (700 – 400 mb)

## **SECTION 5: INSTRUMENTS**

### **FLIGHT INSTRUMENTS – PRINCIPLES AND OPERATIONAL USE**

- 1 Pitot Static System
- 2 Airspeed Indicator
- 3 Altimeter and Encoding Altimeter
- 4 Radio / Radar Altimeter
- 5 Outside Air Temperature
- 6 Turn-and-bank Indicator / Turn Co-ordinator
- 7 Vertical Speed Indicator (VSI)
- 8 Heading Indicator
- 9 Attitude Indicator (AI)
- 10 Radio Magnetic Indicator (RMI)
- 11 Horizontal Situation Indicator (HSI)
- 12 Flight Director

### **FLIGHT MANAGEMENT INSTRUMENTS**

- 1 Flight Management System (FMS)
- 2 Electronic Flight Instrument System (EFIS)

### **ENGINE AND TRANSMISSION INSTRUMENTS – PRINCIPLES AND USE**

- 1 N1 / N2 / Rotor Tachometer
- 2 Torquemeter or Degrees of Pitch
- 3 Transmission
- 4 Oil Temperatures and Pressures
- 5 Turbine Temperature
- 6 Fuel Pressure
- 7 Fuel Flow

### **AIRCRAFT COMPASS SYSTEMS**

- 1 Construction
- 2 Use
- 3 Limitations and Faults
- 4 Gyromagnetic Remote Indicating Compass

## SECTION 6: NAVIGATION – GENERAL

### NAVIGATION TERMS

- 1 Air Position
- 2 Great Circle
- 3 Rhumb Line
- 4 Greenwich Hour Angle

### MAPS AND CHARTS

- 1 Lambert Conformal
- 2 Transverse Mercator
- 3 Enroute Low Altitude Charts

### TIME AND LONGITUDE

- 1 Time Zones and Relation to Longitude

### FLIGHT PLANNING CALCULATIONS

- 1 Heading and True Airspeed
- 2 Wind and Wind Speed
- 3 IAS – CAS – EAS – TAS
- 4 Track and Groundspeed
- 5 Time
- 6 Weight and Balance
- 7 Fuel Load / Zero Fuel Weight
- 8 Pay Load / Weight Shift
- 9 Critical Point (CP)
- 10 Point of No Return (PNR) / Radius of Action

### FLIGHT PLAN FORMS

- 1 Flight Plan
- 2 Flight Itinerary

### EN ROUTE NAVIGATION

- 1 Use of Aeronautical Charts
- 2 Calculation of Heading and Groundspeed
- 3 Use of Radio Aids to Determine Position and Transferring Position Lines
- 4 Gyro Steering Techniques in Areas of Compass Unreliability
- 5 Maintaining a Flight Log (Air Position)
- 6 Determination of Wind Velocity
- 7 Use of Canada Flight Supplement (CFS)

**SECTION 7: 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 Navigational 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

**PILOT NAVIGATION**

- 1 Use of Aeronautical Charts
- 2 Measurement of Track & Distance
- 3 Map Reading
- 4 Setting Heading – Visual Angle of Departure
- 5 Check Points and Pin-Points
- 6 Plotting Bearings
- 7 Use of Position Lines to Obtain a Fix
- 8 Ground Speed Checks and E.T.A. Revisions
- 9 Track Made Good
- 10 Determining Drift by 10° Lines
- 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 and Deviation
- 22 True Track, Magnetic Track
- 23 True, Magnetic and Compass Headings
- 24 Indicated and 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 True Heading and True Airspeed
- 2 Applying the Wind
- 3 True Track and Ground Speed
- 4 Magnetic Heading and Magnetic Track
- 5 Density Altitude and True Altitude
- 6 Indicated, Calibrated and True Airspeed
- 7 Time, Ground Speed and Distance
- 8 Fuel Consumption and Conversions
- 9 Climbs and 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 the Canada Flight Supplement
- 9 Documents to be Carried in Aircraft
- 10 Flight Plans and Itineraries
- 11 Flight Log Forms
- 12 Aircraft Serviceability

**RADIO THEORY**

- 1 Wave Length and Frequency
- 2 Frequency Bands
- 3 Characteristics of Low, High and Very High Frequency Radio Waves
- 4 Frequency Bands Used in Navigation and Communication

**VHF OMNIDIRECTION RANGE (VOR)**

- 1 Principles of Operation
- 2 Aircraft Equipment
- 3 Tuning and Identifying
- 4 Serviceability Checks
- 5 Interpretation/ Orientation/ Homing
- 6 Intercepting Predetermined Radials and Tracking
- 7 Position Lines and Fixes
- 8 Time and Distance Formula
- 9 Checking Ground Speed
- 10 Voice Feature
- 11 VHF (VOR) Airways and Air Routes
- 12 Reception Limitations

**AUTOMATIC DIRECTION FINDER (ADF)**

- 1 Principles of Operation
- 2 Aircraft Equipment
- 3 Tuning and Identifying
- 4 Serviceability Checks
- 5 Interpretation/Orientation/ Homing
- 6 Intercepting Predetermined Tracks and Tracking
- 7 Position Lines and Fixes
- 8 Relative Bearings, Conversion to Magnetic and True Bearings
- 9 Time and Distance Formula
- 10 Checking Ground Speed
- 11 Voice Feature
- 12 Inaccuracies and Limitations
- 13 LF/MF (NDB) Airways and Air Routes

**RADIO MAGNETIC INDICATOR (RMI)**

- 1 Basic Principals , Use and Limitations

**LONG RANGE AREA NAVIGATION (LORAN C)**

- 1 Principals of Operation
- 2 Inaccuracies and Reception Limitations

**GLOBAL NAVIGATION SATELLITE  
SYSTEM (GNSS-GPS)**

- 1 Basic Principals, Use and  
Limitations

**OTHER RADIO AND RADAR AIDS BASIC  
PRINCIPALS AND USE**

- 1 Distance Measuring Equipment  
(DME)
- 2 Transponder
- 3 Emergency Locator Transmitter  
(ELT)
- 4 VHF Direction Finding (DF)  
Assistance
- 5 Airport Surveillance Radar (ASR)  
Primary and Secondary
- 6 Precision Approach Radar (PAR)
- 7 Very Low Frequency (VLF)  
Navigation Systems – Basic  
Principle only

## SECTION 8: FLIGHT OPERATIONS

### GENERAL

- 1 Pilot-In-Command Responsibilities
- 2 Winter Operations
- 3 Float Operations
- 4 Thunderstorm Avoidance
- 5 Mountain Flying Operations
- 6 Collision Avoidance – Use of Landing Lights
- 7 Marshalling Signals
- 8 Aerodrome/Heliport Marking and Lighting
- 9 Hover Taxi/Air Taxi
- 10 Obstruction Markings/Lighting
- 11 Units of Measurement and Conversion
- 12 Use of Aircraft Flight Manual Including Approved and Unapproved Operational Information

### PERFORMANCE

- 1 Effects of Critical Surface Contamination
- 2 Ground Effect
- 3 Weathercock Effect
- 4 Ground Resonance
- 5 Overpitching/Rotor Droop
- 6 Blade Sailing
- 7 Power Available and Required
- 8 Range and Endurance
- 9 Loss of Tail Rotor Effectiveness
- 10 Autorotation Speeds
- 11 Best Rate of Climb ( $V_y$ )
- 12 Dynamic Rollover
- 13 Mast Bumping
- 14 Vibrations
- 15 Blade Stall
- 16 Bank/Speed vs Rate/Radius of Turn
- 17 Effect of Change of Weight or Centre of Gravity (C of G) on Performance

### USE OF PERFORMANCE CHARTS

- 1 Hover Ceiling, In Ground Effect (IGE) and Out of Ground Effect (OGE)
- 2 Rate of Climb
- 3 Height Velocity Curve (HVC)
- 4 Critical Wind Azimuth
- 5 Performance (V) Speed –  $V_y$ ,  $V_{ne}$

### WEIGHT AND BALANCE

- 1 Terms (e.g. datum, arm, moment)
- 2 Locating Centre of Gravity (C of G)
- 3 C of G Limits – Longitudinal
- 4 C of G Limits – Lateral
- 5 Weight (e.g. empty, gross)
- 6 Load adjustment
- 7 Cargo Tie Down/ Passenger Loading/ External Loading

### EXTERNAL LOADS

- 1 Equipment
- 2 Ground/Air Signals
- 3 Safety/Precautions
- 4 Emergencies

### WAKE TURBULENCE

- 1 Causes
- 2 Effects
- 3 Avoidance

### SEARCH AND RESCUE (SAR) (A.I.P. CANADA – SAR Information)

- 1 Types of Service Available
- 2 Emergency Locator Transmitter (ELT) Exclude Categories
- 3 Aircraft Emergencies
- 4 Survival – Basic Techniques

**CRITICAL SURFACE CONTAMINATION**

- 1 Clean Aircraft Concept
- 2 Frozen Contaminants
- 3 Cold Soaking Phenomenon
- 4 Practices for Pilots to Ensure a  
Clean Aircraft
- 5 Pre-Take-Off Inspection

## SECTION 9: HUMAN FACTORS

### AVIATION PHYSIOLOGY

- 1 Hypoxia / Hyperventilation
- 2 Gas Expansion Effects
- 3 Decompression (including SCUBA diving)
- 4 Vision / Visual Scanning Techniques
- 5 Hearing
- 6 Orientation / Disorientation (including visual and vestibular illusions)
- 7 Positive and Negative "G"
- 8 Circadian Rhythms / Jet Lag
- 9 Sleep / Fatigue
- 10 Toxic Hazards (CO<sub>2</sub>)

### THE PILOT AND THE OPERATING ENVIRONMENT

- 1 Personal Health / Exercise / Fitness
- 2 Obesity / Diet / Nutrition
- 3 Medications (prescribed and over-the-counter)
- 4 Substance Abuse (alcohol and drugs)
- 5 Pregnancy
- 6 Heat / Cold
- 7 Noise / Vibrations
- 8 Effects of Smoking
- 9 Toxic Hazards (including carbon monoxide)

### AVIATION PSYCHOLOGY

- 1 The Decision-Making Process
- 2 Factors that Influence Decision-Making
- 3 Situation 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
  - Information Selection – eg. "glass" cockpits
- 2 Alerting and Warning Systems
  - Appropriate Selection and Set up
  - False Indications
  - Distractions and Responses
- 3 Standard Operating Procedures (SOPs)
- 4 Correct Use of Charts, Checklists and Manuals

### INTERPERSONAL RELATIONS

- 1 Communication with
  - Flight Crew and Cabin Crew
  - Passengers
  - Company Management
  - Flight Operations
  - Maintenance Personnel
  - Air Traffic Services
- 2 Crew Problem Solving and Decision-Making
- 3 Crew Management / Small Group Dynamics
- 4 Operating Pressures
  - Family
  - Peer Group
  - Employer

### **RECOMMENDED STUDY MATERIAL**

- List of Civil Aviation Publications (TP 3680E) - Contains titles, reference numbers, source and cost.
- Student Pilot Permit or Private Pilot Licence for Foreign and Military Applicants, Air Regulations (PSTAR) (TP 11919E)
- When in Doubt... Small and Large Aircraft - Aircraft Critical Surface Training (TP 10643E)
- Aircraft Critical Surface Contamination Examination Questions (TP 10615E)
- Helicopter Flight Training Manual (TP 9982E)
- Air Command Weather Manual (TP 9352E)
- Air Command Weather Manual Supplement (TP 9353E)
- Human Factors for Aviation - Basic Handbook (TP 12863E)
- AWARE (Aviation Weather... Playing by the Rules) Aeronautical Information Publication (A.I.P. Canada) (TP 2300E)
- *Canadian Aviation Regulations* (CARs)
- Flying the Weather VFR (TP 3115E)

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 text books and other publications produced by commercial publishers can be obtained through local flying training organizations, 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 - 9325, including the Basic Helicopter Handbook (AC61-13A) (<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>