CAE Oxford Aviation Academy

FLIGHT PLANNING AND MONITORING

ATPL GROUND TRAINING SERIES

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Printed in Singapore by KHL Printing Co. Pte Ltd

Textbook Series

Book	Title	Subject
1	010 Air Law	
2	020 Aircraft General Knowledge 1	Airframes & Systems
		Fuselage, Wings & Stabilising Surfaces
		Landing Gear
		Flight Controls
		Hydraulics
		Air Systems & Air Conditioning
		Anti-icing & De-icing
		Fuel Systems
		Emergency Equipment
3	020 Aircraft General Knowledge 2	Electrics – Electronics
		Direct Current
		Alternating Current
4	020 Aircraft General Knowledge 3	Powerplant
		Piston Engines
		Gas Turbines
5	020 Aircraft General Knowledge 4	Instrumentation
		Flight Instruments
		Warning & Recording
		Automatic Flight Control
		Power Plant & System Monitoring Instruments
6	030 Flight Performance & Planning 1	Mass & Balance
		Performance
7	030 Flight Performance & Planning 2	Flight Planning & Monitoring
8	040 Human Performance & Limitations	
9	050 Meteorology	
10	060 Navigation 1	General Navigation
11	060 Navigation 2	Radio Navigation
12	070 Operational Procedures	
13	080 Principles of Flight	
14	090 Communications	VFR Communications
		IFR Communications

Contents

ATPL Book 7 Flight Planning and Monitoring

Chapter

1

Air Information Publications

1 Air Information Publications

Introduction

As part of basic preparation before any flight, pilots need to be able to brief themselves about:

- Air Traffic Control procedures regarding departure, en route, destination and alternate airfields.
- Frequencies of communication and navigation aids (navaids) en route and at airfields.
- Radio navigation and approach aids.
- Aerodrome Flight Information Service (AFIS), Automatic Terminal Information Service (ATIS) and in-flight weather services.
- Danger, Restricted and Prohibited Areas; Military training areas, Air Navigation Obstacles and Aerial Sporting and Recreational Activities.

In many operations offices and flight planning rooms a lot of this information is available on wall boards, often in the form of maps. Also, much of it will be available on printed maps and charts, such as those produced by Jeppesen and AERAD, amongst others.

However, these are secondary sources. Jeppesen and AERAD (and others) are not the authority on airspace, frequencies, and navigation aids. They merely print and reproduce, in an easily accessible form, information extracted from documents produced by the national aviation authority of that country (CAA, FAA, DGAC, etc). It is this national aviation authority which is the primary source.

These primary source documents are:

Air Information Publication (AIP). A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.

The United Kingdom Air Information Publication is an example.

AIP Supplements. Temporary changes to the information contained in the AIP which are published by means of special pages.

In the UK these are printed on yellow paper and filed in the AIP SUPPLEMENT SECTION of the UK AIP, GENERAL (GEN) volume.

NOTAM. A notice distributed by means of telecommunications containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

A NOTAM is originated and issued promptly whenever information to be distributed is of a temporary nature and short duration or when operationally significant permanent changes of long duration are made at short notice. They are displayed in, or issued by, operations and flight planning centres.

Format of an AIP

The format of an AIP produced by an ICAO contracting state conforms to a common standard in accordance with the Standards and Recommended Practices (SARP) of Annex 15 to the Convention on International Civil Aviation and with the Aeronautical Information Services Manual (ICAO Doc 8126). Thus the Air Information Publication United Kingdom is a typical reference document. It is divided into:

- VOLUME I - AIP PART 1, GENERAL (GEN) and AIP SUPPLEMENTS (AIP SUP)
- VOLUME II - AIP PART 2, EN ROUTE (ENR)
- VOLUME III - AIP PART 3, AERODROMES (AD)

AIP Gen - Location Indicators

GEN 2.4 - LOCATION INDICATORS ENCODE					
Location	Indicator	Location	Indicator	Location	Indicator
Aberdeen	EGPD	Culdrose	EGDR	Hucknall	EGNA
Aberporth	EGUC	Cumbernauld	EGPG	Humberside	EGNJ
Alderney	EGJA				

Figure 1.1 Location indicators

Location Indicators are allocated mainly to licensed aerodromes, Air Control Centres and Flight Information Centres. An indicator comprises four letters; the first two denote the country and the last two the airfield or centre. Thus:

EG	**UNITED KINGDOM**	
EGLL	,,	**London/Heathrow**
EGTT	,,	**London ATCC(ACC FIC)**
LF	**FRANCE**	
LFPG	,,	**Paris/Charles De Gaulle**
ED	**FEDERAL REPUBLIC OF GERMANY**	**- civil airfields**
ET	,,	**- military airfields**
EDD	,,	**- international aerodromes**
EDDM	,,	**Munich**
LI	**ITALY**	
LIRA	,,	**Rome/Ciampino**
LE	**SPAIN**	
LEMD	,,	**Madrid/Barajas**
KA to KZ	**UNITED STATES**	
CY and CZ	**CANADA**	

Agency Designator, three letters, and **Office Designator,** one letter, may be added after the **Location Indicator.** This allows messages to be directed to an **agency** and/or an **office** at a particular location.

For example the **Agency Designators** for an **Air Traffic Control Unit** and a **Flight Information Centre**, at any location, are **ZAZ** and **ZIZ**; the **Office Designators** at any location for **Freight and Cargo** and **Passenger Handling** are **F** and **P**.

Normally, for day to day operations, pilots need to be aware only of the significance of the Location Indicator, particularly when filing a Flight Plan (CA48), where the entries for departure, destination and diversion airfields, and FIR/UIR boundaries, are represented by a particular four-letter code.

AIP GEN - NOTAMS (Notices to Airmen)
(Ref. UK AIP GEN 3.1)

All operationally significant information **not** covered by AIP Amendment or AIP Supplement will be issued as a NOTAM.

All operationally significant changes issued as Aeronautical Regulation and Control (AIRAC) AIP Amendments, AIP Supplements or Aviation Information Circulars (AIC) will be additionally announced by "Trigger" NOTAMS, which remain valid for 15 days after a permanent change and for the complete duration of any temporary change or condition.

Three categories of NOTAMS are disseminated by the Aeronautical Fixed Service (AFS):

- **NOTAMN**, which contains **new** information.
- **NOTAMR**, which **replaces** a previous one.
- **NOTAMC**, which **cancels** a previous one.

UK NOTAMS are divided into two categories:

- Those containing information on UK International Airports and en route information of interest to both international and domestic recipients. (A to H, J and exceptionally X).

- Those containing information on domestic aerodromes and information to domestic recipients only. (L to N, R and exceptionally X).

Edited Example NOTAMS:

- **Series A**

  (A0012/99 NOTAMN)
  E) MIDHURST DVOR 'MID' 114.000MHZ U/S)

- **Series E**

  (E0011/99 NOTAMR)
  E) NO STOPWAY LIGHTS ON RWY 09 DUE WIP RESITING)

- **Series L**

  (L0018/99)
  E) NDB 'GST' NOT AVBL DUE MAINT.)

(A decode of the series lettering is at table 3.1.1, UK AIP GEN 3-1-5)

AIP GEN - Aerodrome Flight Information Service (AFIS)

and

Automatic Terminal Information Service (ATIS)
(Ref. UK AIP GEN 3.3.3)

OXFORD KIDLINGTON

Sevice Designation	Call Sign	Frequency (MHz)	Hours of Operation	Remarks
AFIS	Oxford Information	118.875	Sat, Sun & PH 0830 -1700 (Winter) Sat, Sun & PH 0730-1600 (Summer)	
ATIS	Oxford Departure Information	121.750	Sat, Sun & PH 0830 -1700 (Winter) Sat, Sun & PH 0730-1600 (Summer)	

Figure 1.2 Extract from AD 2 UK AIP.

The **Flight Information Service (FIS)** (*Figure 1.2*) is provided at aerodromes to give information useful for the safe and efficient conduct of flights in the Aerodrome Traffic Zone (ATZ). From the information received pilots will be able to decide the appropriate course of action to be taken to ensure the safety of the flight.

FIS is available during the aerodrome's operation hours. The Flight Information Service officer is responsible for:

- Issuing information to aircraft in the ATZ to assist pilots in preventing collisions.
- Issuing information to aircraft on the manoeuvring area to assist pilots in preventing collisions between aircraft and vehicles/obstructions on the manoeuvring area, or between aircraft moving on the apron.
- Informing aircraft of essential aerodrome information (i.e. the state of the aerodrome and its facilities).
- Alerting the safety services.
- Initiating overdue action.

At busy airfields to alleviate Radio-telephony (RTF) loading on the operational channels, **Automatic Terminal Information Service (ATIS)** (*Figure 1.2*) broadcast messages are used to pass routine arrival/departure information on a discrete RTF frequency or on an appropriate VOR. Pilots of aircraft inbound to these airports are required on first contact with the aerodrome ATS Unit to acknowledge receipt of current information by quoting the code letter of the broadcast. Pilots of outbound aircraft are not normally required to acknowledge receipt of departure ATIS but are requested to ensure that they are in possession of up-to-date information. (See ICAO Doc 7030 for further information on ATIS).

EXAMPLE OF A TYPICAL ATIS AT OXFORD/KIDLINGTON:

"ATIS B: Runway 02 right hand; Helicopter Area 1 Left; Surface W/V 330/10; QNH1018, QFE 1008; Temperature -1°C, Dewpoint -3°C. Contact tower on 121.95 MHz."

AIP GEN - Meteorological Charts
(Ref.UK AIP GEN 3.5)

National Meteorological Offices routinely issue written forecasts of selected areas at fixed times daily. For the UK, these are on Forms F214 and F215. The UK Met Office also issues European and North Atlantic forecasts. Details of areas of coverage and times of issue and the periods of validity are given in the UK AIP.

AIP GEN - Meteorological Information

Aviation Routine Weather Reports-**METAR**/(Actuals), Aerodrome Forecasts-**TAF**, information concerning en route weather phenomena which may affect the safety of aircraft operations-**SIGMET** (including volcanic activity), and selected special weather reports- **SPECI**, are broadcast by teleprinter and/or radio throughout the UK and internationally in text form.

The Meteorological Watch Offices (MWOs) are responsible for preparing and disseminating **SIGMETS** to the appropriate ACC/FIC within their own and agreed adjacent FIRs. Aircraft in flight should be warned of the occurrence or expected occurrence of a SIGMET phenomenon for the route ahead for up to 500 NM or 2 hours flying time. SIGMET examples are:

- At subsonic levels
  - Freezing Rain
  - Severe Mountain Wave
  - Volcanic Ash Cloud

- At transonic and supersonic levels (FL250-600)
  - Hail
  - Volcanic Ash Cloud
  - Moderate or Severe Turbulence

Information to aircraft in flight is usually supplied in accordance with area Meteorological Watch procedures, supplemented when necessary by an **En Route Forecast Service**. Information is also available from the appropriate ATS Unit at the commander's request, or from **meteorological broadcasts**.

Aircraft can obtain aerodrome weather information from any of the following:

- **VOLMET** broadcasts. (See Table *Figure 1.3*)
- **ATIS** broadcasts.
- By request to an ATS Unit but whenever possible only if the information required is not available from a broadcast.

METEOROLOGICAL RADIO BROADCASTS (VOLMETS)

Call Sign/ID	EM	Frequency MHz	Operating Hours	Stations	Contents	Remarks
1	2	3	4	5	6	7
London VOLMET (Main)	A3E	135.375	H24 continuous	Amsterdam Brussels Dublin Glasgow London Gatwick London Heathrow London Stansted Manchester Paris/CDG	1 Half hourly reports (METAR) 2 The elements of each report broadcast in the following order: (a) Surface wind (b) Visibility (or CAVOK) (c) RVR if applicable (d) Weather (e) Cloud (or CAVOK) (f) Temperature (g) Dewpoint (h) QNH (i) Recent weather if applicable (j) Windshear if applicable (k) Trend if applicable (l)Runway contamination warning if applicable 3 Non-essential words such as 'surface wind', 'visibility' etc are not spoken. 4 Except for 'SNOCLO' The Runway State Group is not broadcast 5 All broadcasts are in English.	The spoken word 'SNOCLO' will be added to the end of the aerodrome report when that aerodrome is unusable for take-offs and landings due to heavy snow on runways or runway snow clearance
London VOLMET (South)	A3E	128.600	H24 continuous	Birmingham Bournemouth Bristol Cardiff Jersey London Luton Norwich Southampton Southend		
London VOLMET (North) (Note 1)	A3E	126.600	H24 continuous	Blackpool East Midlands Isle of Man Leeds Bradford Liverpool London Gatwick Manchester Newcastle Teesside		
Scottish VOLMET	A3E	125.725	H24 continuous	Aberdeen/Dyce Belfast/Aldergrove Edinburgh Glasgow Inverness London/Heathrow Prestwick Stornoway Sumburgh		

Note 1: Broadcasting range extended to cover Southeast England and English Channel
Note 2: An HF VOLMET broadcast for North Atlantic flights (Shannon VOLMET) is operated by the Republic of Ireland

Figure 1.3 VOLMET broadcasts

AIP ENR - Navigation Aids En Route

(Ref. UK AIP ENR 4.1)

ENR 4.1 - RADIO NAVIGATION AIDS - EN ROUTE						
Name of Station (VOR set Variation)	IDENT	Frequency (Channel)	Hours of Operation (Winter/ Summer)	Co-ordinates	DME Aerial Elevation	Remarks
1	2	3	4	5	6	7
Saint Abbs VOR/DME (5.5°W - 1995)	SAB	112.50 MHz (Ch 72X)	H24	555427N 0021223W	760 ft AMSL	DOC 50 NM/50 000 ft (200 NM/50 000 ft in Sector 054° - 144°(M)
Scotstown Head NDB	SHD	383.0 KHz	H24	573333N 0014902W	-	Range 80 NM (25 NM in Sector 180° to 335° MAG)
Seaford VOR/DME (5.5°W -1997)	SFD	117.0 MHz (Ch 117X)	H24	504538N 0000719E	300 ft AMSL	DOC120 NM/50 000 ft 260°-290°(M), 50 NM/50 000 ft elsewhere

Figure 1.4 En route radio navaids

Questions may be asked on the frequencies and call signs of particular navigation aids. As an example, ENR4 of the UK AIP lists the en route radio navigation aids alphabetically, together with their individual identifying morse call signs, transmitting frequencies, operational hours, DME aerial elevation, where applicable, and any remarks. Thus:

- A VHF Omni-range (VOR) and a Distance Measuring Equipment (DME) are situated at Saint Abbs Head where in 1995 the magnetic variation was 5.5°W; the VOR beacon is aligned with magnetic north.
- The morse call sign is Sierra Alpha Bravo.
- The VOR frequency to be selected by a civil operator is 112.50 MHz which also activates the DME's interrogator/transponder UHF frequencies; military aircraft select channel 72X to obtain range from the DME.
- The station operates continuously 24 hours a day at,
- The published latitude and longitude in degrees minutes and seconds.
- The DME antenna is 760 ft above mean sea level.
- Neither the VOR nor the DME should be used beyond 50 NM and above 50 000 ft or 200 NM and 50 000 ft in the sector between 054°(M) and 144°(M).

AIP ENR - Name Codes for Significant Points
(Ref. UK AIP ENR 4.3)

ENR 4.3 - NAME CODE DESIGNATORS FOR SIGNIFICANT POINTS			
‡ - See also AIP Ireland # - See also AIP Spain	† - See also AIP France § - See also AIP Norway		
Name Code	Co-ordinates	Purpose (ATS Route or Other Route)	Definition (°MAG/ NM)
ABDAL	512646N 0015149W	Cotswold CTA - Arrivals to Bristol, Cardiff & Filton	CPT VOR/DME fix 268°/24 NM
ABSIL	543843N 0042000E	UM604 - IN866	VES VOR/DME fix 249°/148 NM
ACORN	511456N 0001146E	London TMA - Gatwick SIDs	BIG VOR/DME fix 133°/8 NM
			DET VOR/DME fix 261°/15 NM
			LAM VOR/DME fix 179°/24 NM
ADMIS	51594N 0001036E	B317 - R77 - UB317 - UR77	BKY VOR/DME fix 088°/4 NM
			CLN VOR/DME fix 287°/37 NM
ADSON	510338N 0021512W	R37	SAM VOR/DME fix 285°/35 NM
AGANO	493956N 0020000W	Channel Islands CTR - Alderney Arrivals	JSY VOR/DME fix 008°/27 NM
			GUR VOR/DME fix 064°/67 NM

Figure 1.5 Coded designators

Navigation positions not marked by radio navigation aids are given a coded designator of up to five characters and are also defined by a radial and bearing from a co-located VOR/DME, as can be seen from *Figure 1.5* above.

AIP ENR - Navigation Warnings
(Ref. UK AIP ENR 5)

For safety reasons, when planning a VFR or IFR flight at low or high Flight Levels, the pilot must take into account the following:

- Prohibited, Restricted and Danger Areas (*Figure 1.6*)
- Military Exercise and Training Areas (*Figure 1.7*)
- Other Activities of a Dangerous Nature, such as High Intensity Radio Transmissions (*Figure 1.8*).
- Air Navigation Obstacles En Route, such as bridges and chimneys.
- Aerial Sporting and Recreational Activities.

ENR 5.1 - PROHIBITED, RESTRICTED AND DANGER AREAS		
Identification and Name Lateral Limits	Upper Limit (ft) Lower Limit (ft)	Activity Details, Remarks and Byelaw Reference (One hour earlier during summer period)
1	2	3
Danger Areas		
EG D001 Trevose Head 501918N 0053042W - 502400N 0053900W- 503200N 0053400W - 503930N 0052400W- 504300N 0051230W - 503830N 0050430W- 501918N 0053042W-	ALT 100 SFC	**Activity**: Helicopter Exercises including winching (Air Force Dept.) **Hours**: Mon to Thu 0800-2359, Fri 0800-1800. **Service**: DACS: St Mawgan APP on 126.500 MHz when open. Other times DAAIS: London Information on 124.750 MHz. **Remarks**: Nil.
‡ **EG D003 Plymouth** 501001N 0034740W - 500339N 0033430W- 494105N 0034912W - 493719N 0040938W- 501001N 0034740W-	Up to ALT 55 000 SFC Subject to co-ordination procedures above ALT 22 000	**Activity**: Ship Exercises / Target Towing/Firing/ Pilotless Target Aircraft (Navy Dept). **Hours**:Mon to Thu 0800-2359, Fri 0800 - 1600 and as notified **Service**: DACS: Plymouth Military on 121.250 MHz when open; other times London Mil via London Information on 124.750 MHz. **Remarks**: Pre-flight information may be obtained from Plymouth Operations, Tel: 01752-557550

Figure 1.6 Danger/Restricted/Prohibited areas

ENR 5.2 - MILITARY EXERCISE AND TRAINING AREAS		
Name Lateral Limits	Systems/means of activation announcement/ information for Civil Flights	Remarks and Activity Times (One hour earlier during summer period)
1	**2**	**3**
Areas of Intense Air Activity (AIAA)		
Oxford (h) 515600N 0014900W - 520130N 0011745W 515745N 0011126W - 514328N 0010000W 513433N 0010000W - 513423N 0011138 W 513938N 0015510W - 515600N 0014900W	Radar services are available within this area from Brize Radar on 134.300 MHz. The attention of pilots is also drawn to the Brize Norton Control Zone. (See ENR 2-2-2-1/2)	**Hours:** Permanently active. **Vertical Limits:** SFC to 5000 ft ALT. **Remarks:** There is intense air activity associated with closely woven civil and military climb out and approach procedures for the many airfields in this vicinity. Pilots flying in this area are advised to keep a constant vigilance particularly during weekdays when military activity is at its peak, and especially in the area 8.5 NM/308°(T) and 6 NM/145° (T) from Oxford/ Kidlington aerodrome where aircraft may be holding waiting clearance to join airways.

Figure 1.7 Military Training areas

ENR 5.3 - OTHER ACTIVITIES OF A DANGEROUS NATURE				
Name Lateral Limits	Vertical Limits	Advisory Measures	Authority Responsible for Information	Remarks Activity Times (One hour earlier during summer period)
1	**2**	**3**	**4**	**5**
High Intensity Radio Transmission Areas (HIRTA)				
Barford St John Radius 0.05 NM centred on 520001N 0012105W	ALT 850 ft			
Boulmer Radius 0.9 NM centred on 552400N 0013706W	ALT 1600 ft			
Buchan Radiius 0.65 NM centred on 572759N 0014706W	ALT 4000 ft			

Figure 1.8 Other Dangerous activities

AIP AD - Aerodrome Categorization
(Ref. UK AIP AD 1.4)

In the UK there are two types of civil aerodrome licence namely, PUBLIC USE LICENCE and ORDINARY LICENCE.

Aerodromes or heliports operated in accordance with a PUBLIC USE LICENCE must have their hours of availability notified in the UK AIP and the aerodrome/heliport must be available to all operators on certain equal terms and conditions. However, this does not necessarily mean that the aerodrome is available to all flights without limitation. Aircraft operators must check and comply with the requirements and conditions of use indicated at AD 2 or 3.

Aerodromes or heliports operated in accordance with an ORDINARY LICENCE may accept flights operated by the holder of the licence or by those specifically authorized by that licence holder. This normally means that prior permission is required for most flights but it does not exclude the possibility of scheduled or non-scheduled public transport flights being arranged after the formal agreement of the licence holder.

Aerodrome Communication Facilities
(Ref. UK AIP AD 2)

OXFORD/KIDLINGTON

EGTK AD 2.18 ATS COMMUNICATION FACILITIES				
Service Designation	Call Sign	Frequency (MHz)	Hours of Operation	Remarks
1	**2**	**3**	**4**	**5**
APP	Oxford Approach	125.325	Mon-Fri 0830-1730 and by arrangement (Winter) Mon-Fri 0730-1630 and by arrangement (Summer)	
TWR	Oxford Tower Oxford Ground	118.75 121.950	Mon-Fri 0830-1730 and by arrangement (Winter) Mon-Fri 0730-1630 and by arrangement (Summer)	
AFIS	Oxford Information	118.875	Sat, Sun & PH0830-1700 (Winter) Sat, Sun & PH 0730-1600 (Summer)	
ATIS	Oxford departure Information	121.750	Sat, Sun & PH0830-1700 (Winter) Sat, Sun & PH 0730-1600 (Summer)	

Figure 1.9 Aerodrome communication facilities

Aerodrome Radio Navigation and Landing Aids

BOURNEMOUTH

EGHH AD 2.19 RADIO NAVIGATION AND LANDING AIDS							
Type Category (Variation)	IDENT	Frequency	Hours of Operation Winter Summer # and by arrangement		Antenna Site co-ordinates	Elevation of DME transmitting antenna	Remarks
1	2	3	4		5	6	7
LLZ 08 ILS CAT 1	I BMH	110.5 MHZ	HO	HO	504700.26N 0014920.71W		
GP	IBMH	329.6 MHz	HO	HO	504641.46N 0015050.18W		3° ILS Ref Datum Hgt 53 ft. Localizer range is limited to 18 NM+/- at 10° and 8 NM at+- 35° of the localizer centre line
L	BIA	339 kHz	H24	H24	504639.62N 0015032.95W		On AD Range 20 NM
LLZ 26 ILS CAT 1	I BH		HO	HO	504638.13N 0015133.70W		3° ILS Ref Datum Hgt 50 ft. The quality of guidance provided does not permit use of the facility for coupled approaches below 350 ft.
GP	I BH		HO	HO	504659.81N 0014952.58W		
DME	I BMH (RWY 08) I BH (RWY 26)		HO	HO	504643.75N 0015023.24W	44 ft AMSL	On AD Freq. Paired with ILS I BH and I BMH. Zero range is indicated at the threshold of Runway 26 and 160 m before crossing threshold of runway 08.

Figure 1.10 Radio navigation and landing aids

From the table opposite:

- Bournemouth has a **Category I Instrument Landing System (ILS)** for runways **08** (call sign **I BMH**) and **26** (call sign **I BH**). The **Localizer (LLZ)** frequency for either runway system is **110.50 MHz**; the paired glide path (**GP**) frequency for each is **329.60 MHz.** The ILS hours of operation are denoted as **HO**, which means that the service is available to meet operational requirements. The antenna co-ordinates, published in the remarks column, are given in degrees, minutes, seconds and hundredths of latitude and longitude.

  The remarks column also states that the **glide slope** for each ILS is 3°, and that the ILS **Ref Datum Hgt (Reference Datum Height)** for runway 08 and 26 is **53 ft** and **50 ft**.

  "The ILS reference datum point is a point at a specified height (around 50 ft) located vertically above the intersection of the runway centre line and threshold, through which the downward extended portion of the ILS glide path extends."

  The remarks column for the ILS also publishes the localizer limitations for runway 08 and states, for the ILS on runway 26, that "The quality of guidance provided does not permit use of the facility for coupled approaches below 350 ft."

- **L** in the Type Column indicates that the airfield has a low powered Non-directional Beacon (NDB), known as a **Locator**, sited on the aerodrome (**AD**) at the published latitude and longitude; its call sign is **BIA**, frequency **339 kHz** and operational hours **H24** (continuous service). **Range 20 NM** in the remarks column is the promulgated range or Designated Operational coverage (DOC):

  "The range promulgated for UK NDBs is based upon a daytime signal protection ratio between wanted and unwanted signals that limits bearing errors at that distance to +/- 5°. At ranges greater than those promulgated bearing errors will increase. Adverse propagation conditions particularly at night will also increase bearing errors. This protection takes into account average atmospheric noise but not night-time sky waves."

  See the latest AIC on Radio Navigation Aids - Designated Operational Coverage.

- The **DME** (Distance Measuring Equipment) is frequency paired with ILS **I BMH** (RWY 08) and **I BH** (RWY 26). **Ch** (channel number) **42X** is the selection for military TACAN (TACtical Air Navigation) equipped aircraft. The operational hours are **HO** and the aerial elevation is **44 ft AMSL**. With reference to the Remarks column, **Zero range is indicated at the threshold of runway 26 and 160 m before crossing the threshold of runway 08**.

Other Sources

Publications such as Aerad and Jeppesen Flight Guides, Low and High Level Airways Charts, Arrival and Departure Charts and Airfield Approach Charts all, variously, provide information on airfield opening hours, handling, communication and radio navigation and landing aids etc.

Search and Rescue

There may on occasions be a question relating to Search and Rescue (SAR). SAR is covered in Air Law. References for this topic are:

- 010 Air Law
- UK AIP Document GEN 3.6
- ICAO Document Search and Rescue, Annex 12

Questions

1. **Where would you find information regarding Customs and Health facilities?**

    a. ATCC broadcasts
    b. NOTAMs
    c. NAV/RAD supplements
    d. AIPs

2. **Where would you find information regarding Search and Rescue procedures?**

    a. ATCC broadcasts
    b. NOTAMs
    c. SIGMETs
    d. AIPs

3. **In which document would you find information on known short-term unserviceability of VOR, TACAN, and NDB?**

    a. NOTAM
    b. Aeronautical Information Publication (AIP)
    c. SIGMET
    d. ATCC

4. **Where may details of temporary Danger and Restricted Airspace be found?**

    a. SIGMETs
    b. Aeronautical Information Circulars (AIC)
    c. NOTAM and Aeronautical Information Publication (AIP)
    d. ATCC

5. **Details of temporary danger areas are published:**

    a. in AICs
    b. on the appropriate chart
    c. by VOLMET
    d. in NOTAMs

6. **What are the types of NOTAM?**

    a. Temporary, short-notice, permanent
    b. A, B, C
    c. NOTAMN, NOTAMR, NOTAMC
    d. A, E, L

Answers

1	2	3	4	5	6
d	d	a	c	d	c

Chapter

2

Fuel Policy and Fuel Monitoring

Universal Application of Fuel Policy

You are shortly about to start practical planning examples on the Single-engine Piston, the Multi-engine Piston and the Medium Range Jet Transport aircraft. As you will find out, we enter various tables and graphs for these aircraft types and, from these, we are able to work out how much fuel will be used for a particular length of flight under different conditions of aircraft weight, air temperature and wind component. In general, these predictions are quite accurate as long as the meteorological conditions experienced are close to the forecast values used to produce the plan. We call this the **Trip Fuel**.

On its own, however, this is not enough. If we had just the trip fuel on board at the moment of take-off, the engine would stop because of fuel starvation the moment we arrived at the destination, which is obviously not an acceptable way to operate. Clearly, we need some fuel other than the minimum to just do the trip. After all, we start using fuel before take-off. We have to consider start-up and taxi. We also need reserve fuel, firstly in case the trip does not go as planned, and secondly in order to taxi in and shut down.

The principles which establish how much fuel should be carried on an air transport flight have been internationally agreed and are laid down in CS-OPS 1. Whilst the actual amounts vary from aircraft type to type, because different aircraft have different fuel consumptions, the rules by which the minima for each flight are calculated are universal.

This is known as **EASA Fuel Policy**.

Realistic Trip Fuel

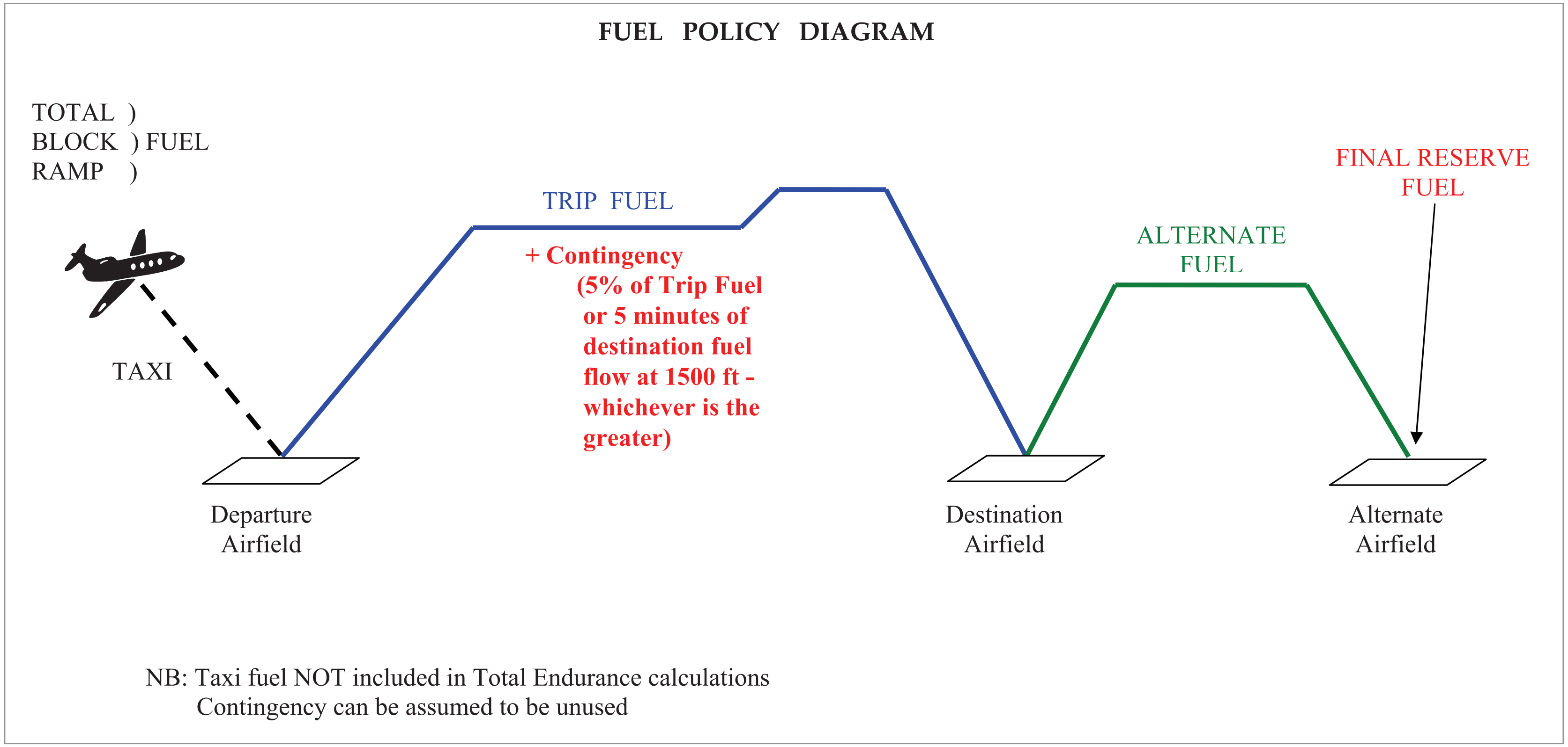
Whatever the commercial pressures to carry minimum fuel, there is no point in coming up with an unrealistically low figure for trip fuel. It has to be based on what you actually expect to happen. This means taking into account, for instance, the most likely routing, rather than a straight line route from departure to destination. If the departure airport insists on Standard Instrument Departures (SIDs) or the destination airport insists on Standard Instrument Arrivals (STARs), as is normal, then the SIDs and STARs may add tens of miles of track distance to the en route portion of the trip. These should be included in calculating the trip fuel. In particular, the following points should be noted:

The operator shall ensure that the planning of flights is based only upon:

- Procedures and data derived from the Operations Manual or current aeroplane specific data.

- The conditions under which the flight is to be conducted, including:

  - Realistic **fuel flows** expressed as **kg/h, lb/h or gal/h**;
  - The **aircraft's anticipated weights (masses)**
  - **Expected meteorological conditions;** and
  - **Air Traffic Service procedures and restrictions**


FUEL POLICY DIAGRAM
TOTAL)
BLOCK) FUEL
RAMP)
TAXI
TRIP FUEL
+ Contingency
(5% of Trip Fuel
or 5 minutes of
destination fuel
flow at 1500 ft -
whichever is the
greater)
ALTERNATE
FUEL
FINAL RESERVE
FUEL
Departure
Airfield
Destination
Airfield
Alternate
Airfield
NB: Taxi fuel NOT included in Total Endurance calculations
Contingency can be assumed to be unused

EASA Fuel Policy - Breakdown of Fuel

Under EASA fuel policy, fuel is considered under the following breakdown:

Taxi	
Trip	
Reserves which are further broken down into:	Contingency
	Alternate
	Final Reserve
	Additional
Extra	

Taxi Fuel

The amount required to start up, taxi, and hold (if necessary) before take-off. It will also include any fuel required to operate pre-flight services, such as cabin conditioning, and may include use of the APU. In the Boeing 737, for instance, 260 kg of Taxi Fuel is allowed. This is over a quarter of a tonne of fuel before take-off.

Trip Fuel

This should include fuel:

- For the take-off from the airfield elevation, the departure procedure (SID) and thence to the top of climb (TOC) at the initial cruising level/altitude.
- From the TOC to top of descent (TOD), including any step climbs or descents.
- From TOD to the point where the approach is initiated; account is taken of expected arrival procedures (STARs).
- For approach and landing.

Reserve Fuel

Reserve Fuel is further subdivided into:

- Contingency Fuel
- Alternate Fuel
- Final Reserve
- Additional Fuel

Each of these will be dealt with separately shortly.

Extra Fuel

Extra Fuel is any fuel above the minima required by Taxi, Trip and Reserve Fuel. It can simply be because more has been uplifted than is required for the trip, so the surplus is defined as Extra Fuel or, more usually, it can be because, even when all the minima required by EASA fuel policy are carried, the aircraft commander decides that more is needed because of particular circumstances.

Reserve Fuel

Contingency Fuel

An operator must ensure that every flight carries sufficient fuel for the planned operation, and reserves to cover any replanning necessary for in-flight contingencies. **A contingency is a chance occurrence or unforeseen event. Contingency Fuel** is carried to compensate for deviations:

- Of an individual aircraft from the expected fuel consumption data
- From the forecast meteorological conditions
- From the planned routing and/or cruising levels/altitudes.

Alternate Fuel

Alternate Fuel is simply the fuel required to fly from missed approach at the destination to the planned alternate. It should take into account probable routing and expected wind component, but it does not have its own allowance of contingency fuel. Contingency allowance is applied only to the trip fuel.

Final Reserve Fuel

If you fly from departure to destination, use the contingency fuel en route, and then have a missed approach at the destination and fly to the alternate, you will have no fuel left on arrival. We therefore have a minimum landing fuel, and you should normally never land with less than the Final Reserve Fuel. It consists of 30 min (jet/turboprop) at 1500' above AAL in ISA conditions, or 45 min (piston engine aircraft) fuel consumption at endurance speed.

Additional Fuel

Contingency, Alternate and Final Reserve fuel cover most cases, and provided that suitable diversions are available en route and near the destination, this is all that is required for Reserve Fuel. There are two cases, however, where Additional Fuel may be needed:

No Alternate

This is also known as the "Island Holding" situation. If there is no alternate available at some isolated aerodrome, then you need to be able to cope with the aircraft landing two minutes ahead of you bursting a tyre on the runway, or possibly a short duration tropical squall going through.

No En Route Alternate and Inability to Hold Height

If you are a long way from an alternate and you suffer some malfunction which requires you to reduce to a lower altitude (engine failure or pressurization failure or both), you may have to fly a long portion of the flight at a higher fuel consumption than planned. In this case you may need Additional Fuel.

EU-OPS policy states minimum Additional Fuel should be sufficient to permit:

a. If an engine fails or the pressurization is lost at the most critical point, the aircraft to descend as necessary and proceed to an adequate alternate aerodrome and hold at 1500 ft for 15 minutes above the aerodrome elevation in ISA conditions

except that this additional fuel is not required if adequate basic trip, contingency, alternate and final reserve is sufficient to complete the above profile and

b. Holding for 15 minutes at 1500 ft above the destination aerodrome in ISA conditions when a flight is operated without a destination alternate aerodrome

On most flights Additional Fuel is not required but in either of the above cases, it may be necessary.

Calculation of Contingency Fuel

Numerical calculation of taxi, trip, alternate and final reserve fuels is fairly straightforward. Taxi fuel is usually a standard allowance. Trip fuel and alternate fuel are extracted from graphs or tables from the appropriate Operational Flight Manual. We will practise this process in Chapters 3, 4 and 5. Final reserve fuel is a simple calculation based on 30 (jet/turboprop) or 45 (piston) minutes hold at endurance speed. However, contingency fuel can vary depending on the type of operation.

Contingency Fuel is the higher of **A** and **B** below:

A

As agreed with the appropriate national aviation authority:

- 5% of the planned trip fuel, or, in the event of in-flight replanning, 5% of the trip fuel for the remainder of the flight. No en route alternative is needed in this case.

- If the operator has a fuel monitoring programme and agrees a particular method of statistical analysis which includes standard deviations (the details need not concern us for the purposes of the ATPL), this can be reduced yet further by agreement with the authority.

B

An amount to fly for 5 minutes at holding speed at 1500 ft (450 m) above the destination aerodrome in standard conditions.

For the most part the contingency Fuel will be based on 5% of trip fuel but be aware of the alternate B because questions do occur when holding for 5 minutes at 1500 ft will be a HIGHER figure.

Fuel Policy - Worked Examples

Example 1

Jet aircraft. Taxi fuel is 60 kg. Cruise fuel flow is 5000 kg/h. Hold fuel flow is 3000 kg/h. Flight time is 2 h 30 min. Contingency is 5% of trip fuel. Alternate fuel is 900 kg. What is the required ramp fuel?

Taxi			60
Trip		5000 kg/h × 2.5 h	12 500
Reserve			
	Contingency		625
	Alternate		900
	Final Reserve	30/60 × 3000	1500
	Additional		Not required
Extra			Not required
Total ramp fuel			**15 585 kg**

Example 2

Jet aircraft. Taxi fuel is 100 kg. Trip fuel is 5325 kg. Hold fuel is 6000 kg/h. Alternate fuel is 4380 kg. Contingency is the higher of 5% trip fuel or 5 minutes of holding at 1500 ft.

What is minimum required take-off fuel?

a. 12 971 kg
b. 14 500 kg
c. 13 205 kg
d. 13 370 kg

Ans: c

Example 3

Piston aircraft. Taxi fuel 20 lb. Cruise fuel flow 150 lb/h. Hold fuel flow 60 lb/h. Flight time 1 hour 20 min. Alternate fuel 40 lb.

Assuming minimum fuel uplift, normal en route diversions available and that contingency fuel is not used en route, what will be your fuel on arrival at the alternate?

a. 315 lb
b. 95 lb
c. 57 lb
d. 295 lb

Ans: c

Example 4

Piston aircraft. Taxi fuel 20 lb. Cruise fuel flow 150 lb/h. Hold fuel flow 60 lb/h. Flight time 1 hour 20 min. Alternate fuel 40 lb.

Assuming minimum fuel uplift, normal en route diversions available and that contingency fuel is not used en route, what will be your fuel on arrival at the destination after a 20 minute hold?

a. 87 lb
b. 97 lb
c. 57 lb
d. 77 lb

Ans: d

Fuel Monitoring

Having planned the expected fuel consumption, we now have to ensure that the aircraft is performing closely to the plan, and take appropriate action if it does not.

A commander must ensure that **fuel checks are carried out in flight at regular intervals**. The fuel remaining must be recorded and evaluated to:

- Compare actual consumption with planned consumption
- Check that the remaining fuel is sufficient to complete the flight
- Determine the expected fuel remaining on arrival at the destination

The relevant fuel data must be recorded.

If, as a result of an in-flight fuel check, the expected fuel remaining on arrival at the destination is less than the required alternate fuel plus final reserve fuel, **the commander must take into account the traffic and the operational conditions prevailing at the destination airfield, along the diversion route to an alternate aerodrome and at the destination alternate aerodrome,** when deciding to proceed to the destination aerodrome or to divert, so as **to land with not less than final reserve fuel.**

Modern major carriers use computer flight planning. Either they install their own dedicated ground flight planning computer, such as BA's CIRRUS system or Lufthansa's LIDO system, or they subscribe to a commercially available system such as JETPLAN. The computer output is usually in the form of large sheets of fanfold paper and a typical print-out is shown on the next page. Line 18 in this example is a list of the titles of each column and the last entry is "REM". This means "Fuel Remaining". Look down the columns and you will see that for each waypoint (KONAN, KOKSY, REMBA, etc) there is a REM value (0045, 0043, 0038, etc). This is the minimum fuel that should remain (in hundreds of kilogrammes) overhead the waypoint (i.e. 4500 kg, 4300 kg, 3800 kg, etc). All that the pilot has to do is check as he passes over each waypoint that the fuel remaining is not less than the flight plan fuel and he then knows that he has sufficient to complete the trip and arrive with appropriate reserves.

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Line
1 PLAN 6340                          EGKK TO EDDF 757B M80/F 09/30/92
2 NONSTOP COMPUTED 1145Z   FOR ETD 1830Z PROGS 30000Z                                    KGS
3               FUEL     TIME  DIST   ARRIVE  TAKEOFF        LAND   AVPLD       OPNLWT
4 POA EDDF      003091   00/55      0362   1925Z     077390          074299   012500   058638
5 ALT  EDDL     001485   00/24      0101   1949Z     COMP M015
6 HLD           001521   00/30
7 CON           000155   00/03
8 REQ           006252   01/52
9 XTR           000000   00/00
10 TOT          006252   01/52
11 EGKK DVR6M DVR UG1 NTM NTM1A EDDF
12 WIND P029 MXSH 5/KOK TEMPO P01 NAM 0337
13 FL 370
14 LRC FL370 003091 00/56
15 LRC FL330 003180 00/57
16 LRC FL410 003111 00/55
17 EGKK ELEV 00202FT
18 AWY          WPT      MTR  DFT  ZD   ZT    ETA   ATA    CT      WIND    COMP    GRS   DSTR  REM
19 MSA          FRQ
20 DVR6M        DVR      092  . .  068  0/11 . .    . .    0/11    ....    ....    ....  0294
21 023          114.95
22 UG1          TOC      097  . .  014  0/02                                            0289  0046
23 023
24 UG1          KONAN 097     L01  010  0/01 . .    . .    0/14    27045   P045    502   0270  0045
25 023
26 UG1          KOK      097  L01  025  0/03 . .    . .    0/17    26041   P040    497   0245  0043
27 023          114.5
28 UG1          REMBA    108  L02  090  0/11 . .    . .    0/28    27030   P028    488   0155  0038
29 026
30 UG1          NUVIL    109  L01   024  0/03       . .    . .     0/31    27025   P024  485   0131
0036
31 034
32 UG1          SPI      110  L01  004  0/01 . .    . .    0/32    27025   P024    485   0127  0036
33 034
34 UG1          LARED    131  L02  009  0/01 . .    . .    0/33    28025   P020    481   0118  0036
35 034
36 UG1          TOD      131  L03  007  0/01 . .    . .    0/34    28025   P021    481   0111  0035
37 043
38 UG1          NTM      131   . .  030  0/06 . .    . .    0/40    . . .   . . .   . . . 0081  . . .
39 043
40 NTM1A        EDDF     089   . .  081  0/16 . .    . .    0/55    . . .   . . .   . . . 0000  0032
41 043
42 ELEV         00364FT
43 EGKK         N51089W000113       DVR        N51097E001217         KONAN  N51078E002000
44 KOKN51057E002392             REMBA   N50398E004549                NUVIL
N50322E005315
45 SPI          N50309E005375               LARED       N50252E005480          NTM
N50010E006320
46 EDDF         N50021E008343
47 FIRS EBUR/0014   EDDU/0036
48 (FPL-JD105-IN)
49 -B757/M-SXI/C
50 -EGKK1830
51 -N0457F370  DVR6M   DVR UG1 NTM NTM1A
52 -EDDF0055 EDDL
53 -EET/EBUR0014   EDDU0036
54 REG/GBDKC  SEL/JDHC
55 E/0152   P/121   R/V   S/M   J/L   D/6   150C   YELLOW
56 A/WHITE BLUE
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Figure 2.1 Computer flight plan - Gatwick to Frankfurt

For longer flights, it is also necessary to keep a track on the fuel consumption trend. We may have adequate reserves at the start of a trip but if the fuel consumption rate is higher than forecast we may go below the minimum requirement at a later stage of the flight. We need to have adequate early warning of the fuel flow as well as the total quantity.

On sophisticated modern aircraft this is accomplished by use of the Flight Management System. The fuel contents and the fuel flow-meter readings are passed directly into the Flight Management Computer (FMC). The FMC also knows the route distance to go, the current ground speed and the anticipated descent profile. From this it can work out the expected fuel on arrival. This is available for the pilots to check at any time. This expected arrival fuel is also compared with the sum of the alternate fuel and the final reserve fuel. If it goes below this sum, a warning to the pilots is displayed on the Control and Display Unit (CDU).

For aircraft without an FMS, the 'Howgozit' fuel graph is the usual method. A graph is drawn with 'Fuel Remaining' as the 'y' axis and 'Distance to Go' as the 'x' axis. See the example at *Figure 2.2*.

Note: Questions on the 'Howgozit' are not set in the EASA exam. This is simply to help your understanding of fuel monitoring.

In this example, we are assuming that we have a flight of 1000 nautical ground miles. We have to land with 1000 kg (our final reserve fuel) and the fuel required to fly to the alternate is 700 kg. Therefore our minimum on arrival at the destination is 1700 kg.

(Just out of interest, note that the slope changes shortly after the start. This is because aircraft usually climb at a slower speed than cruise, but the engines are at or near max continuous power in the climb but at cruise power when level).

We are expecting to use 5000 kg en route, so this is our trip fuel. Our contingency will be 5% of the remaining trip fuel, so this will be 250 kg at the start of the trip, reducing to zero at the end. Our minimum take-off fuel is therefore 6950 kg.

Now, although we must have our contingency fuel on board, very often we do not use it. After all, the trip fuel is supposed to be based on a realistic figure. Therefore the contingency is only to cover unforeseen fuel consumption deviations, incorrect met forecasts and unexpected ATC re-routing. On the majority of trips, these should not occur. In these cases, the fuel will track down the 'probable fuel consumption' line and we will arrive with the contingency fuel unused.

During the flight we take fuel checks every half hour (or other interval, as specified in the company's Flight Operations Manual). From these we build up the history of the fuel consumption and establish a trend. Extrapolating the slope will indicate to us the expected arrival fuel if the trend continues. In *Figure 2.3*, for instance, we are going to arrive with sufficient fuel. In *Figure 2.4*, we are not. In this case, appropriate action would have to be considered, such as returning to the departure airfield or diverting to a suitable en route airfield to up-lift fuel.

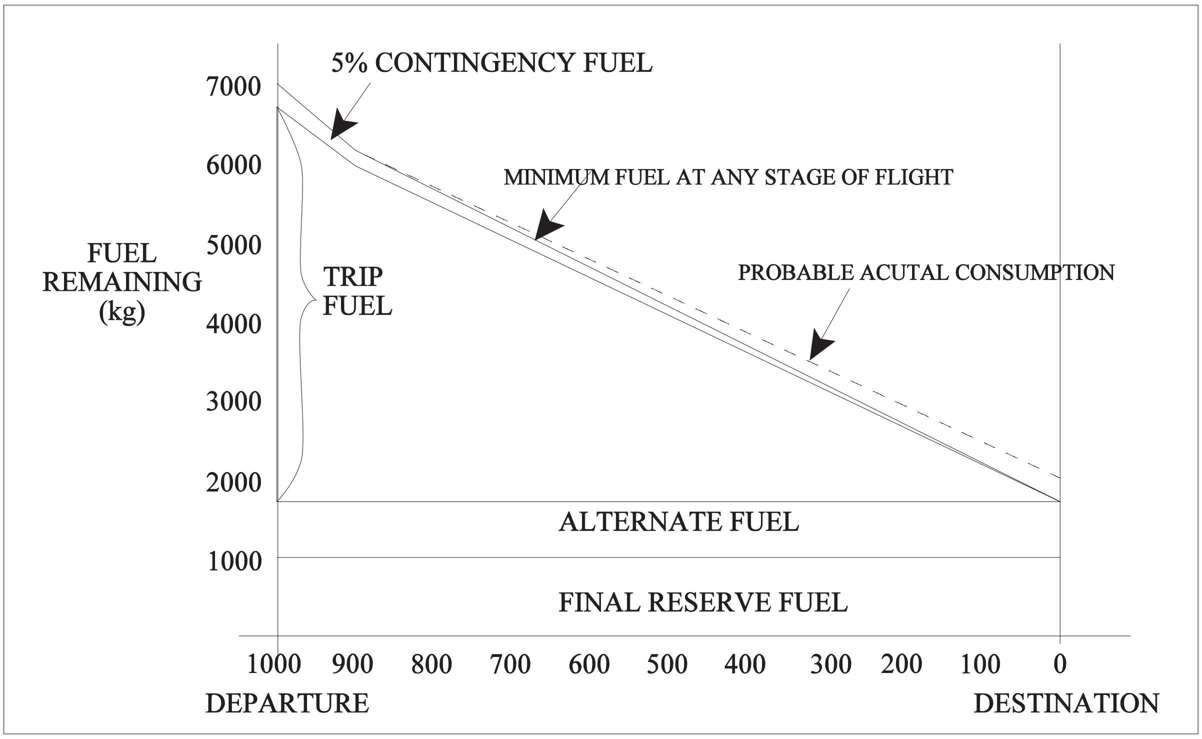


Figure 2.2 Fuel graph

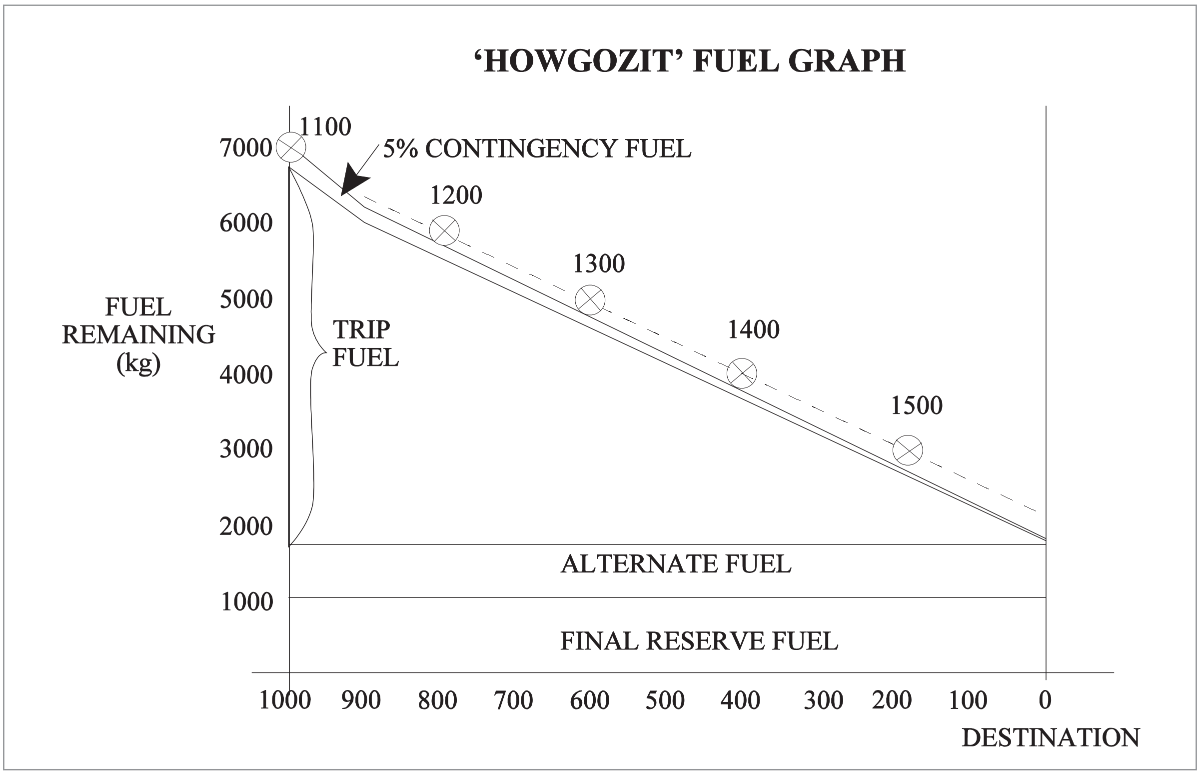


Figure 2.3 Sufficient fuel

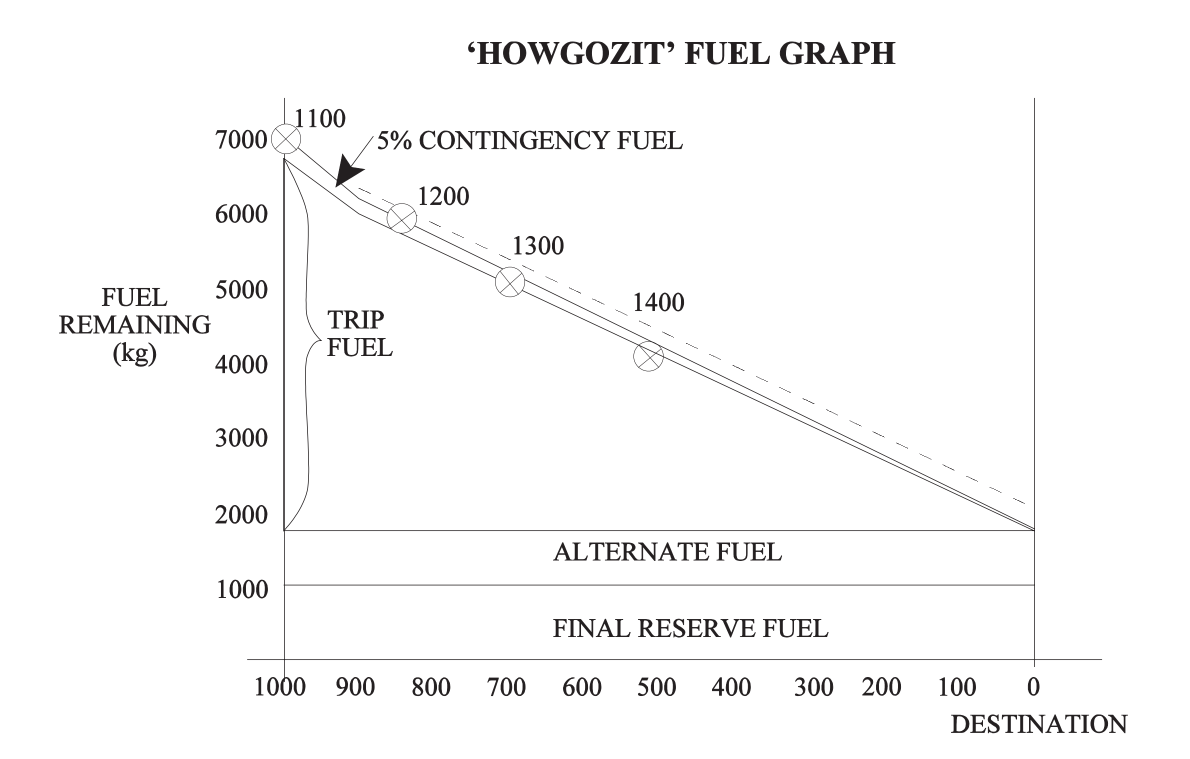


Figure 2.4 Insufficient fuel

A check of the aircraft's fuel system may be required if it was thought that the excess consumption was caused by a fuel leak or a fuel-gauge fault. An error in computation at flight planning or in the actual fuel amount up-lifted at departure may have been the cause of the short- fall. Aircraft have run short of fuel. Very strong un-forecast headwinds have been encountered. Pounds to kilograms, kilograms to pounds, have been erroneously converted and specific gravities applied incorrectly!

Special Cases 1 – Decision Point Procedure

There is a special case when we may get airborne without sufficient contingency fuel for the planned trip to the destination. This is called **decision point procedure**.

Decision Point Procedure - A Typical Scenario

Consider the 'Howgozit' in *Figure 2.6*. A flight from Oxford to Faro, in southern Portugal, is planned. There are alternates near Faro - Seville or Jerez, for instance. The total of the final reserve fuel and the alternate fuel is 3000 kg. The trip fuel is exactly 10 000 kg. There is a suitable en route diversion at Lisbon, so contingency fuel is 3%, which comes to 300 kg. This means that we need 13 300 kg at take-off.

Unfortunately, the maximum capacity of our fuel tanks means that we can get in only 13 150 kg at take-off. This is 150 kg short of the minimum requirement. Does this mean that we cannot do this flight? Not necessarily, if there is a suitable en route alternate.

We define the top of descent for going into Lisbon, our alternate, as the Decision Point. We have plenty of fuel to proceed to Lisbon, so this is legal. At this Decision Point, we carry out a fuel check. Unless unforeseen circumstances have arisen, we will probably not have used the contingency fuel and so will still have 150 kg above the expected consumption line for Faro.

The requirement for contingency fuel is 3% above the trip fuel required for the remainder of the flight, not the start trip fuel. At this stage of the trip, the required contingency fuel is only 55 kg. If the fuel remaining includes this 55 kg contingency fuel plus the remainder of the trip fuel for Faro (along with the usual alternate fuel and final reserve fuel), we continue to Faro. If the fuel remaining comes to less than this figure, we divert to our alternate, Lisbon.

Figure 2.5 Oxford to Faro

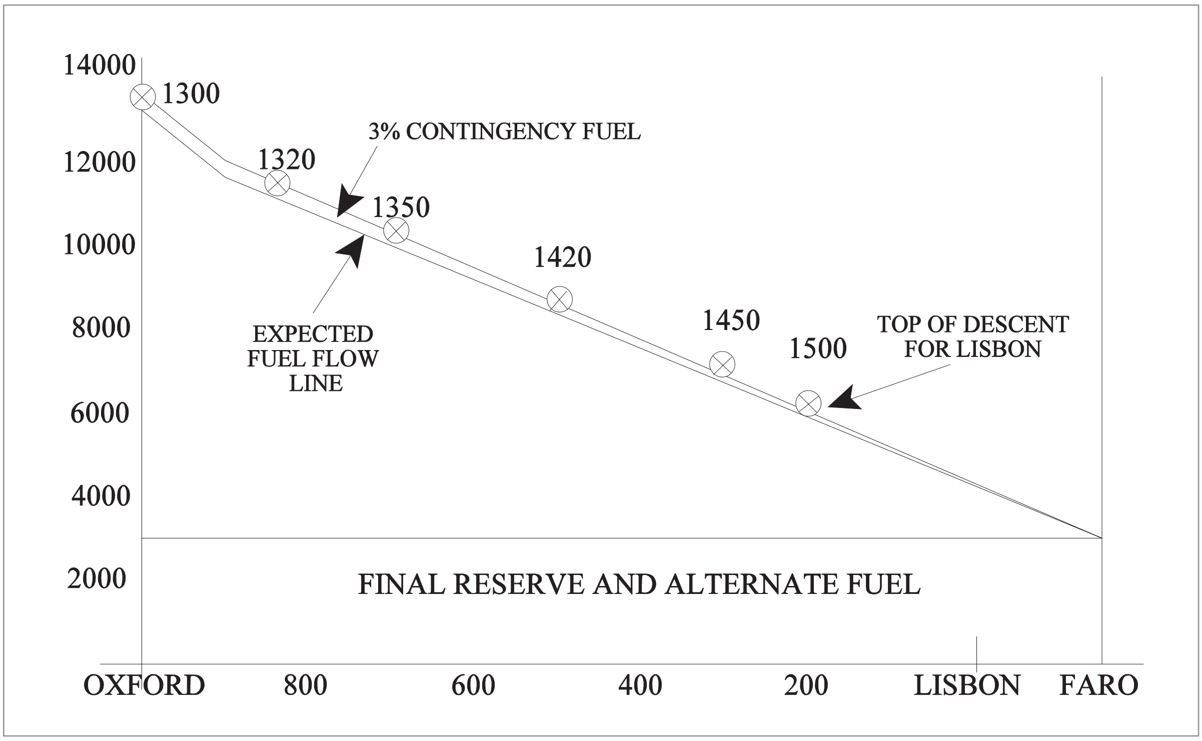


Figure 2.6 Oxford to Faro

Decision Point Procedure should not be attempted unless the departure fuel is sufficient to guarantee a reasonable expectation of there being enough fuel remaining at the Decision Point to permit continuation to the scheduled destination. The success of a Decision Point Procedure will depend on whether unforeseen events, such as not being cleared to the optimum cruise level or avoidance of weather, have caused the contingency fuel allowance to be used. The normal non-consumption of contingency fuel, which can be a considerable amount (usually 3% at least of the fuel between departure and Decision Point), permits Decision Point Procedure to be feasible and safe.

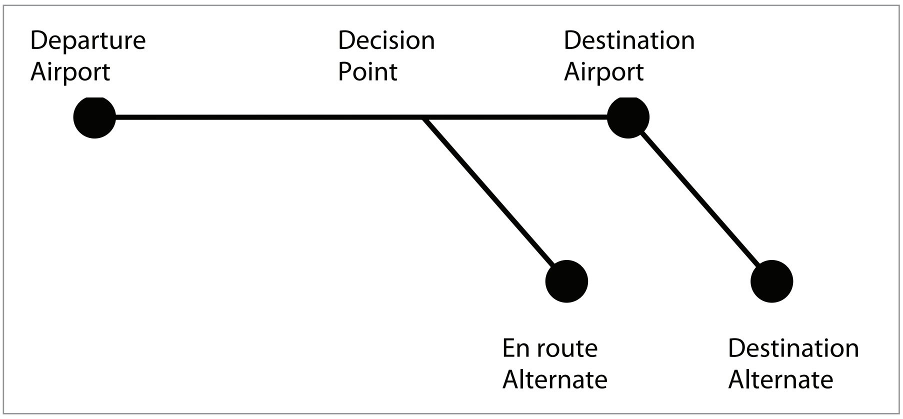


Figure 2.7 Decision point procedure

Comparing the Decision Point Procedure fuel requirement with the normal fuel requirements, **the maximum fuel reduction available is the contingency fuel (3% or 5% of trip fuel) between Departure and Decision Point.**

Alternatively, we can say that **contingency fuel can be reduced down to that required between Decision Point and Destination.**

Special Cases 2 – Isolated Aerodrome Procedure

An 'Isolated' aerodrome is defined as an aerodrome for which there is no Destination Alternate. An island in an ocean is a good example, for instance, Easter Island in the South Pacific. In this case the aircraft might have to hold for longer than usual (e.g. in the case of a blocked runway or a tropical storm passing through) with no option of diverting. Reserves normally consist of contingency fuel, alternate fuel and final reserve fuel. In the case of an Isolated aerodrome there is no alternate, so there is no alternate fuel. Instead, for a jet or turboprop aircraft, the combination of final reserve fuel and additional fuel must comprise enough fuel to fly for two hours at normal cruise consumption after arriving at the destination aerodrome. CS-OPS 1 specifies that the fuel must include:

- Taxi fuel
- Trip fuel
- Contingency fuel
- Additional fuel if required but not less than:
    - For aeroplanes with reciprocating engines, fuel to fly for 45 minutes plus 15% of the flight time planned to be spent at cruising level, or two hours, whichever is less.
    - For aeroplanes with turbine engines, fuel to fly for two hours at normal cruise consumption after arriving overhead the destination aerodrome, including the final reserve fuel.

Questions

1. **Given:**

Dry Op Mass	**= 33 510 kg**
Traffic Load	**= 7600 kg**
Final reserve fuel	**= 983 kg**
Alternate fuel	**= 1100 kg**
Contingency fuel	**= 102 kg**

The estimated landing mass at the alternate should be:

a. 42 312 kg
b. 42 093 kg
c. 42 210 kg
d. 42 195 kg

2. **What is the purpose of Decision Point Procedure?**

a. Carry minimum fuel to increase Traffic Load
b. Increase safety of the flight
c. Reduce landing mass to avoid stressing the aircraft
d. Reduce contingency fuel to below that required from Decision Point to destination

3. **What is Decision Point Procedure?**
It is a procedure to reduce the amount of fuel carried on a flight by:

a. reducing contingency fuel from 10% to 5% of trip fuel
b. reducing contingency fuel to only that required from Decision Point to destination
c. reducing trip fuel to only that required from Decision Aerodrome to destination
d. reducing contingency fuel to below that required from Decision Point to destination

4. **Turbojet a/c; taxi fuel 600 kg; fuel flow cruise 10 000 kg/h; fuel flow hold 8000 kg/h; alternate fuel 10 200 kg; flight time 6 hours; visibility at destination 2000 m. What is the minimum ramp fuel?**

a. 80 500 kg
b. 79 200 kg
c. 77 800 kg
d. 76 100 kg

5. **Given: DOM 33 510 kg; Traffic load 7600 kg. Trip fuel 2040 kg. Final reserve 983 kg. Alternate fuel 1100 kg. Contingency 5% of trip fuel.**
Which of the following is correct?

a. Est. landing mass at destination 43 193 kg
b. Est. landing mass at destination 43 295 kg
c. Est. take-off mass 43 295 kg
d. Est. take-off mass 45 233 kg

6. Multi-engine a/c on IFR flight. Given: trip fuel 65 US gal; contingency 5% trip; Alternate fuel including final reserve 17 US gal; Usable fuel at departure 93 US gal. At a point halfway to destination, fuel consumed is 40 US gal. Assuming fuel consumption is unchanged, which of the following is correct?

a. At departure reserve fuel was 28 US gal
b. At destination required reserves remain intact
c. Remaining fuel is insufficient to reach destination with reserves intact
d. At destination there will be 30 gal in tanks

7. Minimum planned take-off fuel is 160 kg (30% total reserve is included). Assume the ground speed on this trip is constant. When half the distance has been flown, the remaining fuel is 70 kg. Is it necessary to divert to a nearby alternate?

a. Diversion to a nearby alternate is necessary, because the remaining fuel is not sufficient
b. Diversion to a nearby alternate is not necessary, because the reserve fuel has not been used completely
c. Diversion to a nearby alternate is necessary, because it is allowed to calculate the fuel without reserve
d. Diversion to a nearby alternate is necessary, unless the captain decides to continue on his own responsibility

Answers

1	2	3	4	5	6	7
d	a	b	c	b	c	a

Chapter

3

Nautical Air Miles

Nautical Air Miles

Many of the graphs for the Single-engine Piston (SEP), Multi-engine Piston (MEP) and, later, the Medium Range Jet Transport (MRJT) aircraft, refer to nautical air miles (NAM). They are a measure of the air distance flown by an aircraft, i.e. the distance flown at the True Airspeed (TAS). In still air (or when there is no wind component along the aircraft's heading vector) the NAM flown are equal to the Nautical Ground Distance (NGM) flown. NGM is the distance flown by the aircraft over the ground, as may be measured on a chart.

Usually the air is moving and an aircraft flying through this moving air will fly a different distance over the ground. If the air is moving in the opposite direction to the aircraft (a headwind, or minus wind component) then the aircraft will fly more NAM than NGM. (See *Figure 3.1*.)

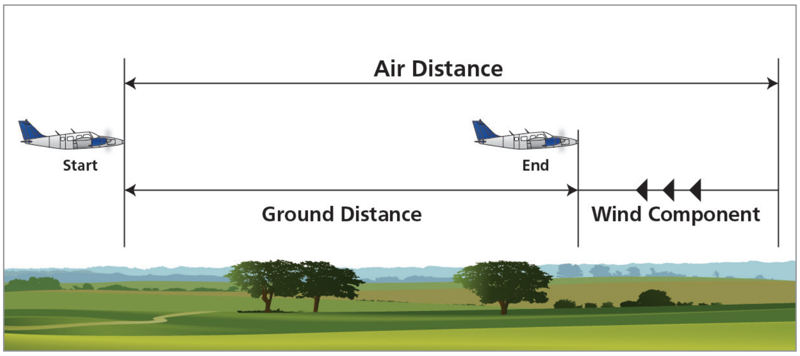


Figure 3.1 NAM greater than NGM

Similarly, if the wind is blowing in the direction that the aircraft is flying, (a tailwind or plus wind component) the NAM will be less than NGM. (See *Figure 3.2*.)

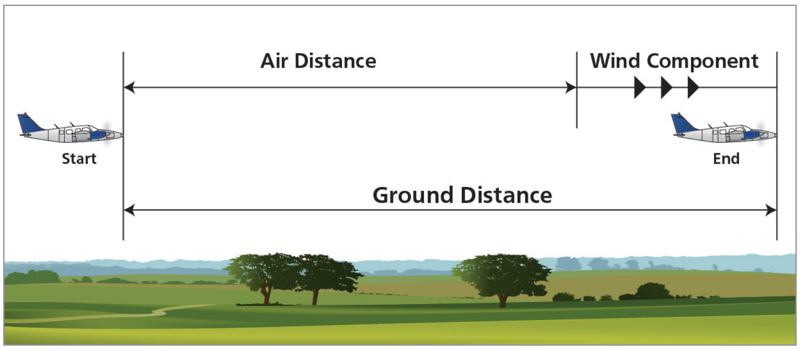


Figure 3.2 NAM less than NGM

The relationship between NAM, NGM, TAS, GS (ground speed) and wind component (WC) is:

$$\frac{NAM}{NGM} = \frac{TAS}{GS}$$

Example

An aircraft flies at TAS 142 kt for 63 NAM. If the WC is -20 kt, how many NGM does it fly?

$$\frac{NAM}{NGM} = \frac{TAS}{GS}$$

$$\frac{63}{x} = \frac{142}{122}$$

$$x = 122/142 \times 63 = 54$$

OR on your Navigation Computer

Red cursor: 142 on the inner scale is set against 122 on the outer. Blue cursor: 63 is read on the inner scale against 54 on the outer.

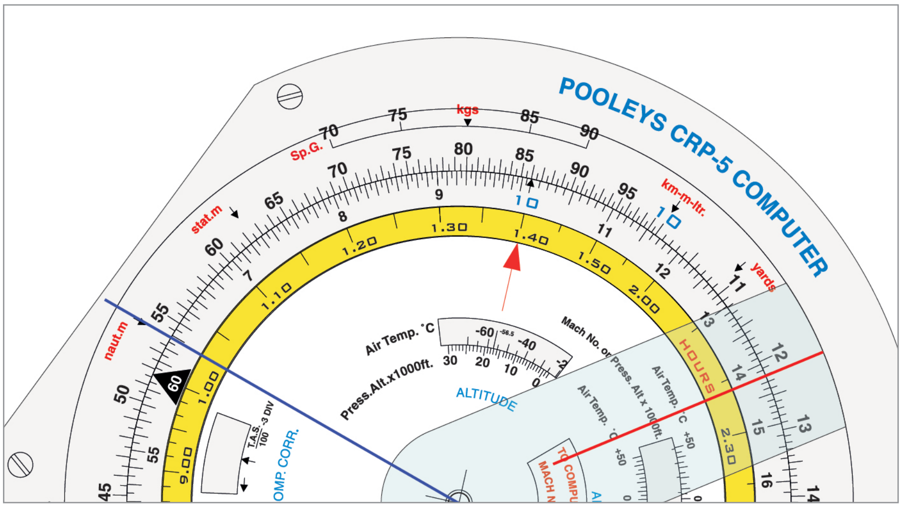


Figure 3.3 NAM to NGM using navigation computer

If the TAS (or GS) are not known, for example in a climb or descent, the conversion can still be carried out.

Consider an aircraft with a TAS of 100 kt:

In one hour it would fly 100 NAM. But in that hour the air has been moved by the wind component. If the WC is -25 (25 head), then the air has moved 25 NM in the direction from which the aircraft came. So the ground distance flown is:

$$100 - 25 = 75 \text{ NGM}$$

Similarly, if the WC is +25 (25 tail) the ground distance is:

$$100 + 25 = 125 \text{ NGM}$$

We can see that the difference between air and ground distance is the +/- WC per minutes flown, or:

$$\frac{+/-\ WC}{60} \times \text{minutes flown}$$

This gives the formula:

$$NGM = NAM +/- \left(\frac{WC}{60} \times \text{sector time} \right)$$

Example

An aircraft climbs to cruising level in 11.5 minutes, covering 23.5 NAM. If the wind component is -30 kt, how many NGM are flown in the climb?

$$NGM = 23.5 - \left(\frac{30}{60} \times 11.5 \right)$$

$$= 23.5 - 5.75$$

$$= 17.75 \text{ (or 18) NGM}$$

Questions

Take time to become very proficient doing these problems by completing the following exercises.

	TAS	W/C	GS	NAM	NGM
1	120	+20			250
2	120	-20			250
3	150	+30		330	
4	150	-30		330	
5	215	+15			755
6		+25	230	610	684
7		-20	95		185
8	550	-50			1235
9	135	+18			322
10	95	-10		310	277
11	550		520		215
12	140		160	425	
13			125	250	310
14	90			155	140
15	615	-65			2050
16	485	+55			215
17	375	+12		1500	
18	280	-20		715	
19	155	+35			785
20	405	-38		218	

	TIME	W/C	NAM	NGM
21	20	+30	105	
22	20	-30	105	
23	12	-25		88
24	30	+35	210	
25	8	-12	18	
26	15	+28		100
27	9	-35	50	
28	15	+50	85	
29	25	-40		125
30	18	+30	65	

Answers

	TAS	W/C	GS	NAM	NGM
1	120	+20	140	214	250
2	120	-20	100	300	250
3	150	+30	180	330	395
4	150	-30	120	330	264
5	215	+15	230	706	755
6	205	+25	230	610	684
7	115	-20	95	224	185
8	550	-50	500	1358	1235
9	135	+18	153	284	322
10	95	-10	85	310	277
11	550	-30	520	227	215
12	140	+20	160	425	486
13	101	+24	125	250	310
14	90	-9	81	155	140
15	615	-65	550	2292	2050
16	485	+55	540	193	215
17	375	+12	387	1500	1548
18	280	-20	260	715	664
19	155	+35	190	640	785
20	405	-38	367	218	198

	TIME	W/C	NAM	NGM
21	20	+30	105	115
22	20	-30	105	95
23	12	-25	93	88
24	30	+35	210	227
25	8	-12	18	16
26	15	+28	93	100
27	9	-35	50	45
28	15	+50	85	98
29	25	-40	142	125
30	18	+30	65	74

Chapter

4

Single-engine Piston Aeroplane (SEP)

Introduction

The tables for SEP refer to a more complex aircraft than the Warrior. The SEP is **a monoplane** with a **reciprocating engine.** It has a **constant speed propeller**, propeller rpm being controlled by the pilot via an rpm (or pitch) lever. The fuel/ air mixture may be "rich" (more fuel) or "lean" (less fuel). Total fuel/ air mixture going into the engine is adjusted by varying the manifold pressure; the higher the manifold pressure, the more mixture being burnt.

The SEP manifold pressure is measured in inches of mercury; e.g. "25.0 inHg". As the aircraft climbs, the throttle lever must be advanced, manually, in order to maintain a desired pressure. Sometimes an engine device can add more fuel/ air mixture automatically, without the pilot moving the throttle lever. Eventually, in the climb, an altitude will be reached where manifold pressure can no longer be maintained. In this case, the throttle lever will remain at "maximum forward" and manifold pressure will start to reduce. **This altitude is called "full throttle height" and the power is said to be at "full throttle".**

The SEP has a **retractable undercarriage**. The tables assume that the undercarriage is at the appropriate position for the stage of flight i.e. "down or extended" for landing and take-off, "up or retracted" for climb, cruise and descent. There is no requirement to consider abnormal cases.

Details:

Maximum Take-off Mass (MTOM)	**3650 lb**
Maximum Landing Mass (MLM)	**3650 lb**
Maximum fuel load	**74 US.gal**
Fuel density	**6 lb/US.gal (unless advised otherwise)**

Single-engine Piston Aeroplane
(SEP) GRAPHS & TABLES

Please refer to CAP 697 where all the graphs and tables for SEP will be found.

NB. In the EASA Flight Planning exam you will be issued with a workbook instead of the CAP 697 in which will be the necessary pages for that particular paper.

Each graph and table type within CAP 697 has an example to explain how the particular graph or table is used. Therefore, the method is not repeated in these notes.

SEP - Time, Fuel and Distance to Climb Data
(Ref. CAP 697 Fig. 2.1.)

The graph gives time, fuel and distance (NAM) to climb to any height (as pressure altitude and OAT) from MSL. If the airport is at MSL, the climb data can be read from the graph in one pass. If the airport is not at sea level then you have to extract the data for the top of climb (TOC) or initial cruising level, then extract data for the airport and take the airport data away from your cruising level to get the correct figures.

Climb Examples

1. Refer to CAP 697 Figure 2.1

Given:

Airfield at	MSL	
OAT	+20°C	
Mass	3650 lb	
Climb to	FL100	OAT -10°C

What is the time, fuel and distance covered in the climb?

Time Fuel Distance

With a 30 kt tailwind; what is the ground distance covered in the climb?

2. Refer to CAP 697 Figure 2.1

Given:

Airfield at	3000 ft	
OAT	+15°C	
Mass	3200 lb	
Climb to	FL120	ISA

What are the time, fuel and distance covered in the climb?

	Time	Fuel	Distance
FL120			
3000 ft			
Difference			

With a 40 kt headwind; what is the ground distance covered in the climb?

Answers to Climb Examples
1.

Time	Fuel	Distance
13	**4.8**	**27**

33 NGM

2.

	Time	Fuel	Distance
FL120	**14**	**5**	**29**
3000 ft	**3**	**1**	**5**
Difference	***11***	***4***	***24***

17 NGM

Cruise Power Settings Tables

Each table in the Figure 2.2 series shows the performance data for a given power setting. For example, table 2.2.1 is for:

Manifold pressure of 25.0 inHg (mercury) @ 2500 rpm.

The data is given for three different ISA temperature deviations: STANDARD DAY, ISA +20°C and ISA -20°C. Note that above a certain altitude (full throttle height), the stated manifold pressure cannot be produced by the engine and the tabulated values of manifold pressures (shaded areas) are approximately the maximum that can be expected.

The tables are used by turning to the page for the selected power setting and then selecting the appropriate Pressure Altitude and interpolating for each single degree of ISA Deviation to extract the necessary information.

Interpolation between pressure altitudes is required.

Cruise Example
3. Refer to CAP 697 Figure 2.2 & 2.3 and extract the following data

			TAS	IAS	PPH	USG
Given: 25” @ 2500 rpm	FL90	ISA +5°C				
Given: 21” @ 2100 rpm	FL90	ISA -15°C				
Given: 23” @ 2300 rpm	FL100	ISA +10°C				

Answers to Cruise Example

3. Refer to CAP 697 Figure 2.2 & 2.3 and find the following data

			TAS	IAS	PPH	USG
Given: 25” @ 2500 rpm	FL90	ISA +5°C	**167**	**147**	**75.55**	**12.6**
Given: 21” @ 2100 rpm	FL90	ISA -15°C	**142**	**130.5**	**59.1**	**9.77**
Given: 23” @ 2300 rpm	FL100	ISA +10°C	**157**	**134**	**65.10**	**10.85**

ISA	**ISA +20**
157	**156**
137	**132**
66.2	**64**
11	**10.7**

Range Profile Figure

This table gives an estimate of the maximum still air range, for each of four power settings, for a selected pressure altitude.

The calculated range includes fuel for:

- Climb
- Cruise
- Taxi and run-up, plus
- A reserve fuel for 45 minutes at economy cruise power

This table enables the pilot to rapidly select a suitable cruise level for a route distance and preferred power setting. It is also possible to select a power setting, given a preferred cruise altitude and route distance.

To use the table, enter on the left with **cruising pressure altitude** and move horizontally to the **selected power setting curve**. Move vertically downwards to read off the range in **Nautical Air Miles**.

You will note that on each power setting curve that TAS is quoted for Pressure Altitudes 4000 ft, 8000 ft and 12 000 ft. You may have to interpolate between these altitudes to extract an accurate TAS to use in the conversion of NAM to NGM.

Note. Range is affected by wind, therefore you will have to convert the NAM extracted from the graph into NGM, using the formula discussed in Chapter 3.

Range Examples

4. Refer to CAP 697 Figure 2.4 Extract Range (NAM)

Given: Full Throttle @ 2500 rpm	FL100	
Given: Full Throttle @ 2100 rpm	FL100	
Given: Full Throttle @ 2300 rpm	FL70	

5. Given:

Full Throttle @ 2500 rpm FL80

30 kt tailwind component

What is the ground range?

Answers to Range Examples

4. Refer to CAP 697 Figure 2.4 Extract Range (NAM)

Given: Full Throttle @ 2500 rpm	FL100	**839**
Given: Full Throttle @ 2100 rpm	FL100	**904**
Given: Full Throttle @ 2300 rpm	FL70	**832**

5. Given:

Full Throttle @ 2500 rpm FL80

30 kt tailwind component

What is the ground range ?

799 NAM from graph, also extract a TAS of 169 kt from the graph

$$\frac{\text{TAS}}{\text{GS}} = \frac{\text{NAM}}{\text{NGM}} \qquad \frac{\mathbf{169}}{\mathbf{199}} = \frac{\mathbf{799}}{x} \qquad x = \mathbf{941\ NGM}$$

Endurance

The table gives endurance (how long the aircraft can remain airborne; not necessarily the time to achieve the maximum range). Use in a similar manner to Figure 2.4.

As this endurance includes a 45 minute reserve the endurance you extract is called a safe endurance.

Note. Endurance is NOT affected by wind.

Endurance Example

5.	Refer to CAP 697 Figure 2.5		Extract Endurance
	Given: FT @ 2500 rpm	FL100	
	Given: FT @ 2100 rpm	FL100	
	Given: FT or 23” @ 2300 rpm	FL70	

Answer to Endurance Example

5.	Refer to CAP 697 Figure 2.5		Extract Endurance
	Given: FT @ 2500 rpm	FL100	**5.1 hrs 5 hrs 6 min**
	Given: FT @ 2100 rpm	FL100	**6.35 hrs 6 hrs 21 min**
	Given: FT or 23” @ 2300 rpm	FL70	**5.2 hrs 5 hrs 12 min**

Airfield "A" Data	Elevation	MSL	Aircraft plans to cruise to "D" at 23" 2300 rpm power
	Temp	+20°C	Using SEP Fig 2.1 and Fig 2.2 complete the fuel log
	Departure Mass	3400 lb	Calculate the Trip Fuel, Time En route and ETA at "D"

Aircraft takes off from "A" at 10:00

and climbs from "A" to FL80 (temperature at TOC is 0°C)

Wind Light & Variable

FROM	TO	FL	ISA DEV	W/V	TAS	NGM	TK	HDG	GS	TIME	FUEL FLOW	FUEL REQD	ETA
A	TOC	↗		L & V		100	120						
TOC	B	80	+5°C	230/30			120						
B	C	100	0	270/40		150	160						
C	D	60	-10°C	200/20		80	130						
TOTALS													

Questions

1. **Refer to CAP 697 SEP1, fig 2.1**
Given: Aerodrome elevation 2500 ft,

OAT	**+10°C**
Initial weight	**3500 lb**
Climb to	**FL140 OAT -5°C**

What is the climb time, fuel, NAM?

a. 22 min 6.5 g 46 NAM
b. 24 min 7.5 g 50 NAM
c. 2 min 1.0 g 4 NAM
d. 26 min 8.5 g 54 NAM

2. **Refer to CAP 697 SEP1, fig 2.2.3**
Given FL75
OAT +10°C
Lean mixture
2300 rpm
Find fuel flow (GPH) gallons per hour and TAS.

a. 68.5 GPH 160 kt
b. 11.6 GPH 160 kt
c. 71.1 GPH 143 kt
d. 11.6 GPH 143 kt

3. **Refer to CAP 697 SEP1 fig 2.4**
Given:

Aeroplane mass at start up	**3663 lb**
Fuel load (density 6 lb/gal)	**74 gal**
Take-off altitude	**sea level**
Headwind	**40 kt**
Cruise altitude	**8000 ft**
Power settings	**full throttle** **2300 rpm** **20°C lean of peak**

Calculate the range

a. 548 NM
b. 844 NM
c. 730 NM
d. 633 NM

4. **Refer to CAP 697, SEP1, fig 2.5**
Given FL75
Lean mixture
Full throttle / 2300 rpm
Take-off fuel 444 lb
Take-off from MSL
Find endurance in hours

a. 5 h 20 min
b. 4 h 42 min
c. 5 h 12 min
d. 5 h 23 min

SEP Exercise 1 -Answers

Airfield "A" Data — Elevation: MSL; Temp: +20°C; Departure Mass: 3400 lb

Aircraft plans to cruise to "D" at 23" 2300 rpm power
Using SEP Fig 2.1 and Fig 2.2 complete the fuel log
Calculate the Trip Fuel, Time En route and ETA at "D"

Aircraft takes off from "A" at 10:00
and climbs from "A" to FL80 (temperature at TOC is 0°C)
Wind Light & Variable

FROM	TO	FL	ISA DEV	W/V	TAS	NGM	TK	HDG	GS	TIME	FUEL FLOW	FUEL REQD	ETA
A	TOC	↗		L & V		18	120			8		3.4	10:08
TOC	B	80	+5°C	230/30	160	82	120	130	168	29	11.8	5.8	10:37
B	C	100	0	270/40	157	150	160	174	166	54	11	9.9	11:31
C	D	60	-10°C	200/20	158	80	130	137	150	32	12.2	6.5	12:03
TOTALS						330				123		25.6	

Worked Answers

Climb from A to FL80
(Fig 2.1)

Time = 8 min
Fuel = 3.4 USG
Distance = 18 NAM & NGM as no wind
Therefore TOC to B is 100 - 18 = 82 NM

Cruise	**TAS**	**FF**	(Table 2.2.3)
TOC to B	160	11.8	Using the Standard Day Block
B to C	157	11	Using the Standard Day Block
C to D	158	12.2	Interpolating between Standard Day and ISA -20°C

Answers

1	2	3	4
a	b	d	c

Chapter

5

Multi-engine Piston Aeroplane (MEP)

Introduction

Data sheets are provided for a multi-engine aircraft (MEP1). This is a monoplane with two reciprocating engines, twin counter-rotating constant speed propellers and a retractable undercarriage; similar to a Piper Seneca.

Maximum Take-off Mass (MTOM)		**4750 lb**
Maximum Zero Fuel Mass (MZFM)		**4470 lb**
(Mass of aircraft = crew and payload but no fuel)		
Maximum Landing Mass (MLM)		**4513 lb**
Maximum fuel load		**123 US.gal**
Assumed fuel density	**(Unless otherwise advised)**	**6 lb/US.gal (SG.72)**
Maximum fuel mass		**123 × 6 = 738 lb** **(123 × .72 × 8.3 = 735 lb)**

The Power Settings of 75%, 65% and 45% equate to High Speed Cruise, Economy Cruise and Long Range Cruise. You will note that there is a fourth power setting of 55% which has no cruise description.

The data sheets are used in a similar manner to those for SEP1. The following paragraphs explain the use of the data sheets.

NB. In the Flight Planning exam you will be issued with a workbook instead of the CAP 697 in which will be the necessary pages for that particular paper.

MEP 1-Fuel, Time and Distance to Climb Data

There are separate reference lines for **time, distance and fuel to climb**, but only one combined scale.

Climb Examples

1. **Refer to CAP 697 Figure 3.1**
Given: Airfield at MSL OAT +20°C
Climb to FL120 OAT -10°C
What is the fuel, time and distance covered in the climb?

F	T	D

With a 35 kt tailwind; what is the ground distance covered in the climb?

2. **Refer to CAP 697 Figure 3.1**
Given: Airfield at 4000 ft OAT +0°C
Climb to FL140 OAT -20°C
What is the fuel, time and distance covered in the climb?

	F	T	D
FL140			
4000 ft			
Difference			

With a 40 kt headwind; what is the ground distance covered in the climb?

Answers to Climb Examples

1. Refer to CAP 697 Figure 3.1
Given: Airfield at MSL OAT +20°C
Climb to FL120 OAT -10°C
What is the fuel, time and distance covered in the climb?

F	T	D
10	19	34

With a 35 kt tailwind; what is the ground distance covered in the climb?

45 NGM

2. Refer to CAP 697 Figure 3.1
Given: Airfield at 4,000 ft OAT +0°C
Climb to FL140 OAT -20°C
What is the fuel, time and distance covered in the climb?

	F	T	D
FL140	12	22	39
4000 ft	4	6	11
Difference	8	16	28

With a 40 kt headwind; what is the ground distance covered in the climb?

17 NGM

MEP 1-Range at Standard Temperatures
(CAP 697 Figure 3.2)

Two values of air range can be extracted, with either **45 MIN. RESERVE FUEL AT 45% POWER** (left-hand side of graph) or **WITH NO RESERVE** (right-hand side of graph).

NB. On the top right side of the graph is a power phrase to percentage translation. Eg. Economy power is 65%.

You also should correct the air range in accordance with the notes at the top left-hand side of the graph. The corrections are to add 1 NM for every degree above ISA and subtract 1 NM for every degree below ISA.

Remember range is affected by wind so you might have to convert NAMs into NGMs. If this occurs you will be given a TAS and a Wind Component to apply the NAM/NGM = TAS/GS formula.

Range Examples

3.	Refer to CAP 697 Figure 3.2	Range with reserves	Range no reserve
	Given: Economy @ FL100 ISA		
	Given: LRC @ FL140 ISA		

Answers to Range Examples

3.	Refer to CAP 697 Figure 3.2	Range with reserves	Range no reserve
	Given: Economy @ FL100 ISA	760	850
	Given: LRC @ FL140 ISA	930	1040

MEP 1-Cruise Power Setting and Fuel Flow
(CAP 697 Figure 3.3)

Power settings are expressed as **75% (HIGH SPEED), 65% (ECONOMY), 55% AND 45% (LONG RANGE)**. TAS is extracted from the SPEED POWER table, figure 3.4.

Enter the table with the required % power to obtain fuel flow in US.gal/h

For example: Economy Power (65%) has a fuel flow of 23.3 US.gal/h. Given a time let us say of 2 hours 30 minutes you can work out a trip fuel of 58.25 US.gal.

The manifold pressure is read off against pressure altitude and rpm in the correct % power column

Note that, for example, 75% power and a fuel flow of 29.0 GPH should be achieved at FL60 at:

- **33.4 inHg @ 2500 rpm, or**
- **32.2 inHg @ 2600 rpm.**

Also, that the fuel flow decreases as power decreases, thus giving greater range and endurance.

To correct for temperatures different from ISA:

For each 6°C above ISA, add 1% to tabulated manifold pressure.

For each 6°C below ISA, subtract 1% from tabulated manifold pressure.

Unlike the SEP power graphs the TAS is NOT extracted here, so a separate graph is provided for you to get your TAS.

MEP 1-True Airspeed

(CAP 697 Figure 3.4)

This graph is used to obtain the TAS for the various temperature, altitude and % power setting combinations in the cruise configuration.

Examples of extraction of TAS

4.	**Refer to CAP 697 Figure 3.4**	**TAS**
	Given: High Speed@ FL120 ISA	
	Given: Economy @ FL120 ISA	
	Given: LRC @ FL120 ISA	
	Given: Economy @ FL80 OAT +20°C	
	Given: Economy @ FL80 OAT -20°C	

Answers to TAS Extractions

4.	**Refer to CAP 697 Figure 3.4**	**TAS**
	Given: High Speed @ FL120 ISA	**183**
	Given: Economy @ FL120 ISA	**178**
	Given: LRC @ FL120 ISA	**146**
	Given: Economy @ FL80 OAT +20°C	**176**
	Given: Economy @ FL80 OAT -20°C	**166**

MEP 1-Endurance

(CAP 697 Figure 3.5)

The endurance in hours can be obtained either with the 45 MIN. RESERVE FUEL AT 45% POWER (left-hand side of graph) or WITH NO RESERVE (right-hand side of graph)

Endurance Examples

5.	**Refer to CAP 697 Figure 3.5**	**Safe Endurance**	**Total Endurance**
	Given: High speed @ FL100		
	Given: Economy @ FL100		
	Given: LRC @ FL100		

Answers to Endurance Examples

5.	**Refer to CAP 697 Figure 3.5**	**Safe Endurance**	**Total Endurance**
	Given: High speed @ FL100	**3.6 h (3:36)**	**4.1 h (4:06)**
	Given: Economy @ FL100	**4.5 h (4:30)**	**5 h**
	Given: LRC @ FL100	**6.4 h (6:24)**	**7.2 h (7:12)**

MEP 1-Descent Fuel, Time and Distance
(CAP 697 Figure 3.6)

This table works in the same way as the climb table in that one entry will give the fuel, time and distance to descend from a pressure altitude (FL) to MSL. If the destination airfield is not at MSL, then a second entry is needed to extract data for a hypothetical descent from airfield FL to MSL. This data is subtracted from the former to give the actual descent fuel, time, distance.

Descent Example

6. Refer to CAP 697 Figure 3.6
Given: Descend from FL120 OAT -20°C
To airfield at 4000 ft OAT +0°C
What is the fuel, time and distance covered in the descent?

	F	T	D
FL120			
4000 ft			
Difference			

With a 20 kt headwind; what is the ground distance covered in the descent?

Answers to Descent Examples

6. Refer to CAP 697 Figure 3.6
Given: Descend from FL120 OAT -20°C
To airfield at 4,000 ft OAT +0°C
What is the fuel, time and distance covered in the descent?

	F	T	D
FL120	4	12	32
4000 ft	2	4	10
Difference	2	8	22

With a 20 kt headwind; what is the ground distance covered in the descent?

19 NGM

MEP Exercise 1

Airfield "A" Data

Elevation MSL

Temp +15°C

Aircraft departs "A" at 11:30

Airfield "D" Data

Elevation MSL

Temp +15°C

Cruise Data

TOC to B - High Speed Cruise

B to C - Economy Cruise

C to TOD - Long Range Cruise

Calculate the Trip Fuel, Time En route and ETA "D"

FROM	TO	FL	OAT	W/V	TAS	NGM	TK	HDG	GS	TIME	FUEL FLOW	FUEL REQD	ETA
A	TOC		0°C	120/20		70	115						
TOC	B	FL100	- 4°C	150/30			115						
B	C	FL120	- 10°C	170/40		150	270						
C	TOD	FL100	- 6°C	140/30		80	305						
TOD	D		0°C	120/20			305						
TOTALS						300							

MEP Exercise 1 Answers

Airfield "A" Data	Airfield "D" Data	Cruise Data
Elevation MSL	Elevation MSL	TOC to B - High Speed Cruise
Temp +15°C	Temp +15°C	B to C - Economy Cruise
Aircraft departs "A" at 11:30		C to TOD - Long Range Cruise
		Calculate the Trip Fuel, Time En route and ETA "D"

FROM	TO	FL	OAT	W/V	TAS	NGM	TK	HDG	GS	TIME	FUEL FLOW	FUEL REQD	ETA
A	TOC		0°C	120/20		23	115			16		9	11:46
TOC	B	FL100	- 4°C	150/30	180	47	115	121	155	18	29	8.7	12:04
B	C	FL120	- 10°C	170/40	178	150	270	257	180	50	23.3	19.4	12:54
C	TOD	FL100	- 6°C	140/30	142	51	305	302	171	18	16	4.8	13:12
TOD	D		0°C	120/20		29	305			10		4	13:22
TOTALS						300				112		45.9	

Questions

1. Refer to CAP 697, MEP, Fig 3.1.
A flight is to be made from an airfield (elevation 3000 ft) to another. The cruising level is FL120, temp ISA. The OAT at the departure airfield is +10°C, the wind component in the climb is +30 kt. Calculate the fuel used, time and distance flown in the climb.

a.	8 gal	13 min	26 NGM
b.	8 gal	14 min	33 NGM
c.	7 gal	14 min	19 NGM
d.	11 gal	19 min	34 NGM

2. Refer to CAP 697 MEP Fig 3.6.
A flight is to be made to an airfield, pressure altitude 3000 ft, in a MEP aircraft. The forecast OAT for the airfield is +1°C and the cruising level will be FL110, OAT -10°C. Calculate the still air distance in the descent and the ngm covered with a 20 kt headwind.

a. 29 NM/26 NM
b. 21 NM/23 NM
c. 20 NM/18 NM
d. 20 NM/20 NM

3. Refer to CAP 697 MEP1 Fig 3.2.
Given:

Cruising level	**11 000 ft**
OAT in the cruise	**-15°C**
Usable fuel	**123 US gallons**

The power is set to economy cruise

Find the range in NM with 45 min reserve fuel at 45% power.

a. 752 NM
b. 852 NM
c. 760 NM
d. 602 NM

Answers

1	2	3
b	c	a

Chapter

6

Medium Range Jet Transport (MRJT) Simplified Flight Planning

Introduction

The performance database for a modern jet aircraft is invariably contained in the operating company's flight planning computer set-up and the aircraft's Flight Management System (FMS). The company Operation's computers will produce flight plans for optimum routes and cruise modes, according to the instructions given.

- **Best direct track non-airways.**
- **Best direct airways track.**
- **Best North Atlantic track.**
- **Least fuel or time track.**
- **Extended Range Operations (EROPS) and Non-normal Operations, such as gear down flight.**

Crews use the FMS data base for in-flight fuel monitoring, and replanning of the aircraft's performance when necessary, in order to obtain prompt accurate information and to reduce the need to refer to the relevant Operations Manual.

However, Part Flight Crew Licensing, Flight Planning & Monitoring (Aeroplanes), requires the student to be familiar with the reference material in the **CAP 697 MRJT** , which is based upon extracts from the Boeing 737-400 Operations Manual, and to answer related examination questions.

NB. In the Flight Planning exam you will be issued with a workbook instead of the CAP 697 in which will be the necessary pages for your particular exam.

Aeroplane Data and Constants

The aeroplane is a monoplane with twin turbojet engines and a retractable undercarriage.

Structural Limits:

Maximum Ramp (Taxi) Mass (MRM)	**63 060 kg**
Maximum Take-off Mass (MTOM)	**62 800 kg**
Maximum Landing Mass (MLM)	**54 900 kg**
Maximum Zero Fuel Mass (MZFM)	**51 300 kg**
Dry Operating Mass (DOM) (Average value, from source other than CAA Data Sheet)	**34 270 kg**
Maximum Fuel Load	**5311 US.gal** **16 145 kg @ 3.04 kg/US.gal**

Constants:

Fuel Density, unless otherwise stated:	**3.04 kg/US.gal** **6.7 lb/US.gal**

From the foregoing data note the following:

- **Maximum Take-off Mass (MTOM)** is the maximum permissible total aeroplane mass at the start of the take-off run.

- **Maximum Landing Mass (MLM)** is the maximum total permissible landing mass upon landing under normal circumstances.

- **Maximum Zero Fuel Mass (MZFM)** is the maximum permissible mass of the aeroplane with no **usable** fuel.

- **Dry Operating Mass (DOM)** is the total mass of the aeroplane ready for a specific type of operation, excluding all **usable** fuel and traffic load. This mass includes:

    - crew and their baggage.
    - catering and removable passenger service equipment.
    - potable water and lavatory chemicals.
    - food and beverages.

- **Traffic Load** is the total mass of passengers, baggage and cargo, including any non-revenue load.

- The amount of fuel allowed for running the Auxiliary Power Unit (APU), starting the engines, "push-back" and taxi to the take-off point is:

    Maximum Ramp Mass (MRM) - Maximum Take-off Mass (MTOM)
    63 060 - 62 800 = 260 kg
    Taxi fuel is roughly 11 kg/min. The APU burns 115 kg/h

- The maximum traffic load is:
    MZFM - DOM
    51 300 - 34 270 = 17 030 kg

Optimum Cruise Altitude
(Refer to CAP 697 Figure 4.1)

The optimum pressure altitude for best fuel mileage is presented for .78 Mach cruise, and Long Range Cruise (LRC) or .74 Mach. LRC is recommended for minimum trip fuel as it gives 99% of the maximum fuel mileage in zero wind. When cruising within 2000 ft of the optimum altitude LRC approximates to a .74 Mach cruise.

If the aircraft is flown above or below the optimum altitude for LRC or .78 Mach Table 4.1 tabulates the fuel penalty incurred as a % correction.

Example 1

Enter the Optimum Cruise Altitude table with the Cruise Mass (Weight) 56 800 kg, move vertically up to the selected cruise profile, LRC/.74 Mach or .78 Mach, and move horizontally to read the optimum cruise pressure altitude.

...............................?

...............................?

NB. There are two axis on Fig 4.1 used for the Weight - Brake Release Weight (Take-off Weight) or Cruise Weight. Be sure to get the right one!

Example 2

Cruise weight 62 000 kg. Calculate the optimum pressure altitude for a .74 Mach cruise and the fuel and mileage penalty if the aircraft is cleared to fly 4000 ft below.

.............................?

(Answers page 80)

Short Distance Cruise Altitude

(Refer CAP 697 Figure 4.2)

The cruise distance for sectors of 235 NM or less is limited by those required for the climb and descent. The Short Distance Cruise Pressure Altitude table shows the maximum pressure altitude at which it is possible to cruise for at least a minute.

NB. The only interpolation for ISA is done between +10°C and +20°C

Example 3:

Enter with the trip distance, 175 NM, and move to the temperature line, ISA +20°C; move horizontally to the Reference Line and follow the trade lines to intercept the vertical at the Brake Release Weight, 52 000 kg; move horizontally to read the optimum cruise pressure altitude:

.............................?

Example 4:

Sector distance 150 NM, temperature at MSL take-off of 30°C and brake release weight 42 500 kg. Calculate the maximum short distance cruise pressure altitude.

..............................?

(Answers page 80)

Simplified Flight Planning - Introduction

(Refer to CAP 697 Figures 4.3.1a to 4.4)

Simplified Flight Planning graphs are provided in the CAP 697 MRJT1 for:

Three LONG RANGE CRUISE: **100 - 600 200 -1200 and 1000 - 3000 NM**

Three 0.74 MACH CRUISE: **100 - 600 200 -1200 and 1000 - 3000 NM**

Three 0.78 MACH CRUISE: **100 - 600 200 -1200 and 1000 - 3000 NM**

One 300 KIAS CRUISE: **0 - 1000 NM**

One STEPPED CLIMB: **1000 - 4000 NM**

One ALTERNATE PLANNING - LRC: **0 - 500 NM**

One HOLDING FUEL PLANNING

The LRC, 0.74 Mach, 0.78 Mach and 300 KIAS Cruise graphs have the same presentation.

The Simplified Flight Planning charts determine **trip fuel and time from brake release to touchdown**. APU usage, taxi, in-flight flaps down manoeuvring (other than straight in approach), Cost Index Adjustments and reserve fuel should be added to the trip fuel from these charts to obtain the total fuel required. Additional fuel for holding is obtained from the Holding Fuel Planning table. (CAP 697 Figure 4.4)

Simplified Flight Planning - Method

Example 5

LRC trip distance 1000 NM; cruise at FL290 with 50 kt headwind, ISA -10°C. Estimated landing weight 40 000 kg. Calculate the fuel required and flight time.

Enter with the trip distance and go vertically to the reference line. Follow the flow lines and correct for 50 kt headwind.

Move vertically from this point to the first 29 intersection of the Pressure Altitude lines. Move horizontally across to the Landing Weight reference line and follow the flow lines to correct for Landing Weight.

Move horizontally across and extract the **Fuel Required..................kg**

Go back to the original vertical line and at the 29 intersection on the upper Pressure Altitude intersections move horizontally to the Trip Time reference line; follow the flow lines to ISA -10°C.

Move horizontally and read off the **Trip Time..........h..........min**

If the given wind component exceeds that on a chart, convert the trip distance to nautical ground miles (NGM) to nautical air miles (NAM) and ignore the head and tail flow lines:

$$\text{NAM} = \frac{\text{NGM} \times \text{Average TAS}}{\text{TAS +/- Wind Component}}$$

(Answers page 80)

Simplified Flight Planning - Additional Allowances

Cost Index Adjustment

The LRC Simplified Flight Planning charts are based upon climb, cruise and descent speeds which produce an approximate minimum trip fuel. If the flight is planned to operate with the Flight Management System (FMS) in the economy (ECON) mode adjustments to the trip fuel and time are necessary to account for the different flight profile; the table above itemizes these adjustments.

Ground Operations

Fuel may be saved by minimizing APU operation. **The average APU fuel flow for normal operations is 115 kg/h (250 lb/h)**.

The taxi fuel allowance is 11 kg/min (25 lb/min).

Cruise - Air Conditioning (AC) Packs and Engine/Wing Anti-ice

- **AC packs at high flow:** Increase the trip fuel by 1%.
- **Anti-ice:** Engine only — Increase trip fuel by 70 kg/h
Engine and Wing — Increase trip fuel by 180 kg/h.

Altitude Selection

The best fuel consumption for mileage at a given cruise profile is achieved at the optimum altitude. The fuel penalty for operations off the optimum altitudes is given by CAP 697 Table 4.1 of section 4 page 1.

Descent

The Simplified Flight Planning charts assume a descent at 0.74 Mach/250 KIAS and a straight in approach.

For every additional minute of flaps down operation add 75 kg of fuel.

For Engine Anti-ice during the descent add 50 kg.

Holding Fuel (EU-OPS Final Reserve Fuel is extracted from this table)

The holding fuel is extracted from the HOLDING FUEL PLANNING table (Refer to CAP 697 Figure 4.4). The chart is based upon a racetrack pattern at the minimum drag airspeed, with a minimum of 210 KIAS. Interpolation for weight and pressure altitude is required.

Example: An aircraft holding at a pressure altitude of 1500 ft with a weight, at the start of a 30 minute hold, of 54 000 kg has a planned fuel flow of 2520 k/h. The expected fuel burn in the 30 minute hold is thus:

2520 ÷ 2 = 1260 kg. The aircraft weight at the end of the hold is 54 000 - 1260 = 52 740 kg.

Answers to Simplified Flight Planning

Example 1
33 500 ft at LRC/.74 Mach 32 600 ft at .78 Mach

Example 2
31 500 ft fuel penalty +4% mileage -4%

Example 3
28 000 ft

Example 4
29 500 ft (ISA +15°C)

Example 5
6700 kg 3hours

Questions

1. Refer CAP 697 Figure 4.1
   Given:
   Brake release mass of 55 000 kg
   Cruising at M 0.74

   What is the optimum altitude?

2. Refer CAP 697 Figure 4.1
   Given:
   Cruise mass of 50 000 kg
   Cruising at M 0.78

   What is the optimum altitude?

3. Refer CAP 697 Figure 4.2
   Given:
   Brake release mass of 60 000 kg
   Distance 150 NAM
   ISA +10°C

   What is the short distance cruise altitude?

4. Refer CAP 697 Figure 4.2
   Given:
   Brake release mass of 40 000 kg
   Distance 100 NAM
   ISA +20°C

   What is the short distance cruise altitude?

5. Refer CAP 697 Figure 4.3.1b
   Given:
   Landing mass of 45 000 kg
   Distance 600 NGM
   ISA +20°C
   Cruise using LRC @ FL370
   50 kt headwind

   What is the trip fuel and time?

6. Refer CAP 697 Figure 4.3.1b
   Given:
   Landing mass of 55 000 kg
   Distance 600 NGM
   ISA -10°C
   Cruise using LRC @ FL370
   50 kt headwind

   What is the trip fuel and time?

7. Refer CAP 697 Figure 4.3.1b
   Given:
   - Landing mass of 35 000 kg
   - Distance 600 NGM
   - ISA
   - Cruise using LRC @ FL250
   - 50 kt tailwind

   What is the trip fuel and time?

8. Refer CAP 697 Figure 4.3.1b
   Given:
   - Landing mass of 37 000 kg
   - Fuel available 4500 kg
   - ISA
   - Cruise using LRC @ FL370
   - 75 kt headwind

   How far could you fly?

9. Refer CAP 697 Figure 4.1 and 4.3.3
   Given:
   - Landing mass of 47 500 kg
   - Cruise mass of 58 000 kg
   - Distance 1750 NGM
   - ISA +10°C
   - Cruise using M 0.78
   - Wind light & variable

   a. What is the optimum pressure altitude?
   b. When cruising at FL330 what is your trip fuel and time?

10. Refer CAP 697 Figure 4.1 and 4.3.1
    Given:
    - Landing mass of 50 000 kg
    - Cruise mass of 54 000 kg
    - Distance 800 NGM
    - ISA +20°C
    - Cruise using LRC
    - 50 kt tailwind

    a. What is the optimum pressure altitude?
    b. When cruising at FL350 what is your trip fuel and time?
    c. With FMS in ECON mode with a cost index of 100; what are the fuel and time correction factors?

11. Refer CAP 697 Figure 4.1, 4.3.1 and Table 4.1
 Given:
 Landing mass of 45 000 kg
 Brake release mass of 60 000 kg
 Distance 2000 NGM
 ISA -10°C
 Cruise using LRC
 100 kt headwind

 a. What is the optimum pressure altitude?
 b. When cruising at FL350 what is your trip fuel and time?
 c. If ATC restrict you to FL280; what is the fuel/mileage penalty factor?

12. Refer CAP 697 Figure 4.3.2
 Given:
 Landing mass of 35 000 kg
 Distance 2000 NGM
 ISA
 Cruise using M 0.74 @ FL290
 Nil wind

 What is the trip fuel and time?

13. Refer CAP 697 300 KIAS cruise
 Given:
 Landing mass of 55 000 kg
 Distance 500 NGM
 ISA +10°C
 Cruise @ FL240
 50 kt tailwind

 What is the trip fuel and time?

14. Refer CAP 697 Figure 4.3.3
 Given:
 Landing mass of 35 000 kg
 Fuel available 5000 kg ISA
 Cruise using M 0.78 @ FL350
 50 kt tailwind

 What is the estimated trip distance?

15. Refer CAP 697 Figure 4.3.1
 Given:
 Landing mass of 45 000 kg
 Distance 300 NGM
 ISA -10°C
 Cruise using LRC @ FL330
 120 kt tailwind
 TAS 423 kt

 What is the trip fuel and time?

16. Refer CAP 697 Figure 4.3.5 Stepped Climb Cruise
    Given:
        Brake release mass of 62 500 kg
        Distance 3000 NGM
        50 kt tailwind
        ISA +20°C

    What is the trip fuel and time?

17. Refer CAP 697 Figure 4.3.6 Alternate Planning
    Given:
        Landing mass at the alternate of 47 500 kg
        Distance 250 NGM
        50 kt headwind

    What is the alternate fuel and time?

18. Refer CAP 697 Figure 4.3.3
    Given:
        Landing mass of 50 000 kg
        Distance 700 NGM
        ISA
        Cruise using M 0.78 at FL250
        Wind light & variable

    What is the trip fuel and time when engine anti-ice required for the whole flight?

Answers

1.	34 800 ft			
2.	35 500 ft			
3.	24 000 ft			
4.	20 500 ft			
5.	4000 kg		1.7 h (1 h 42 min)	
6.	4550 kg		1.85 h (1 h 51 min)	
7.	3100 kg		1.45 h (1 h 27 min)	
8.	700 NGM			
9.	a.	32 200 ft		
	b.	10 600 kg	3.95 h (3 h 57 min)	
10.	a.	34 600 ft		
	b.	4400 kg	1.75 h (1 h 45 min)	
	c.	Fuel +7%	Time -4%	
11.	a.	32 900 ft		
	b.	15 400 kg	6.75 h (6 h 45 min)	
	c.	Off optimum by 5000 ft		5.5%
12.	10 900 kg		4.75 h (4 h 45 min)	
13.	3450 kg		1.2 h (1 h 12 min)	
14.	1035 NGM			
15.	1700 kg		0.7 h (42 min)	
16.	15 500 kg		6 hours	
17.	2000 kg		0.82 h (49 min)	
18.	5150 kg plus 1.65 h @ 70 kg/h (116) = 5266 kg			

Chapter

7

Medium Range Jet Transport (MRJT) Detailed Flight Planning

En Route Climb Table

Cruise/Integrated Range Tables

Descent Tables

Detailed Fuel Planning - Introduction
(Refer CAP 697 MRJT1 Figures 4.5.1 to 4.5.4b. Pages 19 to 70)

Four EN ROUTE CLIMB TABLES, ISA -15 to 25°C

One WIND RANGE CORRECTION GRAPH

Eleven LONG RANGE CRUISE TABLES, FL270 - FL370

Seventeen Mach 0.74 CRUISE TABLES, FL210 - FL370

Six Mach 0.78 CRUISE TABLES, FL290 - FL390

Eight LOW LEVEL CRUISE 300 KIAS TABLES, FL140 TO FL210

Two DESCENT TABLES

En Route Climb
Refer CAP 697 MRJT1 Figure 4.5.1

The CAP 697 provide climb tables for a **temperature range -15°C to 25°C**. Fuel, time, distance (nautical air miles) and TAS are extracted against the intersection of **Cruise Pressure Altitude** and **Brake Release Weight**. Interpolation for intermediate levels and weights is required.

The **fuel and time is from brake release** and the **distance from 1500 ft**; the scheduled **climb speed is 280 KIAS/.74 MACH**

The tabulated TAS is the climb average and is to be used to convert nautical air miles to nautical ground miles:

$$\text{NGM} = \frac{\text{NAM} \times \text{AVERAGE TAS} +/- \text{WC}}{\text{AVERAGE TAS}}$$

Note. The minor Fuel Adjustment Table below the main table for departing from airfields not at mean sea level.

Example 1
Given

Brake release weight 62 000 kg

Airport elevation mean sea level

Zero wind

ISA -10

Cleared cruise pressure level 33 000 ft

Calculate the en route climb data

......min; fuel burn............kg;..............NGM; average TAS............kt?

Answer on page 104

Example 2

Calculate the en route climb data from the following:

Airfield elevation 3000 ft

Mean wind component 30 Head

Brake release weight 59 000 kg

Cruise pressure level 35 000 ft

OAT -62°C

.........min; fuel burn...........kg;...........NAM,..............NGM; TAS............kt?

Answer on page 104

Cruise/Integrated Range Tables

Integrated range tables for Long Range Cruise, 0.74 and 0.78 Mach Cruise and Low Level 300 KIAS Cruise are included in the CAP 697 MRJT1, pages 25 to 68. **The same method of data extraction is used for all tables.**

The tables use the "difference" principle, **the difference in two weights being the fuel weight used for a sector.** The **corresponding difference in the tabulated distance equates to the still air distance for that weight of fuel.** Thus, all ground distances affected by a wind component must be first converted to still air distances.

For convenience gross weights are tabulated at 100 kg intervals so that **table values may be extracted without interpolation**. For instance, using the table page 25 of CAP 697 MRJT1, a gross weight of 51 500 kg equates to a cruise distance of 3093 NAM; a cruise distance of 4420 NAM equates to a gross weight of 59 600 kg.

The TAS for the 0.74 Mach and 0.78 Mach is tabulated at the top of each pressure altitude page; for LRC the TAS is found against the adjacent gross net weight figure.

Note the corrections to Fuel Flow and TAS, below each table, for Operation at Non-standard Temperatures

General guidelines and tips to MRJT Integrated fuel tables

- There are 3 main cruise methods:

Long Range Cruise	TAS is a function of aircraft mass
0.74 Mach	TAS is constant for flight level
0.78 Mach	TAS is constant for flight level

It is imperative that you pick the **correct page** for cruise method and flight level. They will NOT give you the page number in the exam, but will refer you to a figure number. For example: Fig 4.5.3.1 then with the flight level **you** get the **correct page**.

- Tables using **NAM**: you are probably going to have to convert from/to NGM.

- Note there are corrections at the bottom of each page:
  - Not interested in "thrust limiting" weights
  - **SHOULD** have to adjust fuel calculated
  - **ALWAYS** adjust the initial TAS for temperature deviation

- Get TAS first, you will need it anyway and in multi-choice might reduce number of options.

- It is the difference in the aircraft mass at the first point compared to the second point that gives the fuel required.

- A picture of what is going on might help.

- The examples on the following pages are the sort of questions and level that the EASA require.

- If you forget what to do, page 24 of CAP 697 MRJT1 will remind you.

Questions

1. An aircraft is to fly from A to B a distance of 1500 NM (NGM) using
   Long Range Cruise (LRC) at FL330.
   Aircraft mass at "A" is 58 500 kg
   ISA +10°C
   50 kt tailwind

   What is the TAS and fuel required?

2. An aircraft is to fly from A to B a distance of 500 NM (NGM) at Mach 0.74 at FL290.
   Aircraft mass at "A" is 54 400 kg
   ISA -20°C
   50 kt headwind

   What is the TAS and fuel required?

3. Aircraft mass at "A" is 51 200 kg
   Aircraft mass at "B" is 48 500 kg
   Cruise at Mach 0.78 @ FL350
   ISA +20°C
   50 kt tailwind

   What is the TAS, ground distance and Specific Fuel Consumption?

4. Aircraft mass at "A" is 55 500 kg
   OAT -59°C
   Wind light & variable
   Cruising using LRC @ FL310
   The aircraft is to fly for 35 minutes

   What is the fuel consumed from "A"?

Answers

1. An aircraft is to fly from A to B a distance of 1500 NM (NGM) using

Long Range Cruise (LRC) at FL330

Aircraft mass at "A" is	58 500 kg
	ISA +10°C
	50 kt tailwind

What is the TAS and fuel required?

Step 1 Find correct page - **31**

Step 2 TAS = 433 + 10 = **443 kt**

Step 3 Convert the 1500 NGM into NAM

$$\frac{TAS}{GS} = \frac{NAM}{NGM} \quad \frac{443 \times 1500}{493} = \mathbf{1348\ NAM}$$

Step 4 Aircraft at "A" is 58 500 kg, enter the table with this mass and extract the cruise NAM of 4704 NM.

Step 5 4704 - **1348** NAM gives a cruise NAM at "B" of **3356**.

Step 6 Enter table looking for a distance of 3356 NAM, you are unlikely to find exactly this figure but take the lower figure of 3354 and this corresponds to an aircraft mass of **51 000 kg** when overhead "B"

Step 7 The difference between 58 500 kg and 51 000 kg is **7500 kg** and this is the fuel required. You should then increase the fuel required by 0.6% which is **45 kg** giving a total of **7545 kg**.

A	1500 NGM	B
58 500 kg		
51 000 kg		
4704 NAM	1348 NAM	3356 NAM

Answer	**TAS**	**443 kt**
	Fuel Required	**7545 kg**

2. An aircraft is to fly from A to B a distance of 500 NM (NGM) at

Mach 0.74 at FL290

Aircraft mass at "A" is 54 400 kg

ISA -20°c

50 kt headwind

What is the TAS and fuel required?

Step 1 Find correct page = **45**

Step 2 TAS = 438 - 20 = **418 kt**

Step 3 Convert the 500 NGM into NAM

$$\frac{TAS}{GS} = \frac{NAM}{NGM} \quad \text{so} \quad NAM = \frac{TAS \times NGM}{GS} = \frac{418 \times 500}{368} = \mathbf{568\ NAM}$$

Step 4 Aircraft at "A" is 54 400 kg, enter the table with this mass and extract the cruise NAM of 3612 NM.

Step 5 3612 – **568** gives a cruise NAM at "B" of **3044**.

Step 6 Enter table looking for a distance of 3.044 NAM, you are unlikely to find exactly this figure but take the lower figure of 3036 and this corresponds to an to aircraft mass of **51 100 kg** when overhead "B"

Step 7 The difference between 54 400 kg and 51 100 kg is **3300 kg** and this is the fuel required. You should then decrease the fuel required by 1.2% which is 40 kg giving a total of **3260 kg**.

A 500 NGM B

54 400 kg

51 100 kg

3 612 NAM 568 NAM 3044 NAM

Answer	**TAS**	**418 kt**
	Fuel Required	**3260 kg**

3. Aircraft mass at "A" is 51 200 kg

Aircraft mass at "B" is 48 500 kg

Cruise at Mach 0.78 @ FL350

ISA +20°C

50 kt tailwind

What is the TAS, ground distance and Specific Fuel Consumption?

Step 1 Find correct page = **59**

Step 2 TAS = 449 + 20 = **469 kt**

Step 3 Aircraft at "A" is 51 200 kg, enter table and extract the cruise NAM of 3279 NM

Step 4 Aircraft at "B" is 48 500 kg, enter table and extract the cruise NAM of 2788 NM

Step 5 3279 – 2788 = 491 NAM between "A" and "B"

Step 6 Convert the 491 NAM into NGM

$$\frac{TAS}{GS} = \frac{NAM}{NGM} \quad \text{so} \quad NGM = \frac{NAM \times GS}{TAS} = \frac{519 \times 491}{469} = \mathbf{543\ NGM}$$

Step 7 Calculate the Specific Fuel Consumption. Strictly speaking though not as per the Performance definition, you need to remember that Specific Fuel Consumption or SFC is the fuel required divided by the <u>ground</u> distance flown. Specific Air Range is the fuel required divided by the <u>air</u> distance flown.

$$SFC = \frac{51\,200 - 48\,500}{543} = \frac{2700\ \text{kg}}{543} = \mathbf{4.97\ kg/NGM}$$ (to 2 decimal places)

A 543 NGM B

51 200 kg

48 500 kg

3279 NAM 491 NAM 2788 NAM

Answer

TAS	**469 kt**
Distance	**543 NGM**
SFC	**4.97 kg/NGM**

4. Aircraft mass at "A" is 55 500 kg

OAT -59°C

Wind light & variable

Cruising using LRC @ FL310

The aircraft is to fly for 35 minutes

What is the fuel consumed from "A"?

Step 1 Find correct page = **29**

Step 2 Correct the OAT -59°C into an ISA deviation = ISA-12°C

Step 3 TAS = 437 - 12 = **425 kt**

Note: As wind is light and variable you can assume that TAS and GS are both 425 kt and NAM and NGM will also be equal.

Step 4 How far can you fly in 35 minutes at 425 kt = **248 NM**

Step 5 Aircraft at "A" is 55 500, enter the table with this mass and extract the cruise NAM of 4047 NM.

Step 6 4047 – 248 NAM gives a cruise NAM at "x" of 3799.

Step 7 Enter table looking for a distance of 3799 nam, you are unlikely to find exactly this figure but, 3800 is close enough and this corresponds to an aircraft mass of **54100 kg** 35 minutes after "A"

Step 8 The difference between 55 500 kg and 54 100 kg is 1400 kg and this the fuel required. Strictly speaking you should then decrease the fuel required by 0.72% which is **10 kg** giving a total of **1390 kg**.

A 35 min x

55 500 kg

54 100 kg

4047 NAM 248 NAM/NGM 3799 NAM

Answer **Fuel required 1390 kg**

Example 4 - Flight Plan

INTEGRATED FLIGHT PLAN EXAMPLE 4

LINE	SECTOR		Temp °C	FL	Temp Devn	WIND		Track °T	TAS	Wind Comp	GS kt	NGM	EET	NAM	Gross Start WT	Cruise Value	Minus NAM	FUEL
	FROM	TO				Dirn	Speed											
1	A	B	-	330	0					-20		240			53500			
2	B	C	-	330	0					-30		370						
3	C	D	-	330	0					-40		410						
4																		
5	1. Extract cruise TAS .... kt. 2. Convert NGM to NAM																	
6	3. Enter 0.74M cruise table with Gross Weight 53500kg and extract Cruise Distance, ... Subtract ....NAM, = ...nam.																	
7	4. Enter table with ....nm and extract corresponding Gross Weight, ...kg. Fuel burn A to B is .... - .... = ...kg.																	
8	5. Copy Minus NAM from LINE 1 into Cruise Value LINE 2. Subtract .... NAM = ... nam.																	
9	6. Enter table with ....nm and extract corresponding Gross Weight, ...kg. Fuel burn B to C is .... - .... = ...kg.																	
10	7. Repeat the process.																	
11	Note: a) The percentage increase or decrease in Fuel Required for 10°C above or below ISA.																	
12	b) The increase or decrease in TAS by 1kt per 1°C above or below ISA.																	

Answer Example 4 - Flight Plan

INTEGRATED FLIGHT PLAN - EXAMPLE 4 Answer

LINE	SECTOR		Temp °C	FL	Temp Devn	WIND		Track °T	TAS	Wind Comp	GS kt	NGM	EET	NAM	Gross Start WT	Cruise Value	Minus NAM	FUEL
	FROM	TO				Dirn	Speed											
1	A	B	-	330	0				430	-20	410	240	35	252	53500	3796	3544	1 4 0 0
2	B	C	-	330	0				430	-30	400	370	55.5	398	52100	3544	3146	2 1 0 0
3	C	D	-	330	0				430	-40	390	410	63	452	50000	3146	2694	2 3 0 0
4															47700			
5	1. Extract cruise TAS 430kt. 2. Convert NGM to NAM																	
6	3. Enter 0.74M cruise table with Gross Weight 53500kg and extract Cruise Distance, 3796nm. Subtract 252NAM, 3544nm.																	
7	4. Enter table with 3544nm and extract corresponding Gross Weight, 52100kg. Fuel burn A to B is 53500 - 52100 = 1400kg.																	
8	5. Copy Minus NAM from LINE 1 into Cruise Value Line 2. 3544. Subtract 398nam = 3146nm.																	
9	6. Enter table with 3146nm and extract corresponding Gross Weight, 50000kg. Fuel burn B to C is 52100 - 50000 = 2100kg.																	
10	7. Repeat the process.																	
11	Note: a) The percentage increase or decrease in Fuel Required for 10°C above or below ISA.																	
12	b) The increase or decrease in TAS by 1kt per 1°C above or below ISA.																	

Descent Table

(Refer CAP 697 MRJT1 Figure 4.5.4a & 4.5.4b)

Time, fuel and distance (NAM) for a flight idle thrust descent are tabulated for:

- M 0.74/250 KIAS, which approximates to an economy descent, and
- M 0.70/280 KIAS, turbulent air penetration descent.

Allowances are included for a straight in approach with undercarriage down.

Increase fuel during the descent by 50 kg for engine anti-ice.

Example 5

Given a landing weight of 54 900 kg and a mean descent wind component of 50 kt head calculate the time, fuel and ground distance for a M 0.74 descent from FL330.

Fuel...........kg; time............min; distance...........NAM; ....NGM.

Example 6

An aircraft with an estimated landing weight of 48 500 kg descends from FL310 to fly a straight in approach, through turbulent air with the engine anti-ice on; the wind component is 45 kt tail. Calculate the fuel burn, time and ground distance

Fuel..........kg; time............min; distance............NAM; ....NGM.

Answers to Examples 5 and 6 are on page 104

Exercise 1 Flight Plan

INTEGRATED FLIGHT PLAN - EXERCISE 1

LINE	SECTOR		Temp °C	FL	Temp Devn	WIND		Track °T	TAS	Wind Comp	GS kt	NGM	EET	NAM	Gross Start WT	Cruise Value	Minus NAM	FUEL
	FROM	TO				Dirn	Speed											
1	A (3000')	TOC	-	↗	0					-30		250			56000	-	-	
2	TOC	B	-49	370						-50								
3	B	C	-49	370						-20		460						
4	C	D	-49	370						+10		390						
5	D	TOD	-49	370						+20		510						
6	TOD	E (MSL)	-	↘	-					+10						-	-	
7																ROUTE FUEL		
8																% INC/DEC		
9	E	ALT.(MSL)	-		-				-	0	-	150				DIVERSION FUEL		
10																5% CONTINGENCY		
11																APU/TAXI		260
12																AIR CONDITION		
13																ANTI-ICE		
14																HOLDING		
15																RAMP FUEL		

Exercise 1

Complete the Integrated Flight Plan from the following data:

Long Range Cruise flight at FL370 from A to E with a nominated alternate airfield.

Airfield elevation at A is 3000 ft;

Mean sea level at E and the Alternate.

The gross take-off weight(mass) at A is 56 000 kg.

The estimated landing weights at E and the alternate are 46 000 kg and 43 000 kg.

Fuel:

Route:	Allow 5% contingency A to E.
Descent:	Straight in descent with gear down and no air turbulence.
Diversion:	Use Alternate Planning CAP 697 MJRT1 Figure 4.3.6.
Taxi/APU:	Allow 260 kg.
Air Conditioning:	1% for cruise A to E.
Engine and wing anti-ice:	180 kg/h for cruise A to E.
Holding:	Compute 45 min holding fuel for straight and level flight at a pressure height of 1500 ft overhead E.
	(CAP 697) Figure 4.4

Use 47 000 kg as the start weight for the hold.

When the plan is completed answer the following:

a. Assuming that the contingency and holding fuel are unused, what is the estimated landing weight at the Alternate?

b. At a cruise weight of 56 000 kg what is the optimum LRC/M 0.74 level?

c. The aircraft's track is 180°(T) and variation 10°E. The lowest optimum IFR cruise level is?

d. If the variation was 10°W what is the amended lowest optimum IFR level?

e. If the gross brake release weight is 46 000 kg, trip distance 150 NAM and temperature ISA +10°C, what is the short distance cruise?

Questions

Exercise 2 Flight Plan

LINE	SECTOR FROM	SECTOR TO	Temp °C	FL	Temp Devn	WIND Dirn	WIND Speed	Track °T	TAS	Wind Comp	GS kt	NGM	EET	NAM	Gross Start WT	Cruise Value	Minus NAM	FUEL
INTEGRATED FLIGHT PLAN - EXERCISE 2																		
1	A	TOC	-	↗	-	200	35	245				236			61500	-	-	
2	TOC	B	-56			220	50	245										
3	B	C	-56			230	60	270				378						
4	C	D	-56			240	65	280				410						
5	D	TOD	-56			260	70	296				562						
6	TOD	E	-	↘	-	230	30	296								-	-	
7																ROUTE FUEL		
8																% INC/DEC		
9	E	Alternate	-			-	-	310	-	-60	-	185				DIVERSION FUEL		
10																5% CONTINGENCY		
11																APU/TAXI		
12																AIR CONDITION		
13																ANTI-ICE		
14																HOLDING		
15																RAMP FUEL		

Exercise 2

Complete the Integrated Flight Plan from the following data:

The aircraft's estimated cruise weight is 60 000 kg; the ramp weight is 61 500 kg. It is tasked to fly a route where the overall magnetic variation is 15°W. The trip is to be flown at the lowest ICAO IFR optimum pressure altitude for M 0.78. Details are provided in the attached Flight Plan and all the airfields are less than 100 ft above mean sea level. The forecast QNH at the destination, E, is 1029 hPa.

Fuel:

Route:	Allow 5% contingency A to E.
Descent:	Straight in descent with gear down with turbulence forecast.
Diversion:	Use Alternate Planning CAP 697 MJRT1 Figure 4.3.6.
	estimated landing weight 47 000 kg.
Taxi/APU:	Allow 20 min APU and 20 min Taxi.
Air Conditioning:	1% extra to cruise fuel to destination.
Engine and wing anti-ice:	180 kg/h for cruise A to E.
Holding at E:	Compute 45 min holding fuel, straight and level, at an altitude of 2000 ft overhead E. (CAP 697 Figure 4.4)
Assume an initial weight of	50 000 kg.

When complete, answer the following:

a. During the descent into E the pilot selected the flaps down 4 minutes before the ILS outer marker. What extra fuel was burnt?

b. How much of the contingency fuel was used if the engine anti-ice was selected during the descent?

c. If the anti-ice, air conditioning and half the taxi/APU fuel have been burnt, what is the estimated landing weight at E?

d. If a LRC flight is planned to operate in the ECON mode what adjustments to fuel and time are needed if the Cost Index is 30?

Answers to Integrated Flight Planning

Example 1	19 min 1550 kg 104 NAM/NGM 374 kt TAS
Example 2	19.5 min 1475 kg 109.5 NAM / 101 NGM 379 kt TAS
Example 4	See flight plan over
Example 5	21 min 285 kg 103 NAM 85.5 NGM
Example 6	19 min 270 + 50 = 320 kg 88.5 NAM 102 NGM

Exercise 1

a. Estimated landing weight at Alternate is 44 766 kg
b. FL338
c. FL330
d. FL310
e. 30 000 ft

Exercise 2

a. 4 × 75 = 300 kg
b. 50 kg
c. 49 971 - (642 + 129 + 98) = 49 102 kg
d. Increase fuel by 1.5%; no time penalty

Answer Exercise 1 Flight Plan

INTEGRATED FLIGHT PLAN - EXERCISE 1 Answer

LINE	SECTOR FROM	SECTOR TO	Temp °C	FL	Temp Devn	WIND Dirn	WIND Speed	Track °T	TAS	Wind Comp	GS kt	NGM	EET	NAM	Gross Start WT	Cruise Value	Minus NAM	FUEL
1	A (3000')	TOC	-	↗	0				392	-30	362	114 250 136	21	124	56000	-	-	1525
2	TOC	B	-49	370	+8				435	-50	385		21	154	54475	4195	4041	875
3	B	C	-49	370	+8				435	-20	415	460	66.5	482	53600	4041	3559	2500
4	C	D	-49	370	+8				435	+10	445	390	52.5	381	51100	3559	3178	2000
5	D	TOD	-49	370	+8				435	+20	455	397 510 113	52.5	379	49100	3178	2799	1800
6	TOD	E (MSL)	-	↘	-				-	+10	-		23	109	47300	-	-	295
7												1610	236.5		47005	ROUTE FUEL		8995
8																% INC/DEC		34
9	E	ALT.(MSL)	-		-				-	0	-	150	31	150	-	DIVERSION FUEL		1300
10																5% CONTINGENCY		450
11																APU/TAXI		260
12																AIR CONDITION		72
13																ANTI-ICE		577
14																HOLDING		1603
15																RAMP FUEL		13291

Answer Exercise 2 Flight Plan

INTEGRATED FLIGHT PLAN - EXERCISE 2 Answer

LINE	SECTOR FROM	SECTOR TO	Temp °C	FL	Temp Devn	WIND Dirn	WIND Speed	Track °T	TAS	Wind Comp	GS kt	NGM	EET	NAM	Gross Start WT	Cruise Value	Minus NAM	FUEL
1	A	TOC	-	↗	-	200	35	245	367	-	341	83 236	17	89	61500	-	-	1400
2	TOC	B	-56	310	-9	220	50	245	449	-	401	153	23	173	60100	4493	4320	1100
3	B	C	-56	310	-9	230	60	270	449	-	400	378	56.5	424	59000	4320	3896	2700
4	C	D	-56	310	-9	240	65	280	449	-	400	410	61.5	460	56300	3896	3436	2800
5	D	TOD	-56	310	-9	260	70	296	449	-	390	476 562	73	548	53500	3436	2888	3200
6	TOD	E	-	↘	-	230	30	296	284	-14	270	86	19	90	50300	-	-	270
7												1586	250		49930	ROUTE FUEL		11470
8															49781	% INC/DEC		-59
9	E	Alternate	-	-	-	-	-	310	-	-60	-	185	42			DIVERSION FUEL		1750
10																5% CONTINGENCY		574
11																APU/TAXI		258
12																AIR CONDITION		98
13																ANTI-ICE		642
14																HOLDING		1653
15																RAMP FUEL		16386

Chapter

8

MRJT Additional Procedures

Extended Twin Operations (ETOPS) - Introduction

The loss of a power unit, or certain major systems, by twin-engine Performance Class A aircraft whilst flying over water or remote areas, causes greater problems than similar events on aircraft with three or four engines. It is, therefore, necessary to limit the distance all such twin-engine aircraft (including those powered by turboprops and reciprocating engines) may be away from an **adequate airfield. This distance equals one hour's flight time, in still air and standard conditions, at the normal one-engine-inoperative cruise speed**.

Any operations planned to fly a twin-engine public transport aeroplane beyond this distance from an adequate aerodrome will be considered to be Extended Twin Operations (ETOPS).

An operator may be authorized to conduct ETOPS with a particular airframe/engine combination within a particular area (for example the North Atlantic) where the maximum diversion time, from any point along the proposed route of flight to an adequate aerodrome, is **up to 180 minutes or less (90, 120 or 138 minutes)** at the normal one-engine-inoperative cruise speed (under standard conditions and in still air). These areas will be specified on the permission issued by the Regulatory Authority for the purpose of approving ETOPS. **An operator shall not conduct operations beyond the threshold distance determined in accordance with EU-OPS 1.245 unless approved to do so by the Authority and prior to an ETOPS flight an operator shall ensure that a suitable ETOPS en route alternate is available within the appropriate diversion time.**

ETOPS - Definitions

Extended Twin Operations are those operations intended to be, or actually, conducted over a route that contains a point further than one hour's flying time (in still air) at the normal one-engine-inoperative cruise speed from an **adequate** aerodrome. When, alternatively a **Threshold Distance** has been agreed with the Authority, all non-ETOPS flights shall remain within the threshold distance of an adequate aerodrome.

ETOPS Segment is the portion of an ETOPS flight that begins when the aeroplane is first more than the threshold distance from any **adequate** aerodrome (ETOPS Entry Point) and ends when the aeroplane is last more than the threshold distance from any **adequate** aerodrome (ETOPS Exit Point).

Normal One-engine-inoperative Cruise Speed. An operator shall determine a speed for the calculation of the maximum distance to an adequate aerodrome for each two-engine aeroplane type or variant operated, not exceeding V_{MO}, based upon the true airspeed that the aeroplane can maintain with one engine inoperative under certain conditions. See EU-OPS 1.245 (b) for determination of this speed, which is only intended **to be used to establish the maximum distance from an adequate aerodrome.**

Threshold Time is 60 minutes.

(Before granting an extension to the threshold time the Licensing Authority considers the following factors: propulsion system reliability record, modification and maintenance programme, flight dispatch requirements, training evaluation programme, operations limitation and specifications, operational validation flight and continuing surveillance and engine reliability monitoring.)

Threshold Distance is the distance travelled in still air in 60 minutes by an aircraft at the normal one-engine-inoperative cruise speed.

Rule Time is the maximum time that any point on the route may be from a suitable aerodrome for landing, as specified by the Authority and included in the operations manual.

Rule Distance is the distance travelled in the rule time, at the normal one-engine-inoperative cruise speed.

Adequate Airfield. In general terms an ***operator*** may make an appraisal that an aerodrome has long enough runways, and is sufficiently equipped, to be considered **adequate** for his planned ETOPS routes. In particular it should be expected that at the anticipated time of use:

- The aerodrome will be available and equipped with the necessary ancillary services, such as ATC, sufficient lighting, communications, weather reporting, navaids and safety cover, and

- At least one let-down aid (ground radar would so qualify) will be available for an instrument approach.

Suitable Airfield. The ***commander*** must satisfy himself on the day, using criteria provided by the operator, that he has sufficient adequate aerodromes which, taking into account the weather and any equipment unserviceabilities, are suitable for his intended operation. An aerodrome shall only be selected as an ETOPS enroute alternative when the appropriate weather reports or forecasts, or any combination thereof, indicate that, between the anticipated time of landing until one hour after the latest possible time of landing, conditions will be at or above the planning minima.

ETOPS - Minimum Equipment List (MEL)

Primary system redundancy levels appropriate to ETOPS will be reflected in the MEL. For aeroplanes in operational service **the existing MEL will be re-evaluated and adjusted as necessary** to reflect the primary system redundancy levels required for ETOPS. **Primary airframe systems are those which have a fundamental influence on flight safety and could be adversely affected by the shutdown of a power unit.**

Examples are:

Electrical/battery, Hydraulic, Pneumatic, Flight Instrumentation, Fuel, Flight Control, Ice Protection, Engine Start and Ignition, Propulsion System Instruments, Navigation and Communications, APUs, Air Conditioning and Pressurization, Cargo Fire Suppression, Emergency Equipment, Engine Fire Detection and Extinguishing Systems and any other equipment for ETOPS.

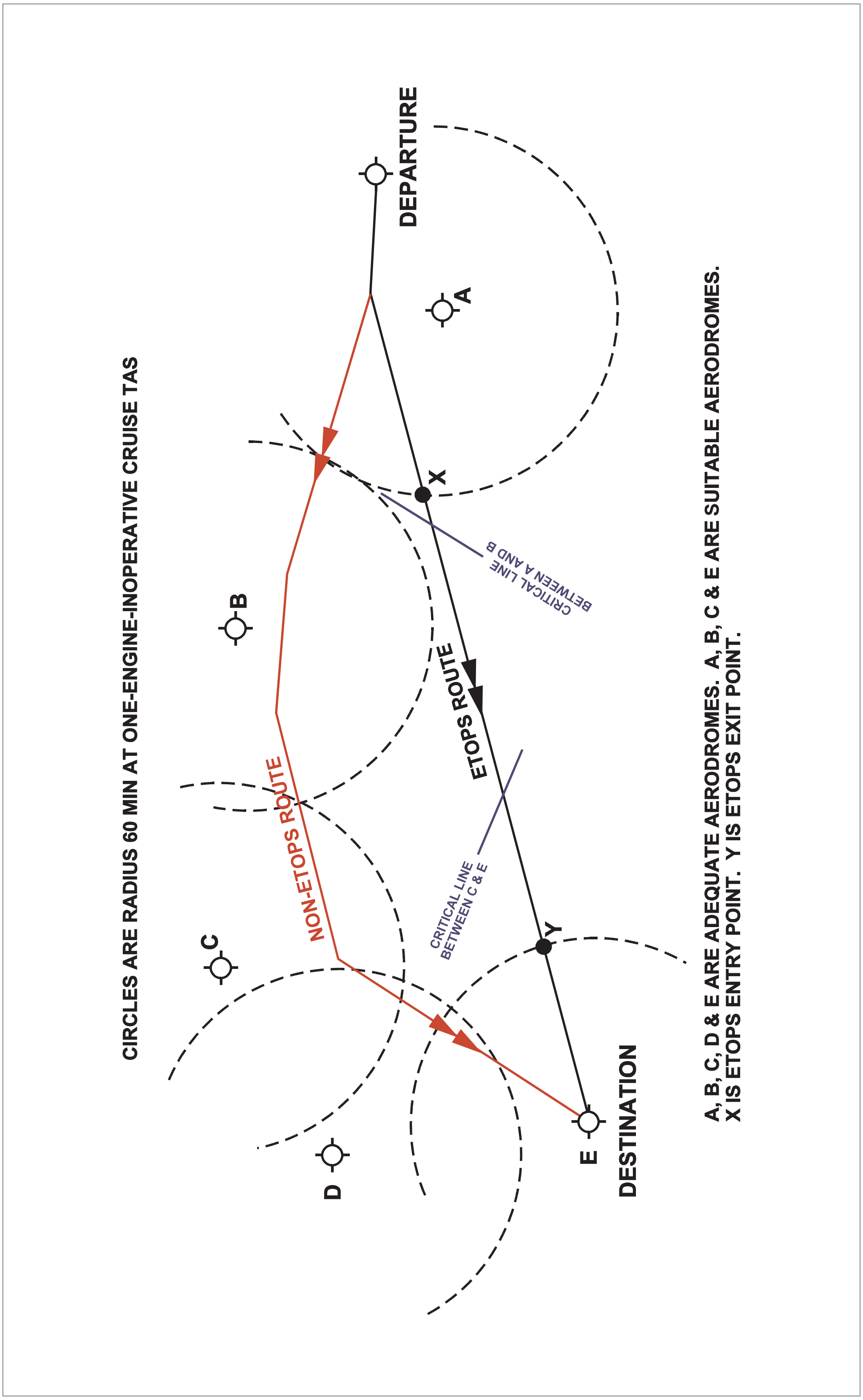


Figure 8.1 ETOPS chart

ETOPS - Communication and Navigation Facilities

An aeroplane shall not be dispatched on ETOPS unless:

- **Communication facilities** are available to provide, under all expected conditions of propagation at the normal one-engine-inoperative cruise altitudes, reliable two-way voice communications between the aeroplane and the appropriate air traffic control unit over the planned route of flight and routes to any suitable alternate to be used in the event of diversion; and,

- **Non-visual** ground navigation aids are available and located so as to provide, taking account of the navigation equipment installed in the aeroplane, the navigation accuracy required over the planned route and flight altitude, and the routes to any alternate and altitudes to be used in the event of diversion for whatever reason; and,

- **Approved visual and non-visual aids** are available at the specified alternates for the authorized types of approaches and operating minima.

ETOPS - Fuel Policy Pre-flight

An operator shall ensure that the **pre-flight** calculation of usable fuel required for a flight includes:

- Taxi fuel

- Trip fuel

- Reserve fuel consisting of:

  - Contingency

  - Alternate fuel, if a destination alternate is required

  - Final reserve fuel (for aeroplanes with turbine power units, fuel to fly for 30 minutes at holding speed at 1500 ft (450 m) above aerodrome elevation in standard conditions), and,

  - **Additional fuel, if required by the type of operation (e.g. ETOPS)**, and,

- Extra fuel if required by the commander

ETOPS - Fuel Policy In-flight

An operator shall ensure that **in-flight** replanning procedures for calculating usable fuel required when a flight has to proceed along a route, **or to a destination other than originally planned**, includes:

- Trip fuel for the remainder of the flight.
- Reserve fuel consisting of:
    - Contingency fuel.
    - Alternate fuel, if a destination alternate is required.
    - Final reserve fuel (for aeroplanes with turbine power units, fuel to fly for 30 minutes at holding speed at 1500 ft (450 m) above aerodrome elevation in standard conditions), and
    - **Additional fuel, if required by the type of operation (e.g. ETOPS)**, and
- Extra fuel if required by the commander.

ETOPS - Critical Fuel

In general an aeroplane shall not be dispatched on an ETOPS flight unless it carries sufficient fuel and oil; and in addition, such additional fuel and oil as may be required to fly to a suitable aerodrome for landing in the event of the shutdown of a engine, or in the event of airframe system failure(s), which may require diversion to an alternate. **It should be assumed that this event occurs at the most critical point in terms of overall fuel and oil requirements along the planned route of flight.** Thus for ETOPS operations the "Trip fuel for the remainder of the flight" will be the CRITICAL FUEL i.e the fuel from the most Critical Point (CP)/Equal Time Point (ETP) to the diversion aerodrome based upon a consideration of three possible events:

- **Simultaneous failure of an engine and the pressurization** (this is the worst scenario) An emergency descent down to FL100 at V_{MO}/M_{MO} with the speed brakes extended and cruise to the diversion airfield at LRC speed.
- **Total pressurisation failure** (but no engine failure). An emergency descent down to FL100 at V_{MO}/M_{MO} with the speed brakes extended and cruise to the diversion airfield at LRC speed.
- **Engine failure** (but no pressurization failure). Descent and cruise will be initiated at the selected speeds and stabilizing level.

The fuel required will be the greatest of the All-engine and two Single-engine cases. This amount is then compared to the fuel planned to be on the aircraft at the most critical CP/ETP; **if it is greater than the planned amount then additional fuel must be uplifted**.

ETOPS - Chart Calculation of the Most Critical Point

Figure 8.2 shows how the most critical point (CP/ETP), i.e. the one based upon the two alternates furthest along track, is derived. It is based upon the Critical Line between airfields at C and E which is found by extending the bisector of the line between C and E to cut the ETOPS track.

Thus, the distances from this intersection to either C or E are equal, and, in still air conditions, the flight time at the one-engine-inoperative TAS will also be equal.

Assume:

One-engine-inoperative cruise TAS 400 kt.

690 NM, from C and E Critical Line intersection with the ETOPS track, to airfield C or E.

Mean forecast wind velocity 230/85, for flight to C or E at planned one-engine-out stabilizing pressure level.

Therefore:

Still air time to C or E	=	690 NM at 400 kt
	=	104 min
104 min at a wind speed of 85 kt	=	147 NM

Back-plot a wind vector from the Critical Line intersection with the ETOPS track, in the direction 230°, for 147 NM. At the end of this vector plot the Equal Line, parallel to the Critical Line.

The intersection of this Equal Line with the ETOPS track is the most limiting ETOPS ETP/CP.

Thus:

- **At this position it is the same engine-out flight time to airfields at C or E,**

  and

- **The flight planned fuel from this point must be equal to or greater than the Critical Fuel to C or E. If it is not then the extra fuel required must be loaded.**

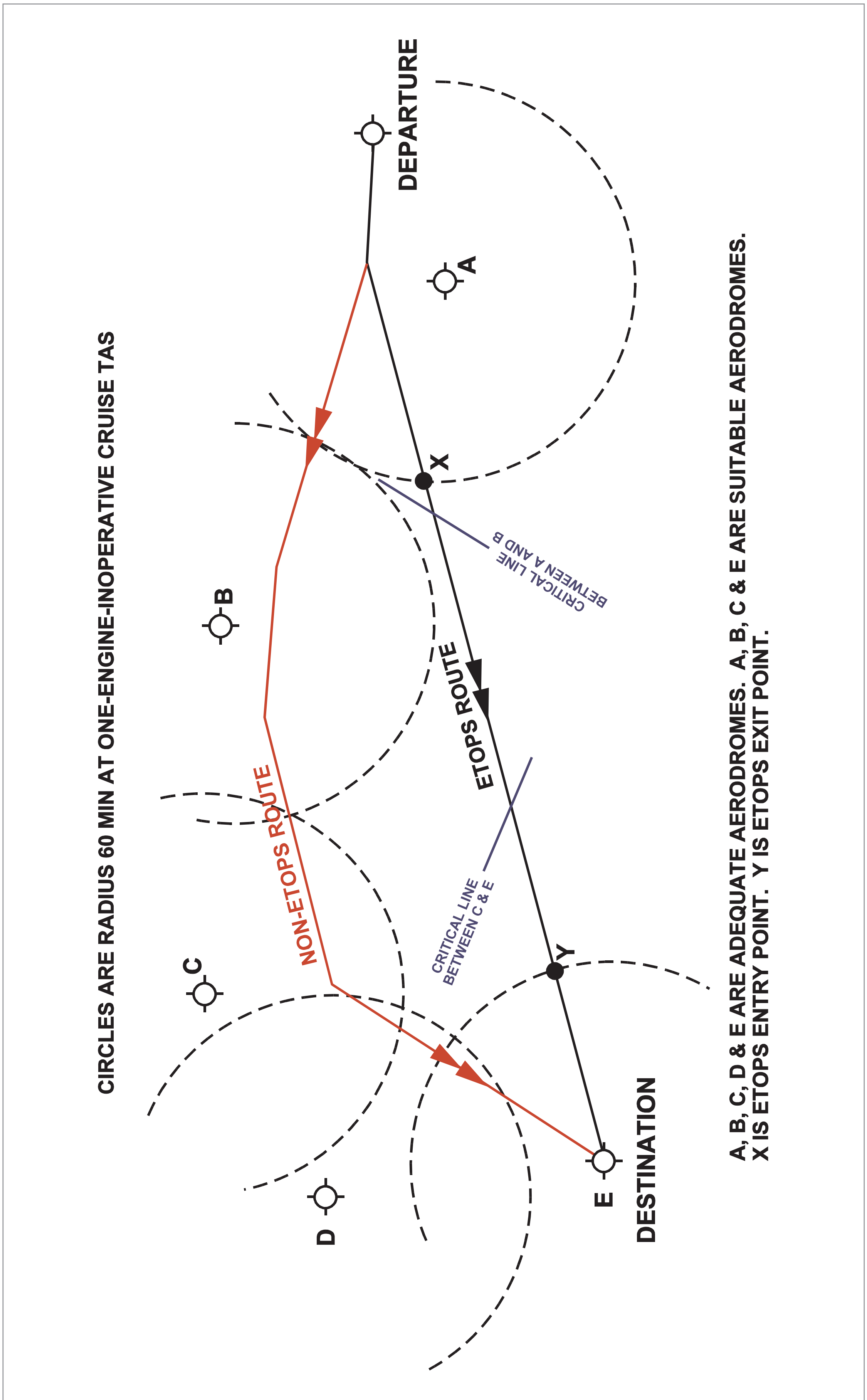


Figure 8.2 ETP for ETOPS

ETOPS – CAP 697 MRJT1

CAP 697, Pages 72 to 75

CAP 697 Figures 4.7.1a & 1b provide the **CRITICAL FUEL RESERVE (LRC) for ONE ENGINE INOPERATIVE and ALL ENGINES OPERATIVE** at the Critical Point. If this fuel reserve is greater than the planned fuel at this point, the fuel load must be increased accordingly. Both graphs are based on the following **common** parameters:

- Pressurization failure
- Emergency descent to 10 000 ft. Level cruise at 10 000 ft
- 250 KIAS descent to 1500 ft over the airfield
- 15 minutes hold at 1500 ft. One missed approach, approach and land
- 5% allowance for wind errors

The One Engine Inoperative graph also includes Auxiliary Power Unit (APU) fuel burn. Thus, **this is the worst case scenario (engine and pressurization failure)** which requires the APU to be started in flight in order to compensate, in part, for the loss of the power plant to provide essential electrics and pneumatics (e.g. air conditioning).

Note the corrections, beneath each graph, for:

- Temperatures hotter than ISA.
- Icing conditions.

Example 1

An aircraft at a weight of 48 000 kg suffers an engine and pressurization failure simultaneously. The forecast conditions at FL100 are +5°C and a 50 kt headwind for the 850 NM distance from the CP to the diversion airfield. Calculate the LRC Critical Fuel Reserve needed.

Ans....................kg

Example 2

Use the same details above, assuming pressurization failure only.

Ans....................kg

Example 3

An aircraft at a weight of 50 000 kg has an engine and pressurization failure simultaneously. The forecast is icing conditions at FL100, -15°C and a 60 kt tailwind and for the 750 NM distance from the CP to the diversion airfield. Calculate the LRC Critical Fuel Reserve needed.

Ans....................kg

Example 4

Use the same details above, assuming pressurization failure only.

Ans....................kg

Answers to Examples 1-4 on page 121

Area of Operation - Diversion Distance

CAP 697 Figure 4.7.2

The area of operation is defined as the region within which the operator is authorized to conduct ETOPS. The distance to the diversion airfield from any point along the route must be flown within the approved time using the single-engine cruise speed, assuming still air and ISA conditions.

The maximum diversion distance used to establish the area of operation may be obtained from this chart.

Method:

Enter the chart with the appropriate speed and weight at the point of diversion. Select the appropriate time.

Read off the maximum diversion distance.

Example 5

Fill in the diversion distances to a diversion airfield from any point on track, given the following table of speeds, weights and approved times:

Speed M/ KIAS	Div. Wt. 1000 kg	120 min	135 min	150 min	180 min
.70/280	45				
.74/290	55				
.74/310	70				
.74/330	38				
LRC	60				

Answer to Example 5 on page 121

In-flight Diversion (LRC) - One Engine Inoperative

Refer to CAP 697 Figure 4.7.3

This graph is a simple method of determining the fuel required and time for the flight from **a diversion point to a selected alternate.** It is based upon **one engine inoperative and NO pressurization failure**, with the aircraft drifting down to **cruise at its selected level**.

Example 6

The one-engine-inoperative, LRC, diversion distance to the alternate is 940 NM at a weight of 60 000 kg; wind component 50 kt head, cruise FL260 and ISA Dev. +20°C. Determine the fuel required and diversion time.

Enter the graph with the diversion distance, move vertically to the WIND REF LINE and follow the curved flow lines to the value 50 Head.

From this position go vertically to the PRESSURE ALTITUDE 1000 ft slope of 26 and move horizontally to the WEIGHT AT POINT OF DIVERSION REF LINE.

Follow the curved flow lines to intercept the 60 000 kg value and from here go horizontally to extract the FUEL REQUIRED .... kg.

Return to the intersection of the vertical distance/wind line with the PRESSURE ALTITUDE.

1000 ft slope of 26 and continue vertically to intercept the second PRESSURE ALTITUDE.

1000 ft slope of 26 and move horizontally to the ISA DEV (°C) REF LINE.

Follow the temperature slope and read off the time...............h..........h.........min.

(*Note: The solid line = 6000 ft, the dashed line = 26 000 ft, therefore, interpolation is required*).

Example 7

The One-engine-inoperative, LRC diversion distance to the alternate is 400 NM at a weight of 60 000 kg; wind component 100 kt tail, cruise FL60 and ISA Dev. +10°C. Determine the fuel required and diversion time.

...................kg ....h..........h..........min

Example 8

Given: Distance from CP to diversion 800 NM, wind component 25 head, weight at CP 55 000 kg. Calculate:

- The fuel required for an engine and pressurization failure diversion; outside air temperature at cruise level is +5°C with forecast icing .... kg
- The fuel required for a pressurization failure diversion; temperature at cruise level is +5°C with forecast icing .... kg
- The fuel and time for a LRC engine failure diversion at FL220, OAT -19°C ....kg ....hr...............hr................min

Answers to Examples 6-8 on page 121

Non-normal Operations

CAP 697 MRJT1 Figure 4.6.1

The references are for "**Gear Down**" **Ferry Flight** with all engines operating at 220 KIAS; climb and descent fuel and time are included.

Example 9

Calculate the trip time and fuel required for a Gear Down Ferry Flight from the following:

Sector distance	850 NM
wind component	75 kt Tail
	FL 240
landing weight	40 000 kg
OAT	-43°C.

Fuel..................kg Time........h...........min

Example 10.

Calculate the trip time and fuel required for a Gear Down Ferry Flight from the following:

Trip distance	550 NM
wind component	100 Head
	FL 260
landing weight	53 000 kg
OAT	-22°C.

Fuel..................kg Time........h...........min

Answers to Examples 9 & 10 on page 121

Fuel Tankering

CAP697 MJRT1 Figures 4.8.1 & 4.8.2

When the cost of fuel at the destination airfield is greater than that at the departure, the LRC or .74 Mach Fuel Tankering graphs may be used to determine if it is economical to carry fuel in excess of that required for the flight; a large percentage of this extra fuel can then be used for the return flight or another sector. These charts should only be used if the cruise altitude capability is not adversely affected by tankering.

To obtain the smaller, but potentially significant, percentage of the surplus fuel that will be burnt, due to the increased gross weight of the aircraft resulting from the tankered fuel, the entering values for each graph are:

- Trip distance **NAUTICAL AIR MILES**
- Cruise pressure altitude
- Landing weight (**WITHOUT TANKERING**)

The LRC example (Figure 4.8.1) shows that, for a trip of 1600 NAM at FL330 and 42 500 kg Landing Weight (Without Tankered Fuel), if excess fuel is carried **13.2% of it will be consumed as a fuel penalty, due to the aircraft's higher gross weight.**

For fuel tankering to be economical the fuel price at the destination must be greater than the break even fuel price. The Fuel Price Differential Graph (Figure 4.8.2) presents the Break Even Fuel Price Destination Airport for any Surplus Fuel Burn percentage and Fuel Price at Departure Airport; the fuel price is quoted as cents/US.gal.

Using the 13.2% Surplus Fuel Burn in the example and a Departure Airfield Fuel Price of 100 cents the Break Even Fuel Price Destination Airport is 116 cents.

Example 11

An aircraft is planned to fly a LRC at FL350, ISA -10°C, at an average gross cruise weight of 55 000 kg and a Landing Weight (Without Tankered Fuel) of 47 500 kg; the wind component is -30 kt and the trip distance 1600 NGM. Calculate:

a. The % Surplus Fuel Burn. ....%

b. The Break Even Fuel Price Destination Airport if the Fuel Price at Departure Airport is 75 cents/US.gal. ....cents

Example 12

An aircraft is to fly a .74 Mach cruise at FL310, ISA +15°C with a Landing Weight (Without Tankered Fuel) of 40 000 kg. The sector distance is 1050 ngm, wind component +35 kt. Calculate:

a. The % Surplus Fuel Burn. ....%

b. The Break Even Fuel Price at Destination if the Fuel price at Departure is 85 cents/US.gal.....................cents

Answers to Examples 11 & 12 on page 121

Answers

Example 1 8100 × 1.005 = 8140 kg

Example 2 8600 × 1.005 = 8643 kg

Example 3 5500 × 1.20 = 6600 kg

Example 4 5800 × 1.18 = 6844 kg

Example 5

Speed M/ KIAS	Div. Wt. 1000 kg	120 min	135 min	150 min	180 min
.70/280	45		878		1167
.74/290	55	766		952	
.74/310	70	744	834		1103
.74/330	38		908	1007	1205
LRC	60	744			1100

Example 6 7300 kg 2.95 h / 2 h 57 min

Example 7 2800 kg 1.05 h / 1 h 03 min

Example 8 a. 7600 × 1.005 × 1.2 = 9166 kg

b. 7900 × 1.005 × 1.18 = 9369 kg

c. 5400 kg 2.4 h 2 h 24 min

Example 9 7100 kg 2h 24 min

Example 10 10 300 kg 2h 48 min

Example 11 16.8% 90 cents

Example 12 6.2% 92 cents

In Examples 11 & 12 the NAM for the graphs must be calculated from the formula using NGM, GS and TAS. The TAS comes from the Integrated Cruise pages for LRC at FL350 and .74 Mach at FL310. Remember to correct the TAS for ISA Deviation in each case before working out the NAM.

Computer Flight Plans - Introduction

The majority of airlines use computer flight planning, either their own systems or those provided, for example, by SITA or Jeppesen. The following is representative of the type of information programmed into a computer database:

Co-ordinates and identification of all likely navigation beacons, waypoints and airfields. Meteorological data, which is automatically loaded from a main International Met. Office (e.g. Bracknell).

The airline's standard routes.

ATC routes, airways, SIDS and STARS, and the twice daily North Atlantic Tracks which are automatically loaded.

The operator's fuel management data and policy.

The structural limits and performance details of all the aircraft types operated.

Airfield dimensions and meteorological information in order that the regulated take-off and landing performance data can be calculated.

The operator's preferred alternate airfield data.

The operator's fuel costing policy.

The operator's preferred aircraft operating method. For example: Long Range Cruise, High Speed Cruise, Cruise Climb, Constant Mach No.

Most computer systems require the minimum basic information to provide a flight plan:

Examples of required information:

Aircraft type	Block time
Departure and	Destination.
Cruise mode	Traffic load required

However great care must be taken to ensure that the correct information is loaded. Remember-

"garbage in, garbage out".

Figure 8.3 shows a printout of a trip from Gatwick (EGKK) to Frankfurt (EDDF).

Line

```
1 PLAN 6340        EGKK TO EDDF 757B M80/F 09/30/92
2 NONSTOP COMPUTED 1145Z        FOR ETD 1830Z PROGS 30000Z KGS
3                  FUEL     TIME    DIST     ARRIVE   TAKEOFF    LAND         AV PLD
OPNLWT
4 POA     EDDF     003091   00/55    0362     1925Z    077390       074299       012500
058638
5 ALT     EDDL     001485 00/24 0101 1949Z COMP M015
6 HLD     001521   00/30
7 CON     000155   00/03
8 REQ     006252   01/52
9 XTR     000000   00/00
10 TOT    006252   01/52
11 EGKK DVR6M DVR UG1 NTM NTM1A EDDF
12 WIND P029 MXSH 5/KOK TEMPO P01 NAM 0337
13 FL 370
14 LRC FL370 003091 00/56
15 LRC FL330 003180 00/57
16 LRC FL410 003111 00/55
17 EGKK ELEV 00202FT
18 AWY WPT MTR DFT ZD ZT ETA ATA CT WIND COMP GRS DSTR REM
19 MSA FRQ
20 DVR6M DVR 092 .. 068 0/11 .. .. 0/11 .... ... . ...          0294
21 023 114.95
22 UG1 TOC 097 .. 014 0/02              02809 0046
23 023
24 UG1    KONAN 097 L01 010 0/01 .. .. 0/14 27045 P045 502 0270 0045
25 023
26 UG1 KOK 097 L01 025 0/03 .. .. 0/17 26041 P040 497 0245 0043
27 023 114.5
28 UG1 REMBA 108 L02 090 0/11 .. .. 0/28 27030 P028 488 0155 0038
29 026
30 UG1 NUVIL 109 L01 024 0/03 ..    .. 0/31 27025 P024 485 0131 0036
31 034
32 UG1 SPI 110 L01 004 0/01 .. .. 0/32 27025 P024 485 0127 0036
33 034
34 UG1 LARED 131 L02 009 0/01 .. .. 0/33 28025 P020 481 0118 0036
35 034
36 UG1 TOD 131 L03 007 0/01 .. .. 0/34 28025 P021 481 0111 0035
37 043
38 UG1 NTM 131 .. 030 0/06 .. .. 0/40 ...         .. ..        0081 ...
39 043 ..
40 NTM1A EDDF 089 .. 081 0/16 .. .. 0/55 .... .. .. 000 0 0032
41 043
42 ELEV 00364FT
43 EGKK N51089W000113 DVR N51097E001217 KONAN N51078E002000
44 KOK N51057E002392 REMBA N50398E004549 NUVIL N50322E005315
45 SPI N50309E005375 LARED N50252E005480 NTM N50010E006320
46 EDDF N50021E008343
47 FIRS EBUR/0014 EDDU/0036
48 (FPL-JD105-IN)
49 -B757/M-SXI/C
50 -EGKK1830
51 -N0457F370 DVR6M DVR UG1 NTM NTM1A
52 -EDDF0055 EDDL
53 -EET/EBUR0014 EDDU0036
54 REG/GBDKC SEL/JDHC
55 E/0152 P/121 R/V S/M J/L D/6 150C YELLOW
56 A/WHITE BLUE
```

Figure 8.3 Computer flight plan - Gatwick to Frankfurt

Line 1	Departure, Gatwick (EGKK) and Destination, Frankfurt (EDDF); aircraft type; cruise at Mach 0.8; IFR and date - month/day/year.
Line 2	Computation time; Expected Time of Departure; based upon meteorological forecast midnight 30th September; weights in kilograms.
Line 3	AV PLD = available payload; OPLN WT = operational weight.
Line 4	POA = point of arrival, EDDF/Frankfurt; 3091 kg of route fuel; 55 minutes flight time; 362 nm route distance; expected arrival time 1925Z; take-off weight 77 390 kg; landing weight 74 299 kg; operational weight (weight less fuel and payload) 58 638 kg.
Line 5	ALT = alternate airfield EDDL/Dusseldorf; 1485 kg diversion fuel; 24 =min diversion time; expected arrival time 1949Z; diversion wind component 15 kt head(minus).
Lines 6 to 10	These state the fuel and time for: HLD = holding fuel, 1521 kg. CON = contingency fuel, 155 kg (5% of 3091 kg). REQ = fuel required, less taxi and start up, for the route, 6252 kg. XTR = extra fuel if required. TOT = total fuel on board and equivalent time (time to empty tanks)
Line 11	Route summary: The Dover6M Standard Instrument Departure(SID) to Dover (DVR) VOR, routing UG1 to Nattenheim (NTM) VOR, the Nattenheim1A Standard Arrival Route (STAR) to EDDF.
Line 12	The average wind component for the route is 29 kt tail(plus). MXSH = maximum windshear (increase in speed) of 5 kt/1000 ft at the KOK VOR. This strength of windshear indicates that clear air turbulence (TURB) is a possibility and a climb to a higher level could produce better fuel economy - a higher ground speed and a lower fuel flow.The average temperature is -1°C. NAM = nautical air mile distance 337 NM. $\mathbf{362\ NGM - \frac{29 \times 55}{60} = 335\ NAM}$
Line 13	A Pressure Altitude of 37 000 ft, FL370, chosen for the flight.
Lines 14 to 16	An analysis of the long range cruise fuel and flight times for FL370, 330 and 410.
Line 17	Elevation of Gatwick (EGKK) airfield, 202 ft.
Line 18	Column headings: AWY = airway designator; WPT = navigation waypoint and its identifier; MTR = magnetic track; DFT = drift; ZD = zone, leg or sector distance; ZT = zone, leg or sector elapsed time in h/min.; ETA and ATA (estimated and actual time of arrival) logged when airborne; CT = the accumulative flight time; WIND = wind velocity as a five figure group 27 = 270°(T), 045 = 45 kt.; COMP = wind component; GRS = ground speed; DSTR = total distance remaining; REM = kg of fuel remaining.
Line 19	MSA = zone, leg or sector minimum safe altitude; FRQ = the radio frequency of the navigational beacon at the waypoint.
Line 22/36	TOC = top of climb; TOD = top of descent.
Line 42	Elevation, 364 ft, of Frankfurt.
Lines 43 to 46	Waypoint co-ordinates for entry into Flight Management Computers, if required.
Line 47	Accumulative elapsed times, from take-off, to the Brussels and Rhein Flight Information Region (FIR) boundaries.

Lines 48 to 55 This is the computerized version of the ATC Flight Plan (CA48), which is usually acceptable to ATC:

Aircraft identification is JD105 for a Non-scheduled, N, IFR flight, I.

Type of aircraft is a Boeing 757, medium, M, wake turbulence and carrying Standard navigation and communication equipment, S, plus equipment, X, to fly in Minimum Navigation Performance Specification airspace and an Inertial Navigation System, I. C indicates a Secondary Surveillance Radar with an altitude transmitting capability. EGKK is the departure airfield with an off-blocks time of 1830UTC.

The first cruising level, F, is FL370 at a cruising speed, N, of 457 kt TAS, routing via the Dover6M SID to DVR. From DVR to the NTM VOR along UG1 airway, thence via the Nattenheim1A STAR to EDDF.

The Total Estimated Elapsed flight time is 55 minutes with EDDL as the alternate airfield.

The Estimated Elapsed Times, from take-off, to the Brussels and Rhein FIRs are 14 and 36 minutes.

The aircraft registration is GBDKC and its SELCAL code JDHC.

The following details are not transmitted unless the aircraft becomes overdue:

The total fuel endurance is 1 h 52 min. The POB (Persons On Board) is 121. The aircraft is equipped with a separate emergency VHF radio and maritime, M, survival equipment. The life jackets are fitted with a seawater activated light.

The aircraft carries six dinghies, D, with a total capacity of 150; 25 people per dinghy.

Each dinghy has a yellow cover, C.

The aircraft colour and markings are white and blue. (See Chapter 12 for CA48).

Computer Flight Plans - Checking Accuracy

Never assume that computer plans are correct invariably; errors can, and do, occur; particularly if the wrong information has been loaded into the computer. Check the information to see if it is sensible. Experienced pilots, who fly regularly a series of routes soon become familiar with route patterns, their seasonal fuels, times and distances, and can quickly spot a duff computer plan. Check that:

- It is up to date and using the latest forecasts
- The fuel amounts and flight times make sense for the time of year
- The track directions and distances are sensible
- The wind velocities and average wind component tally with the meteorological forecast
- The alternates chosen are acceptable
- The method of cruise control is appropriate

If the route is a new one, or one rarely flown, then refer to the aircraft's Simplified Fuel Planning Data to verify the computerized plan or use agreed "Rules of Thumb" based upon average fuel flows and cruise TAS/ground speeds.

Chapter

9

Topographical Chart

9 Topographical Chart

Introduction

The **Jeppesen VFR + GPS (Visual Flight Rules + Global Positioning System) Chart GERMANY ED - 6 EDITION 1999** is the reference for **Part-FCL 033 01 00 00, FLIGHT PLANS FOR CROSS-COUNTRY VFR FLIGHTS.**

The chart is a **Lambert Conformal Conic Projection** with standard parallels of **N37°** and **N65°**; its **scale is 1/500 000** with **elevations in feet**. It is designed for VMC Flight in accordance with VFR. It is effective below FL125 in Austria, FL115 in France, FL100 in Germany and FL150 in Switzerland. The Isogonic lines are valid for 1999; see top of the chart at E008° 55′ and E012° 15′. **The Highest Spot Elevation** is **12 028 ft** at **N4707.4 E01220.8.** Identification of adjacent charts is provided at the diagram top left-hand corner of the chart.

World Geodetic System of 1984 (WGS84)

The co-ordinates of VFR REPORTING POINTS, AERODROMES and RADIO NAVIGATION AIDS use the **World Geodetic System of 1984 (WGS84).** e.g.

STUTTGART NDB = N4842.7 E00920.1

See the right-hand panels of the chart.

Example 1

a. What are the WGS84 co-ordinates of FOXTROTT 2 VFR Reporting Point in the Munchen Control Zone (CTR)?

b. What are the WGS84 co-ordinates and ICAO designator for Innsbruck International aerodrome?

c. State the Radio Navigation Aid, its frequency, call sign, co-ordinates and magnetic variation for MOOSBURG.

Answers can be found on page 141

Track (Course) - Measurement of Direction and Distance

TRUE DIRECTION is measured by placing the centre of a protractor over the midpoint of the track, aligning its north/south axis parallel to the nearest meridian and reading off the track direction in °(**T**). If the **MAGNETIC** direction is required the mean variation for the track is found by interpolation between the appropriate isogonals, updated as necessary for the mean annual change, and applying it to the true track direction as follows:

VARIATION WEST (+) - MAGNETIC BEST

VARIATION EAST (-) - MAGNETIC LEAST

DISTANCE in nautical miles is measured either by using the **NEAREST MERIDIAN SCALE** or the **NAUTICAL MILE SCALE** at the bottom of the chart; this latter scale has a Kilometre and Statute Mile Conversion. Thus:

60 NM = 111.1 km (60 × 1.852)

Example 2

What are the magnetic track and distance, in nautical miles and kilometres, between aerodromes LAHR (EDTL) and STUTTGART (EDDS)?

Answers can be found on page 141

Aeronautical Information

- **AIRPORTS** depicted on the chart are shown with their ICAO four-letter code, location name, elevation in feet, longest runway available in metres and tower communication frequency; (v) indicates that VHF Direction Finding (VDF) is available.

- **WAYPOINT INFORMATION**. Compulsory and Non-compulsory Reporting Points are shown on the chart with their assigned name.

- **NAVAID INFORMATION** provides a navigational aid's frequency and identification; their co-ordinates are tabulated at the side of the chart.

- **TYPES OF AIRSPACE**
  When planning a flight the various types of airspace and their restrictions must be considered.

- **RESTRICTED, DANGER** and **PROHIBITED AREAS** on the chart are depicted as shown.

  - **RESTRICTED AREA** - Airspace of defined dimensions within which the flight of aircraft is restricted in accordance with certain specified conditions.

  - **DANGER AREA** - Airspace which has been notified as such within which activities dangerous to the flight of aircraft may take place or exist at such times as may be notified.

  - **PROHIBITED AREA** - Airspace of defined dimensions within which the flight of aircraft is prohibited.

Topographical Information

Note the symbols for natural high points, given in feet, and the Terrain Contour Tints, given in feet and metres. At the bottom right of the chart is a FEET METRE CONVERSION scale.

1 m = 3.28 ft

MINIMUM GRID AREA ALTITUDE (GRID MORA) figures are shown within each half degree of latitude and longitude; two noughts should be added:

47 = 4700 ft

The resulting value provides a clearance of all terrain by 1000 ft in areas where the highest point is 5000 ft or lower and 2000 ft where the highest point is 5001 ft or more.

9 Topographical Chart

Miscellaneous

- **FLIGHT INFORMATION AND METEOROLOGICAL SERVICES.** Frequencies for ATIS, Flight Information Service and Weather Information are provided within various Flight Information Regions (FIR) at nominated centres, at the inset chart bottom left of the main chart.
- **GENERAL AVIATION FORECAST AREAS** are shown in the adjacent chart. The numbers refer to telephone numbers.
- Note the **AIRSPACE CLASSIFICATION GERMANY** diagram and table. Only class C, D, E, F and G are used in Germany.
- Note the **PHONETIC ALPHABET AND MORSE CODE**.
- Note the **SEMI-CIRCULAR CRUISING LEVELS ON VFR FLIGHTS** and those for France.
- **VFR ROUTES WITHIN FRANCE.** Bearings and tracks are magnetic and distances are in nautical miles.
- Note the table of **AIRSPACE DESIGNATORS AND CONTROL FREQUENCIES.**

Example 3

Give a complete decode of the airfield information at Augsburg.

Example 4

Decode the blue triangle to the east of Augsburg.

Example 5

Decode the navaid information at N4843.2 E01131.3 and N4844.3 E01138.7.

Example 6

What does the symbol at N4822.9 E00838.7 signify?

Example 7

What type of airspace is Salzburg VOR/DME within? Give its dimensions.

Example 8

What are the Salzburg ATIS and Weather Broadcast frequencies?

Answers to Examples 3 to 8 can be found on page 141

Establishment of Minimum Flight Altitudes
(Ref. EU-OPS 1.250)

When selecting a Flight Altitude/Level which gives adequate clearance for a given sector the following should be considered:

- The accuracy with which an aircraft can determine its position.
- The inherent inaccuracies of altimeters and their indications plus corrections required to account for temperature and pressure variations in relation to ISA.
- The characteristics of the terrain.
- Rotor turbulence and standing waves.
- The accuracy of the navigational chart.
- The vertical extensions of Danger, Restricted and Prohibited areas. (Avoid them if they cannot be overflown).
- The vertical extensions of the types of airspace.
- The highest ground or obstacle within the promulgated distances either side of the planned track.
- The ICAO Standard Semi-circular Cruising Levels. (See *Figure 9.1*)

The Minimum Grid Area Altitudes (Grid MORA)

These are printed on the chart have already been referred to. These could be used:

- As a rapid means of assessing the appropriate Flight Level/Altitude.
- As a means of cross-checking terrain clearance values that have been obtained using the stated methods.
- As a rapid means of re-assessing safe clearance of terrain, e.g. when a pilot becomes unsure of his exact position in relation to his intended track.

Students will be required to **find the highest obstacle within a given distance** either side of track. Normally the distance will be 5 NM either side of track

Choosing Cruising Levels

(See *Figure 9.1* and bottom of the chart)

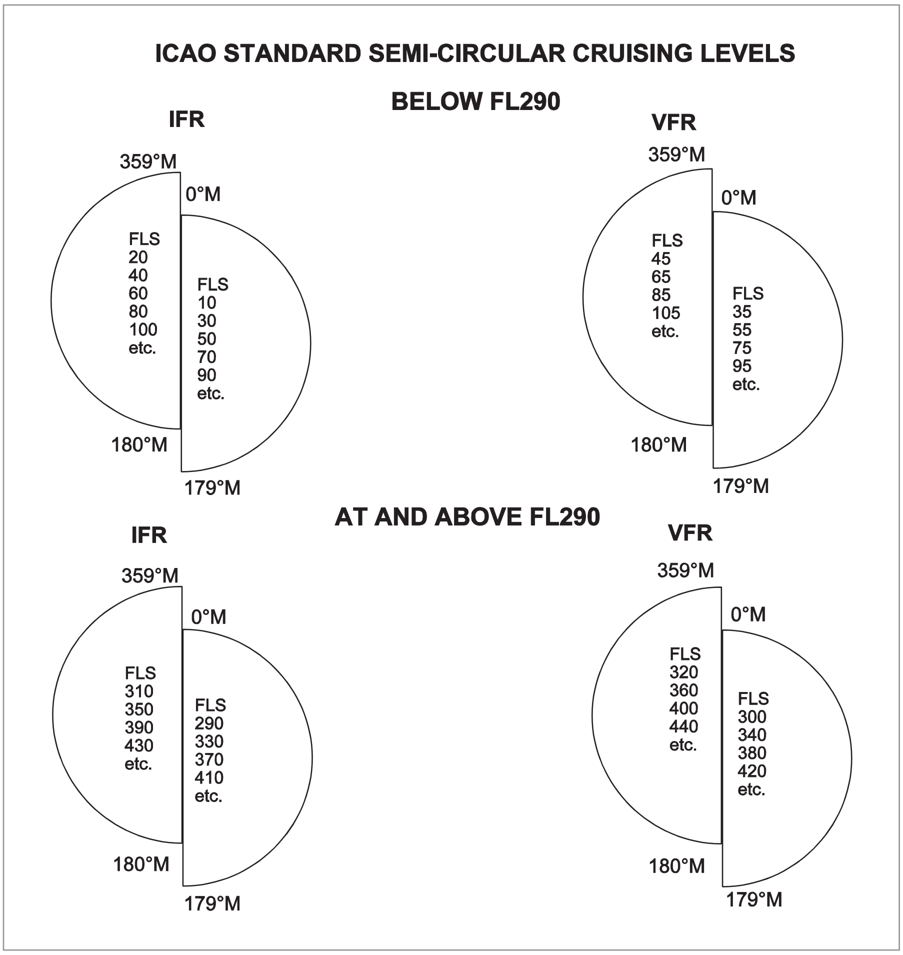


Figure 9.1 ICAO semi-circular cruising levels

The choice of safe Flight Level is determined by the aircraft's planned **Magnetic track** (not heading), stated obstacle clearance allowance and regional forecast route QNH. For VFR flight for SEP and MEP aircraft the **BELOW FL290 VFR** diagram, top right of *Figure 9.1*, is the reference. Flight Levels for a track between **0°M** and **179°M** are **odd levels plus 500 ft**; for tracks between **180°M** and **359°M** they are **even levels plus 500 ft.**

(When choosing levels for the Medium Range Jet Transport (MRJT) aircraft, the **IFR BELOW FL290** and **AT AND ABOVE FL290** will be the reference for **IFR** flight).

Altimeter Errors and Corrections

An altimeter is calibrated in relation to the **International Standard Atmosphere (ISA)**.

A **mean sea level pressure and temperature** of **1013.25 hPa** and **+15°C**, and a mean temperature lapse rate of **2°C (1.98°C)/1000 ft** up to **36 090 ft**, where it remains constant at **-56.5°C**.

Thus, when calculating the height increment/decrement in feet from an airfield to an aircraft's **Flight Level (pressure altitude)**, which is based upon the above standard conditions, the differences in pressure and temperature between the actual and ISA conditions must be accounted for.

Pressure Difference

The initial pressure setting for take-off will be **QNH**, which when set on the altimeter subscale causes it to indicate the aircraft's **altitude** (airfield elevation) above mean sea level at take-off, disregarding instrument error.

On passing the transition altitude the **standard pressure setting of 1013.25 hPa** is set on the altimeter subscale. The difference between **1013.25 hPa** and the airfield **QNH** will result in a **barometric error**, height loss or gain, in the order of **30 ft/hPa**.

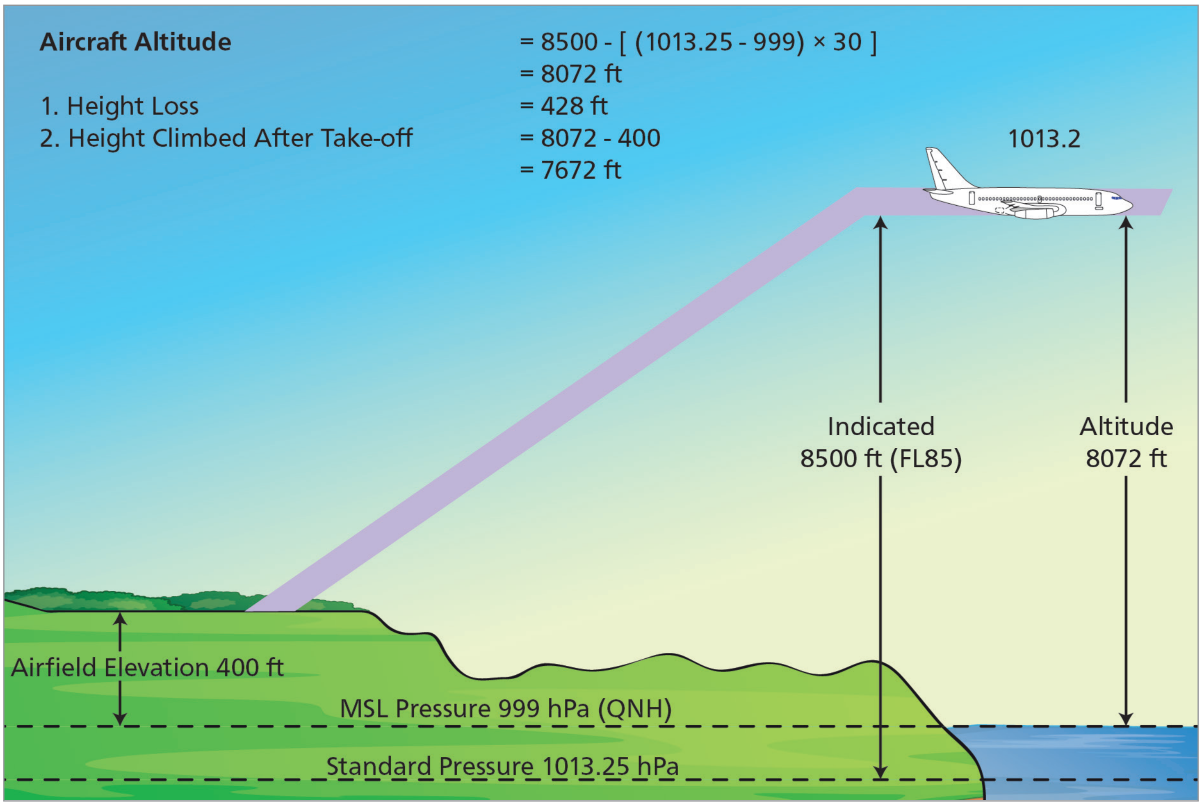


Figure 9.2 1013.25 hPa > QNH - less height gained

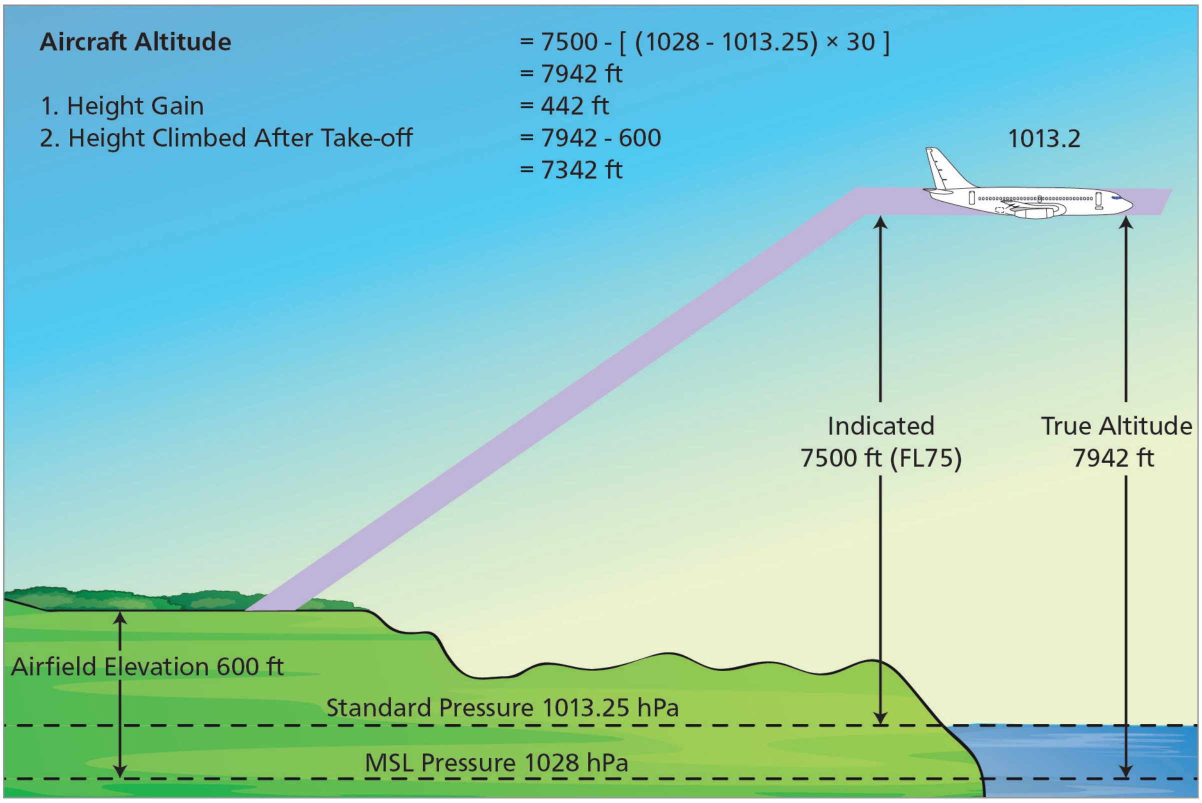


Figure 9.3 1013.25 hPa < QNH - more height gained

Temperature Difference from ISA at Cruising Pressure Level

The standard temperature for an aircraft flying at FL85, for example, is - 2°C. If the Corrected Outside Air Temperature (COAT) is -15°C the aircraft is flying in air colder and denser than standard; as pressure decreases more rapidly in a column of colder air the altimeter will over read. Conversely, when the COAT is warmer than standard the air is less dense and the altimeter will under read. Therefore when 1013.25 hPa is set:

LOWER COAT - altimeter OVER READS
HIGHER COAT - altimeter UNDER READS

The "**ALTITUDE**" window on the reverse of the CRP5 is used to correct for the difference in temperatures. Using the CRP5:

Set **FLIGHT LEVEL (85)** against **COAT (-15°C)** in the "**ALTITUDE**" window; read off **TRUE ALTITUDE (8100)** in feet on the **OUTER SCALE** against **FLIGHT LEVEL (85)** on the **INNER SCALE.** Thus the altimeter is **over reading by 400 ft.**

If FL85 had been chosen to provide a 1000 ft clearance above an obstacle at 7500 ft AMSL within the stated limits on the aircraft's planned sector, then the actual clearance would be 600 ft. A safer level to accord with ICAO VFR Semi-circular Cruise Levels would thus be FL105.

Consider an aircraft flying at FL75 (ISA 0°C), with a COAT of +16°C:

Set **FLIGHT LEVEL (75)** against **COAT (+16°C)** in the "**ALTITUDE**" window; read off **TRUE ALTITUDE (7925)** in feet on the **OUTER SCALE** against **FLIGHT LEVEL (75)** on the **INNER SCALE**. The altimeter will **under read by 425 ft:**

In this instance FL75 was chosen to provide a clearance of 1000 ft above an obstacle of 6500 ft AMSL. The actual clearance is thus 1425 ft.

Hence remember the adage in relation to temperature (and pressure):

"High to low mind how you go"

Example 9

An aircraft is airborne from an airfield, elevation 800 ft, on a track of 090°(M); QNH 996 hPa.

a. What VFR Flight Level must the aircraft maintain in order to clear an obstacle, 4400 ft AMSL, by 1000 ft?

b. What height is climbed to this Flight Level?

Answers can be found on page 141

Exercise 1

With reference to the **VFR + GPS Chart GERMANY EDITION 1999 ED - 6** and VFR flight answer the following:

1. **What type of airfield is at N4728 E00833.**

2. **Reference N4811 E01052. What is the significance of:**

   a. ET in the Location Indicator ETSL?
   b. 141.25 and 2442 m?

3. **What type of airfield is at N4727 E00814?**

4. **What does the symbol at N4755 E01055 mean?**

5. **What does (v) after 125.700 at N4858 E00820 signify?**

6. **Flight from A, N4823 E00839 to B, N4803 E00922;**

   a. What is the track direction (°T) and distance in nautical miles/kilometres?

   b. What is the highest terrain/obstacle within the area extending 5 NM either side of the track and 5 NM radii, centred on and beyond, A and B?

c. **What would be the correct flight level to clear this terrain/obstacle by a minimum of 1000 ft?**

   d. Fully describe the navigational facilities at A and B.

   e. What does the symbol 10.5 NM, on track, from A signify?

   f. What is the highest Minimum Grid Area Altitude (Grid MORA) on this route?

   g. What are the STUTTGART INFORMATION (FIS) and ATIS frequencies?

7. **What are the Airspace Designator and Control Frequency for Munchen?**

8. **Decode the three symbols in the vicinity of N4733 E01018.**

Answers can be found on page 141

Exercise 2 - Flight Log

EXERCISE 2

FROM	TO	GRID MORA	FL	W/V	TRK (T)	VAR	HDG (M)	TAS	GS	DIST	TIME	ETA
										Set Heading:		10:30
VILSHOFEN EDMV	REGENSBURG EDNR			090/20				100				
REGENSBURG EDNR	NORDLINGEN EDNO			120/30				110				
NORDLINGEN EDNO	MENGEN EDTM			270/30				120				
										0	0	

VFR Exercise 2

Complete the flight log on page 138 (opposite), then answer questions 1 to 12.

NB. If you have not yet done Heading and Ground speed on the navigation computer then you cannot completely finish the log and answer questions 1 & 7.

An aircraft is due to depart Vilshofen at 10:30 then fly the following route:

Vilshofen to Regensburg

Regensburg to Nordlingen

Nordlingen to Mengen

1. **What is your ETA at Mengen?**

   a. 01:38
   b. 12:08
   c. 11:28
   d. 10:58

2. **What type of airport is Vilshofen?**

   a. Military airport with a hard runway.
   b. Civil airport with a grass runway.
   c. Civil airport with a hard runway.
   d. Military airport with grass runway.

3. **What type of navaid is Roding? (N4902 E01232)**

   a. A VOR on 114.70 kHz.
   b. An NDB on 114.70 kHz.
   c. A DME on 114.70 MHz.
   d. A VORTAC on 114.70 MHz.

4. **What does the (v) indicate in the description of Straubing (Wallmuhle) airport? (N4854 E01231)**

   a. VFR flights only permitted.
   b. Very High Frequency direction finding (VDF) available.
   c. Open 24 hours.
   d. Very high landing fees charged for IFR flights.

5. **While flying at FL45 between Regensburg and Nordlingen does ED(R)-140 affect your route?**

   a. No – its vertical limits are from FL60 to FL100.
   b. No – its vertical limits are from 6000 ft AGL to FL100.
   c. Yes – as the restricted area base can come down to the surface.
   d. Yes – but a clearance through can be obtained from Neuburg airbase.

6. **What is the airport elevation and runway length of Nordlingen?**

a.	500 metres	1384 feet
b.	1385 metres	500 feet
c.	13307 feet	500 metres
d.	1384 feet	500 metres

7. **When flying between Nordlingen and Mengen; what is your drift?**

a. 10° port.
b. 7° port.
c. 7° starboard.
d. 10° starboard.

8. **You select Gerstetten (N4837 E01003) airfield as an en route alternate; what type of airfield is it?**

a. Civil with hard runway.
b. Civil with grass runway.
c. Glider side.
d. Military with hard runway.

9. **What is the Augsburg ATIS frequency?**

a. 126.95 MHz.
b. 124.97 MHz.
c. 115.90 MHz.
d. 124.57 MHz.

10. **While flying towards Mengen and established on track; what is your QTE?**

a. 223°(M).
b. 043°(M).
c. 043°(T).
d. It is not possible to receive a QTE.

11. **Name all the radio navigation aids you could use at Mengen?**

a. VDF and an NDB on 401 kHz.
b. VDF and an NDB on 401 MHz.
c. Only an NDB on 401 kHz.
d. There are no radio navigation aids serving Mengen.

12. **With a surface wind of 300°/30 kt; which airfield would be a better destination alternate, assuming runway length is not restrictive?**

a. Friedrichshafen.
b. Pfullendorf.
c. Saulgau.
d. Albstadt.

Answers can be found on page 143

Answers

Example 1 a. N4823.6 E01148.8
b. N4715.6 E01120.6, LOWI.
c. VHF Omni-range (VOR)/Distance Measuring Equipment (DME), 117.15 MHz, MBG; magnetic variation 1°E.

Example 2 071°(M), 58.5 NM, 108.5 km.

Example 3 Civil airport with hard runway; ICAO designator EDMA; elevation 1515 ft; longest runway 1280 m; Tower frequency 124.97 MHz; VDF available.

Example 4 Compulsory VFR reporting point; N4323. 6 E01104.0; 312 radial 12 NM from MAH VOR, frequency 108.4 MHz.

Example 5 Ingolstadt TACAN (Tactical Air Navigation), VHF paired frequency 111.40 MHz, call sign IGL. Ingolstadt NDB (Non-Directional Beacon), frequency 345 kHz, call sign IGL.

Example 6 VOR (VHF Omni-range) beacon, frequency 116.10 MHz, call sign SUL.

Example 7 A Control Zone, Class D airspace. from ground level to 7000 ft AMSL.

Example 8 ATIS 125.72 MHz; WX 113.80 MHz from SBG VOR.

Example 9 a) FL75. b) 6184 ft.

Exercise 1 Answers

1. International Airport.

2. a. ET = German military airfield.
   b. 141.25 MHz is the available communication frequency, VDF not available; 2442 m is the longest runway available.

3. Civil Airport with hard runway.

4. Hang-glider site.

5. Means VDF available on that frequency.

6. a. 124°(T), 35 NM/65 km
   b. lit obstacle 3760 ft AMSL.
   c. FL55.
   d. At A: Very high Frequency Omni-range (VOR), 116.10 MHz, call sign SUL. At B:Non-directional Beacon(NDB), 401 kHz, call sign MEG.
   e. Civil Heliport.
   f. 4800 ft.
   g. 128.95 and 126.12 MHz.

7. C; Radar 131.22 MHz.

8. Glider site; cableway; man-made lit obstruction, 5866 ft AMSL.

Exercise 2 Flight Log Answers

FROM	TO	GRID MORA	FL	W/V	TRK (T)	VAR	HDG (M)	TAS	GS	DIST	TIME	ETA
EXERCISE 2 ANSWERS										Set Heading:		10:30
VILSHOFEN EDMV	REGENSBURG EDNR	7200	85	090/20	305	1 E	311	100	116	54	28	10:58
REGENSBURG EDNR	NORDLINGEN EDNO	3700	45	120/30	255	1 E	243	110	129	65	30	11:28
NORDLINGEN EDNO	MENGEN EDTM	4600	65	270/30	223	0 E	233	120	99	67	40	12:08
										186	98	

VFR Exercise 2 Answers

1	2	3	4	5	6	7	8	9	10	11	12
b	c	d	b	a	d	a	b	d	c	a	c

9 Answers

Chapter

10

Airways

Introduction

To prepare for the examination students will need Jeppesen's "Student Pilot Route Manual for Part-Flight Crew Licensing", or an equivalent approved publication; the selected Jeppesen charts are **NOT current** and are **NOT to be used for navigation**. The manual contains more charts than are usually required for the examinations.

For the examination students will, for example, be expected to:

- Select routes, and decode and explain the meaning of the symbols, from en route, area, departure arrival and airfield charts.
- Extract, from the above charts, tracks, distances, heights/altitudes, magnetic variation, and frequencies/call signs of navigation facilities etc.
- Compute heading, ground speed and elapsed time.
- Select the correct flight level(s) for track direction(s) and obstacle clearance.
- Complete a part of a Navigation Plan/Navigation Log.
- Identify airspace classifications and restricted areas.
- Extract Instrument Approach Minima at destination and alternate aerodromes.

You will provide the manual for the examinations; thus, during the examination you may use the legend. However, because the allotted time for answering the questions is limited, **you must be familiar with the ABBREVIATIONS, CHART GLOSSARY and the most commonly used symbols from the CHART LEGENDS, all of which are included in the INTRODUCTION to the manual.**

Jeppesen Manual (JM) - Chart Glossary

The glossary provides:

Unique **ICAO definitions** commonly used in Jeppesen publications; FAA (USA) terms are included when different from ICAO. It is recommended that these definitions, particularly the ICAO ones, are carefully studied and committed to memory. The following ICAO definitions should be noted:

AERODROME ELEVATION. The elevation of the highest point of the landing area.

ALTITUDE. The vertical distance of a level, point or an object considered as a point, measured from mean sea level.

DECISION ALTITUDE (DA) or DECISION HEIGHT (DH). A specified altitude or height in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. DA is referenced to mean sea level; DH is referenced to the threshold elevation.

ELEVATION. The vertical distance of a point or a level, on or affixed to the surface of the earth, measured from mean sea level.

FLIGHT LEVEL (FL). A surface of constant atmospheric pressure which is related to a specific pressure datum 1013.2 hPa, and is separated from other such surfaces by specific pressure levels.

HEIGHT. The vertical distance of a level, a point or an object considered as a point, measured from a specified datum.

MINIMUM DESCENT ALTITUDE/HEIGHT. A specified altitude/height in a **non-precision approach** or circling approach below which descent may not be made without visual reference,

THRESHOLD. The beginning of that portion of the runway usable for landing

TRANSITION ALTITUDE. The altitude at or below which the vertical position of the aircraft is controlled by reference to altitudes.

TRANSITION LAYER. The airspace between the transition altitude and the transition level.

TRANSITION LEVEL. The lowest flight level available for use above the transition altitude.

The glossary also provides **Abbreviations** which relate to the information included in the manual's charts and aviation in general. Continuous reference to the abbreviations, in conjunction with the various charts and enclosed examples and exercises, will facilitate the retention of their meanings in the student's memory. Note the following ICAO abbreviations:

QFE. The atmospheric pressure at aerodrome elevation, or at runway threshold.

QNH. The altimeter subscale reading to obtain elevation when on the ground (Ref. ICAO Doc 8168-OPS/611 Vol. 1, 5th Edition 2006, Chapter 1)

QNE is the height indicated on landing at an aerodrome when the altimeter subscale is set to 1013.2 hPa.

(Ref. Handbook of Aviation Meteorology 3rd Edition, 1994, HMSO)

"When 1013.2 hPa is set on the subscale the height indicated on the pressure altimeter with the aircraft on the ground is known as the QNE value. This setting is used for some high level aerodromes where the QFE would be so low as to be outside the limits of the subscale setting. (**The setting of 1013.2 hPa is sometimes referred to, incorrectly, as the QNE**)." (Ref. CAP 390 ATC Training Manual section 2-Meteorology).

The Jeppesen definition of **QNE** is: Altimeter setting 29.92"Hg or 1013.2 hPa.

JM - En Route Chart Legend

The legend is for use in conjunction with the enclosed charts, the majority of which use the **Lambert Conformal Conic projection** and are designed primarily for airway instrument navigation using cockpit instruments, radio communications and ground based radio navigation aids. It should be noted that **not all symbols apply in all areas** and that symbols in green are printed in green on two-colour charts; all symbols are blue on single-colour charts. Detailed examples and exercises based upon the legend and various charts are provided later in this chapter. A general discussion follows on the legend which is divided into the following classifications.

Navaid Symbols

Note the symbols for:

VOR (Very High Frequency Omni-directional Range).

Terminal VOR.

TACAN (Tactical Air Navigation) or **DME** (Distance Measuring Equipment).

VORTAC/VORDME.

NDB (Low and Medium Frequency Non-directional Beacon).

ILS (Instrument Landing System). **KRM course** is a Russian localizer equivalent.

MLS (Micro-wave Landing System).

Fan Markers.

Broadcast Stations.

Navaid Identification

The shadow box is used when the navaid is associated with an airway or route. Off-airway navaids are un-boxed except that off-airway VORs are boxed on other than US and Canadian charts.

Communications

Radio frequencies for communication are printed above the Navaid name to indicate that voice communication is available through the navaid. Radio frequencies in the 120 MHz range are shown with the numbers "12" omitted, e.g. 122.2 and 122.35 are shown as 2.2 and 2.35.

Navaid/Communications Data

This section shows how a navaid's operational status is depicted; the availability of a **TWEB** (continuous weather broadcast); an **SABH** radio beacons' primary function is to transmit continuous automatic weather information; **R** = En route radar available; **H + 04 & 15 (1)** means that a Marine NDB begins transmission at four minutes passed the hour and at 15 minute intervals thereafter and each transmission lasts for 1 minute.

Restricted Airspace/Restricted Airspace Designation
A knowledge of the symbols and abbreviations for the various types of restricted airspace is essential.

Airports
Memorize the symbols for civil and military airfields.

Airway and Routes and Centrelines
A knowledge of the meaning of these symbols is required. In particular note the depiction of:

Airways.

Types of reporting points.

LF bearings (to the navaid) and radials (from the navaid).

Holding patterns.

Airway Information
Note: in particular, the different designations of airways and routes and minimum clearance limits. For example:

V168. Victor (VOR airway) routes/airways are found on US and Canadian Low Level charts, which are effective up to, but not including, 18 000 ft MSL.

J71. Jet routes/airways are for high performance aircraft. They are effective at and above 18 000 ft MSL to FL450 in the US and at and above 18 000 ft MSL to unlimited in Canada.

A1. European countries use the phonetic alphabet.

Minimum En route IFR Altitude (MEA)
The lowest published altitude between radio fixes that meets obstacle clearance requirements between those fixes and in many countries assures acceptable navigational signal coverage. The MEA applies to the entire width of the airway, segment or route between the radio fixes defining the airway, segment or route.

Minimum Obstruction Clearance Altitude (MOCA)
The lowest published altitude in effect between radio fixes on VOR airways (i.e. below 18 000 MSL), off-airway routes or route segments which meet obstacle clearance requirements for the entire route segment and in the USA assures acceptable navigational signal coverage only within 22 NM of a VOR.

Minimum Off-route Altitude (MORA)
This is an altitude derived by Jeppesen. The MORA provides known obstacle clearance within 10 NM of the route centre line.

Maximum Authorized Altitude (MAA)
A published altitude representing the maximum usable altitude or flight level for an airspace structure or route segment.

E means that **even altitudes/flight levels**, in thousands of feet, are used in the arrow's direction and **odd altitudes/flight levels** in the opposite; contrary to ICAO Semi-circular rules.

O means that **odd altitudes/flight levels**, in thousands of feet, are used in the arrow's direction. It is used only on one-way airways.

E and **O** indicates that all altitudes, even and odd, are available in the indicated direction.
PPR means that Prior Permission is Required from ATC for flight in the arrow's direction.

Airway Navaid/Reporting Point Bypass
The symbols depicting the bypassing of a navaid or reporting point should be noted.

Boundaries
Students need to be familiar with the boundary symbols.

Controlled Airspace & ICAO Airspace Classifications
Reference to the symbols in conjunction with the exercises in this chapter will enable the student to become familiar with the symbols for the above.

ICAO Airspace Classification is designated by the letters A to G:

Class A: IFR flights only are permitted; all flights are subject to ATC service and are separated from each other.

Class B: IFR and VFR flights are permitted; all flights are subject to ATC service and are separated from each other.

Class C: IFR and VFR flights are permitted and all flights are subject to ATC service and IFR flights are separated from other IFR flights and from VFR flights.

Class D: IFR and VFR flights are permitted and all flights are subject to ATC service; IFR flights are separated from other IFR flights and receive traffic information in respect of VFR flights; VFR flights receive traffic information in respect to all other flights.

Class E: IFR and VFR flights are permitted; IFR flights are subject to ATC service and are separated from other IFR flights. All flights receive traffic information as far as is practicable.

Class F: IFR and VFR flights are permitted; all participating IFR flights receive an air traffic advisory service and all flights receive flight information service if requested.

Class G: IFR and VFR flights are permitted and receive flight information service if requested.

Note the depiction, with airspace classification, of **Terminal Control Area (TMA), Control Area (CTA) and Control Zone (CTR)**.

Orientation/Border Information & Miscellaneous

The location of airfields, navaids and reporting points, etcetera, on the charts can be readily plotted by reference to the latitude and longitude grid.

The isogonals are indicated at the edge of a chart or extended fully across the chart in a continuous dashed line.

Shorelines and large inland lakes are shown. The Border and Miscellaneous information should be noted.

The Grid Minimum Off-route Altitude (Grid MORA) values clear all terrain and man-made structures by 1000 ft in areas where the highest elevations are 5000 ft AMSL or lower. MORA values clear all terrain and man-made structures by 2000 ft in areas where the highest elevations are 5001 ft amsl or higher. When a Grid MORA is shown as "Unsurveyed " it is due to incomplete or insufficient information. Grid MORA values followed by +/- denote doubtful accuracy, but are believed to provide sufficient reference point clearance.

High Altitude Chart Legend

This legend's symbols are additional and are applicable to the High Altitude Charts; preceding legend symbols also apply to the charts.

Area Charts

This legend is applicable to Area Charts and is additional to the preceding legends. Students must familiarize themselves with the Area Chart symbols as questions will be posed on them in the examination. Note the symbols for:

Departure and arrival routes.

Speed Limit Point.

Man-made structures.

Depiction of communication frequencies.

Area Charts - Generalized Terrain Contours

Terrain information may be depicted on area charts when terrain within the area chart coverage rises more than 4000 ft above the main airport; see Madrid Area Chart. The absence of terrain contours does not imply the absence of terrain or structures. The contour information does not assure clearance above or around terrain or man-made structures. There may be higher uncharted terrain or man-made structures within the vicinity. Terrain information is useful for visual orientation and general visualization of terrain. It does not replace the minimum altitudes dictated by the airway and air route structure.

JM - SID and STAR Legend

As the examination will include questions on selected Standard Instrument and Standard Terminal Arrival charts the student must have a thorough knowledge of this legend.

The charts provide a **graphical** (i.e. not to scale) **illustration of the governing authority's prescribed procedures.**

JM - Approach Chart Legend

As with the SIDs and STARs questions will be set in the examination on selected Approach Charts. Students are advised to become as conversant as possible with the layout and content of this comprehensive legend. The subdivisions of this legend, which are a potential source of examination questions, are:

- Landing Minimums.
- Airport Chart Format and Plan View.
- Additional Runway Information.
- Lighting Systems.
- Take-off and Alternate Minimums.
- GPS Approach Charts
- ICAO recommended airport signs and runway markings.

Air Traffic Services (ATS) Routes/Standard Routes
(Ref: Current UK AIP ENR 1 and ENR 3)

In the United Kingdom ATS Routes are based upon significant geographical points which may or may not coincide with the location of a radio navigation aid. These significant points can be found in column 1 of the table at ENR 3.

Unless stated otherwise **an airway is 5 NM either side of a straight line** joining each two consecutive points shown in column 1 of the table. **Upper ATS routes** and **Advisory Routes** have no declared width but **for the purposes of ATS provision are deemed to be 5 NM either side of a straight line** joining each two consecutive points. The vertical extent is shown in column 3 of the table.

ENR 3 is divided into:

- **LOWER ATS ROUTES** which have an upper limit of FL245.
  Ref. E(LO)1: See B1 ATS route, 279 and 085 radials from WAL VOR/DME at N5323.5 W00308.0.

- **LOWER ATS ROUTES - (ATS ADVISORY ROUTES).** These have a maximum upper limit of FL240. The route designator for an Advisory Route always ends with **D**, e.g. **A1D, N562D**.
  Ref. E(LO)1: See W911D Advisory Route, 242 and 058 radials from IOM VOR/DME N5404.0 W00445.7

Note: Advisory Routes, class F airspace, are thus not established within Controlled Airspace and are designated routes along which ***Air Traffic Advisory Service*** *is available. An Air Traffic Advisory Service is a service provided within advisory airspace to ensure separation, in so far as is practical, between aircraft which are operating on IFR flight plans.*

Controlled Airspace is airspace of defined dimensions within which **Air Traffic Control Service** is provided to IFR and VFR flights in accordance with the airspace classification A, B, C, D and E. Thus an **Air Traffic Control Service** provides the much more complete service of:

- Preventing collisions between aircraft.
- Preventing collisions on the manoeuvring area between aircraft and obstructions.
- Expediting and maintaining an orderly flow of air traffic.

- **LOWER ATS ROUTES - (CONDITIONAL ROUTES (CDR)).**
  These routes are usable only under specified conditions. (See ENR 1.1.1.1 para 1.5 and ENR 3.2.2.1)

- **UPPER ATS ROUTES** from FL245 to FL460. The route designator is always preceded by U, e.g. UA1, UB40.
  Ref. E(HI)4: See UG1 Upper ATS route, 295 and 111 radials from STU VOR/DME N5159.7 W00502.3.

- **UPPER ATS ROUTES - (CONDITIONAL ROUTES (CDR))**

Example 1 (STAR)

Answer the following questions with reference to London Heathrow STAR 10-2E and the appropriate legend(s):

a. Decode *ATIS.

b. What is the Transition Level and Altitude? Define both terms and transition layer.

c. With reference to the **OCKHAM ONE DELTA (OCK 1D)** procedure: What is the descent planning clearance?

d. Explain the significance of the symbol ➊

e. State the holding speeds in the London TMA.

f. What is the elevation of the airfield?

g. Decode the triangular symbol at ***KENET***.

h. Define the geographical position of ***KENET*** in relation to the **LON** and **OCK VOR/DME** beacons

i. Decode ***SLP***.

j. Explain the symbols defined by the 275 radial (R275°) at 12 NM from the **OCK** VOR.

k. State the speed limiting procedures for this STAR.

l. What is the planned possible descent clearance for the **OCK 1F** procedure?

m. At what distance would this planned descent start from the OCK VOR/DME?

n. With reference to the HONILEY VOR/DME:

   i. State its callsign.

   ii. State its frequency.

   iii. What does "**D**" mean?

o. Detail the meaning of, and the flight procedure for, the oval pattern located at the OCK VOR.

Answers are on page 170

Example 2 (Approach Chart)

Answer the following with reference to the appropriate legend(s) and London Heathrow Approach Chart ILS DME Rwy 27L, 11-3.

Plan View

a. With reference to the top left-hand box decode:

- "HEATHROW Director (APP) (R) 119.72".
- Alt Set: hPa. Rwy Elev: 3 hPa.
- Trans alt. 6000' (5923').

b.
- Define MSA.
- What is the MSA to the East of the airfield?

c. Decode ➊

d. Decode LOC * 109.5 ILL.

e. Decode the information at BOVINGDON.

f. Describe the MISSED APPROACH HOLDING south of BNN VOR/DME.

g. State the difference between the **route** delineated by the 137 radial from the BNN VOR and its **arrowhead** at 19 NM from the BNN DME and the **route** and **arrowhead** delineated by the 096 radial from LON VOR/DME.

h. What is the inbound track of the ILS localiser beam?

i. Where can the details of the danger area EG (D) - 133 be found? Decode the details.

Profile View and Landing Minimums

j. What is the elevation of the threshold of runway 27L?

k. What are the recommended height and altitude at 4 NM from the ILL ILS DME when the ILS glide slope is unserviceable?

l. Decode: OCA (H) RWY 27L. ILS D: 264' (187').

m. Decode TCH 56'.

n. Explain the meaning of the propeller symbol.

o. Decode GS **1405'** (1328').

p. What does - - - - - **M** - ↗ and ↗ signify?

q. Quote the DA/H for the ILS precision approach and the MDA/H for the localizer only (glide slope out) non-precision approach.

r. What is the missed approach procedure?

s. Define:

Non-precision approach and landing operations.

MDA/H.

Precision approach and landing operations.

DA/H.

Missed approach Point. Missed approach procedure. RVR.

t. Decode: ALS out; TDZ or CL out.

u. An aircraft has a ground speed of 150 kt during the descent on the ILS glide path. What is the glide path angle and the required rate of descent?

v. Describe the Missed Approach Point (MAP).

w. What is the visibility and authorized UK RVR for a C Category aircraft when the touchdown lights are out of service?

x. Define visibility.

Answers are on page 171

Example 3 (SID)

Answer the following with reference to the appropriate legend(s) and London Heathrow SID 10-3.

a. State the transition codes for runways 27R, 27L and 23.

b. What is the procedure after the 2 DME arc on the **BROOKMANS PARK SIX HOTEL DEPARTURE?**

c. With reference to the **BPK 6H** what does the symbol at N5130.1 W00037.4 signify and what are the direct and curved path ground distances to it?

d. State the frequency of BUR NDB.

e. Quote the altitudes required:

    i. Crossing the 302 radial.

    ii. Crossing the 320 radial.

    iii. At the BPK VOR

f. An aircraft, cleared for the **BPK 6F** procedure, is airborne at 0613 UTC. What is its ETA at BPK if its average ground speed is planned to be 240 kt? (use mental arithmetic).

g. State the SPEED CONTROL PROCEDURE.

h. What is the routing at D6 LON?

i. What is the minimum crossing height at the appropriate Noise Monitoring Terminal?

j. State the climb procedures thereafter.

k. If an aircraft's ground speed is 240 kt what is its minimum rate of climb to comply with the noise abatement criteria?

l. What is the Minimum Sector Altitude for the BPK 6G departure to the CHT NDB, and what obstacle clearance does it provide?

m. What are the Transition Level and Transition Altitude?

n. State the departure control frequency.

o. What is the radius, and centre, of the Minimum Safe Altitude circle?

Answers are on page 173

Area, Low and High Level Charts

Before attempting the exercises students should study the following example Jeppesen charts together with the relevant legends:

a. LONDON, UK and PARIS, FRANCE AREA.

b. E(LO)2.

c. E(HI)4.

Airways Exercise 1 (LOG)

FROM	TO	AWY/ SID/STAR	FL	VRN.	W/V (MAG)	TR. (MAG)	TR. (TRUE)	HDG. (MAG)	TAS	WC	GS	DIST	EET	ETA
EGLL	D12 LON		↗									14	6	
	MID (TOC)		↗								340			
MID (TOC)			250											
			250											
	UIR BDY		250											
			250											
	SOKMA		ATC										6	
	MERUE(TOD)		ATC								300			
MERUE(TOD)	LFPG		ATC									40	12	
										TOTALS				

Exercise 1

Using the appropriate JM Legends, Jeppesen itemized charts and the following information complete the enclosed Airways Flight Plan.

Charts:

SID	London Heathrow MIDHURST DEPARTURES
AREA	LONDON - UK and PARIS - FRANCE
EN ROUTE	E(HI)4
STAR	PARIS, FRANCE, Charles de Gaulle

Route:

LONDON HEATHROW (EGLL) N5129 W0028 to PARIS CDG (LFPG) N4901 E0233

Depart EGLL using SID MID 3G to MID VOR/DME; aircraft is airborne at 0623UTC

ATS route to BOGNA (N5042.1 W00015.0). N.B. this position on the E(HI)4 chart is called WOR. From BOGNA to HARDY (N5028.3 E00029.5) and then to DPE (N4955.6 E00111.3)

Arrival via STAR DPE 1E, 1W to Paris CDG

Met. Winds:

FL250	MID to HARDY	300/85
	HARDY to DPE	300/60
TAS	FL250	390 kt

Refer to the relevant JM Charts/Legends and answer the following:

Reference LONDON, UK HEATHROW SID, MIDHURST DEPARTURES.

1. Itemize the speed control procedure.

2. State the noise abatement procedure.

3. If an aircraft's ground speed is 175 kt what rate of climb must it maintain to fulfil the noise abatement requirements?

4. State the altitude requirements at: D8 LON, D12 LON, D17 LON and MID VOR/DME.

5. When may these altitude requirements be exceeded?

Reference LONDON, UK AREA chart:

6. What is the significance of the green ➊ at N5135 W00114?

7. State the name and dimensions of the above area.

8. What is the significance of the green ➌ which is 2 NM to the SE of the symbol at f)?

9. For London Heathrow what are the communication frequencies for:

   i. Radar

   ii. Tower

   iii. Ground

   iv. ATIS

   What does Cpt mean? What does the * mean?

10. With reference to the green and blue symbols ➌ in the region N52 W01 what:

    i. Are the navigation facilities available?

    ii. Is the holding pattern at Daventry VOR for eastbound aircraft?

    iii. Is the alternate procedure when Daventry VOR is unserviceable?

11. What does the symbol at N5107 W0026 mean?

12. Describe the alternate holding pattern for BIG N5119.8 E00002.2.

13. Decode fully **CTR A** at N5130 W0030.

With Reference ATS route A37, 058 radial from DET VOR (N5118.2 E00035.9)

14. What is this airway used for normally?

15. Decode **FL90 1900a**.

16. Decode **19** to the south of DET VOR/DME.

17. What is the next reporting point, eastbound, after TOBIX? State its lat/long.

Reference E(HI)4:

18. What is the chart's scale and above what flight level is the chart designed for?

19. What are the upper and lower limits of UK and French Upper Airspace?

20. What is the upper limit of UK and French high altitude airways?

21. If an aircraft is tracking 359°(M) with a heading of 010°(M), what is its lowest available FL in UK Upper Airspace?

22. Itemize the radio communication frequencies on UA47 from the UIR boundary to SOKMU at FL250, and the Upper Air Control Centre in which the aircraft is operating.

23. What is the magnetic variation WORTHING to HARDY?

24. Describe the symbols at N4955.6 E00110.3.

25. What does the blue symbol 1 indicate at N5013 W00141?

Reference PARIS, FRANCE AREA CHART:

26. What is its scale?

27. What is the Approach Radar frequency for an aircraft descending from FL190 to FL110?

28. Overhead ABB VOR what is the decode for the SECTOR TNI box to the northeast?

29. What is the magnetic variation on this chart?

30. What is the distance and magnetic track between N4901.9 E00113.3 and N4933.2 E00229.4?

31. What is the highest Grid MORA?

32. Decode the blue symbol 1.

Reference PARIS, FRANCE CHARLES DE GAULLE STAR:

33. State the ATIS frequency, Transition Altitude and Level.

34. Describe the ALTERNATE HIGH holding pattern at DPE.

35. List all the arrivals for propeller driven aircraft.

36. An aircraft is fitted with a twin-needle Radio Magnetic Indicator (RMI) and DME. How does it fix its position at MERUE?

37. Decode the symbology at SOKMU.

Reference PARIS CHARLES DE GAULLE VOR/DME RWY 27 page 23-1 JEPPESEN APPROACH CHARTS:

38. What are the descent instructions just prior to crossing CRL VOR/DME?

39. What are the instructions at the intersection of the CRL 119 radial at 18 NM DME, and the CGN VOR 072 radial?

40. State the crossing heights at the RSY locator and the distance to the threshold.

41. In the event of an overshoot what are the height instructions to hold at MERUE?

42. State the MDA(H) for a straight in approach and define MDA(H).

Miscellaneous:

43. What are the INS co-ordinates for STAND No. A9?

44. What are the lengths in metres and feet of the two runways at Paris Charles de Gaulle?

45. Are Simultaneous Parallel Departure Procedures allowed at Paris CDG? If so what are the regulations?

Answers on page 176

Airways Exercise 2 (LOG)

FROM	TO	AWY/ SID/STAR	FL	VRN.	W/V (MAG)	TR. (MAG)	TR. (TRUE)	HDG. (MAG)	TAS	WC	GS	DIST	EET	ETA
LFPG	D18 BT	SID	↗								185	18.5		
	TOC		↗								360	36		
TOC	ABB	AWY	240											
	NASDA													
NASDA	CLIFF													
	TIGER(TOD)													
TIGER (TOD)	D12 BIG		↘									10	3	
	BIG		↘									12	4	
BIG	EGLL		↘									30.5	12	
										TOTALS				

Exercise 2

Refer to the appropriate JM legends, listed charts and the following information and complete the enclosed Airways Plan.

Charts:

SID	Paris, France, Charles de Gaulle ABBEVILLE DEPARTURES.
AREA	PARIS, FRANCE and LONDON, UK.
EN ROUTE	E(LO)2.
STAR	LONDON, UK Heathrow.

Route:

PARIS CHARLES DE GAULLE (LFPG) N4901 E0233 to LONDON HEATHROW (EGLL) N5129 W0028. The aircraft is airborne at 0823UTC

Depart LFPG using SID ABB 8A/D to ABB VOR/DME.

ATS route A20 from ABB to CLIFF

Arrival via BIGGIN STAR

Met winds:

FL240	TOC to TIGER	300/70
TAS	FL240	450 kt

General questions charts E(LO)1 and 2:

1. What are their scales?

2. On a proposed flight Manchester to Naples which E(LO) charts are required?

3. State the limits and classifications of designated airspace for the UK and France.

4. In relation to UTC quote the normal summertime hours for Belgium.

5. It is 2040 UTC 30/3/97. What is the LMT beyond E40?

6. In relation to COMMUNICATION decode the following:

G	*****
X	**R**
C	**Cpt**

7. State the common emergency VHF frequency.

8. With reference to Brize Norton:

    a. What is its ICAO location indicator?

    b. What is its panel location (“zigdex”) for E(LO)1 and 2?

    c. Decode its communication facilities.

9. What do the shaded areas on the chart coverage panel signify?

10. SSB means?

11. An aircraft is overhead N5105.2 W00408.6 maintaining a track of 185°(M) with a heading of 180°(M). Should it be flying:

    a. An ODD level?
    b. An EVEN level?
    c. An ODD + 500 ft level?
    d. An EVEN + 500 ft level?

12. Where are details on E(LO)2 of:

    a. High Intensity Radio Transmissions to be found?
    b. Areas of Intense Air Activity to be found?

13. State the vertical limits for UK AERODROME TRAFFIC ZONES.

14. What are the UK ALTIMETER SETTING requirements?

15. In the UK what is the airspace classification of Airways and Advisory Routes?

16. Where are details of UK Military Air Traffic Zones (MATZ) published on E(LO)2?

17. Give the details for EG(D) - 014 at N5030 W0235.

18. Fully decode the symbols at N5044 W0325.

Reference Exercise 2 and chart E(LO)2:

19. At NASDA what IFR is the aircraft leaving and entering? (State their ICAO location indicators).

20. Decode all the airway symbols within a 7 NM radius of N5025 E0126, including the blue thickly dashed line. (Ignore Le Touquet).

21. Decode the semi-circle around CLIFF.

22. What is the highest Grid MORA from ABB VOR onwards? Define Grid MORA.

Reference London, UK Heathrow STAR:

23. Decode the symbols at D12 BIG.

24. State the "SPEED LIMIT PROCEDURES/ATC REQUIREMENTS".

25. Quote the "DESCENT PLANNING/ATC REQUIREMENTS" for the BIG 2A STAR.

26. Decode ④.

27. Which three radials fix CLIFF?

Reference Paris, France Charles de Gaulle SID Abbeville Departures:

28. What does the symbol at 5 NM on the BT VOR 331 radial signify?

29. State the SPEED CONTROL PROCEDURES.

30. With reference to RWY 27 departures, if the take-offs and landings at ORLY are westerly, is an ABB 8A or ABB 8D filed?

31. What is the INITIAL CLIMB OUT procedure and minimum gradient for an ABBEVILLE departure RWY 27?

32. At a ground speed of 230 kt what rate of climb is required in ft/min?

Miscellaneous: (refer to London Heathrow charts)

33. Where are the Noise Abatement Procedures to be found, and what are the day and night-time operational limits?

34. State the JAA MINIMUMS for LONDON HEATHROW for Runway 27L CAT2 ILS for an aircraft with an approach speed of 160 kt IAS.

35. What are the Missed Approach Radio Failure Procedures for EGLL for RWY 27L/R via the EPSOM NDB?

36. With reference to a Surveillance Radar Approach LONDON HEATHROW, page 18-1 JM

a. What is Heathrow Director Approach frequency?
b. What is Heathrow Radar frequency?
c. What are the Missed Approach Holding points and heights?
d. What are the published Heights Above Aerodrome (HAA) at 3 and 2 NM?
e. What is the minimum altitude/height at 4 NM?

Answers on page 180

Answers to Examples/Exercises

Example 1 (STAR)

a. * = Part-time operation; ATIS = Automatic Terminal Information Service.

b. The Transition Level is allocated by ATC; the Transition Altitude is 6000 ft. **Transition Level** is the lowest level available for use above the transition altitude. **Transition Altitude** is the altitude at or below which the vertical position of the aircraft is controlled by reference to altitudes. **Transition layer** is the airspace between the transition altitude and transition level.
(Ref. ICAO Doc 4444-RAC/501)

c. As directed by ATC.

d. For arrivals from the West and Northwest: When the OCK VOR or DME is unserviceable use EPSOM (EPM) 1A, 1D, 1F arrivals.

e. ❷ Holding speed in the London TMA up to and including FL140 is MAX IAS 220 kt. At FL150 and above standard ICAO holding speeds apply. I.e.

Above FL140 to 200 inclusive: 240 kt in normal conditions; 280 kt or Mach 0.8, whichever is less, in turbulent conditions.

Above FL200 to 340 inclusive: 265 kt in normal conditions; 280 kt or Mach 0.8, whichever is less, in turbulent conditions.

Above FL340: Mach 0.83 in all conditions.
(Ref. ICAO Doc 8168-OPS/611 Vol. 1, page 4-3)

f. 80’.

g. ***KENET*** is a non-compulsory airspace fix.

h. **LON**: VOR 277° radial; DME 37 NM. **OCK**: VOR 293° radial; DME 40 NM.

i. ***SLP*** = Speed Limiting Point.

j. X = non-compulsory airspace fix; the shaded square = Speed Limiting Point.

k. “Maintain MAX IAS 250 KT from position 3 min before holding facility or position (SLP) shown on chart”

l. Pilots should plan for a possible descent clearance as follows: **OCK 1F**: FL140 10 NM before Nigit Int (intersection).

m. 37 NM.

n. i. HON
ii. 113.65 MHz.
iii. DME capability is indicated by a small “D” preceding the VOR frequency.

o. Holding Pattern or Racetrack Pattern. Inbound to the OCK VOR on the 332° radial. Outbound from overhead the VOR onto a track of 152°(M) to a maximum range of 9 NM (D9) from the OCK DME. 7000 indicates the minimum holding altitude (MHA).

Example 2 (Approach Chart)

a. i) Heathrow Director, Approach Control Radar available, frequency 119.72MHz.

ii) The altimeter setting information is given in hectopascals (inches on request). The runway elevation of 3 Hpa (3 mb), which equals 90 ft roughly, is the barometric pressure equivalent for the QFE altimeter setting. This value is subtracted from the reported QNH setting to obtain QFE. The height reference datum will be the runway threshold elevation (Rwy), airport elevation (Apt) or the runway touchdown zone elevation (TDZ), as applicable.

iii) The transition altitude 6000’ based on QNH and 5923’ based on QFE; the difference, 77’, equates to the elevation of the runway touchdown point.

b. i) The Instrument Approach Chart Minimum Safe Altitude (MSA), supplied by the controlling authority, is the minimum safe altitude which provides up to 1000’ obstacle clearance within a 25 NM radius from the navigational facility upon which the MSA is predicted. If the radius is other than 25 NM it is stated. This altitude is for **emergency use only** and does not necessarily guarantee navaid reception. When the MSA is divided into sectors, with each sector a different altitude, the altitudes in these sectors are referred to as “minimum sector altitudes”

ii) 2300’.

c. 1: Advise ATC if unable to receive DME. Equivalent radar fix will be provided at 7.5 NM and 4 NM from the ILL ILS localizer.
LOC: Not available without the ILS DME.
Initial and intermediate approach valid up to 220 kt IAS. ILS DME reads zero at threshold of runway 27.

d. The ILS localizer frequency is 109.5 MHz; the ILS call sign is ILL and the * = part-time operation.

e. IAF = Initial Approach Fix based upon the BOVINGDON VOR/DME, frequency 113.75 MHz, call sign BNN. D = Distance Measuring Equipment available. When the BNN VOR/DME is unserviceable use the position at BOVVA which is defined by the 321 radial at 32 NM from the Biggin VOR/DME (see JM STAR 10-2A).

f. The Missed Approach Holding is based upon the CHILTERN Non-directional Beacon (NDB)/Locator, call sign CHT, frequency 277 kHz; race-track pattern inbound 293°(M) to the overhead then left turn outbound onto 113°(M).

g. The route from the BNN VOR/DME is an approach transition; the 096 radial and small arrowhead is a cross radial

h. 274°(M), its QDM.

i. Refer to the en route chart E(LO)2. It extends from the ground to 1400’ and operates from 0800-2359 local time and 1400 to 2200 local time when notammed.

j) 77’.

k. 1410’ QNH; 1333’ QFE; (77’ difference).

l. **D** = AIRCRAFT APPROACH CATEGORY and speed of 141/165 kt, which is $1.3V_{SO}$. The **Obstacle Clearance Altitude/Height (OCA/H)** are 264′, QNH and 187′, QFE. $\mathbf{V_{so}}$ = the stall speed or the minimum steady flight speed in the landing configuration.

OCA (H) is the lowest altitude or height above the elevation of the relevant runway threshold or aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria. For a precision approach procedure (i.e. ILS localizer and glide slope serviceable) **it is the lowest altitude or height** above the relevant runway threshold, **at which a missed approach must be initiated** to ensure compliance with the appropriate obstacle clearance criteria. (Ref. ICAO Doc 8168, 1993)

m. TCH 56′ = ILS glide slope threshold crossing height.

n. Final Approach Fix (FAF) 7.5 NM DME range from the runway threshold, 8.7 NM DME range from LON VOR/DME; 2500′ (2423′) is the minimum glide slope intercept altitude or height.

o. Glide slope altitude (1405′) and height (1328′) at 4 NM ILS ILL DME range from touchdown.

p. The **M** symbol and arrow signifies the **non-precision approach** (i.e. localizer only serviceable, no glide slope information) **Missed Approach Point (MAPt/MAP).** The arrow without the dashes means the applicable **Decision Altitude or Height (DA/H)** for the **precision approach ILS** procedure (localizer and glide slope serviceable).

q. The DA/H is 277′ (QNH)/200′(QFE); the MDA/H for the localizer only (glide slope out) approach is 490′ (QNH)/413′ (QFE).

r. The missed approach is: “Climb straight ahead to 3000′ (2923′) then as directed by ATC (Max IAS 185 kt). In the event of complete radio failure see 11-7.”

s. **Non-precision Approach and landing operations**. An instrument approach and landing which does not utilize electronic glide path guidance, i.e. localizer only ILS, VHF Omni-range (VOR), Non-directional Beacon (NDB), VOR/DME, etc., approaches.

Minimum Descent Altitude/Height (MDA/H). A specified altitude/height in a non-precision approach or a circling approach below which descent may not be made without visual reference.

Precision Approach and landing operations. An instrument approach and landing using precision azimuth and glide path guidance with minima as determined by the category of operation, i.e. ILS, MLS and Precision Approach Radar (PAR).

Decision Altitude/Height (DA/H) is a specified altitude or height in the **precision approach** at which a missed approach must be initiated if the required visual reference to continue the approach has not been established; DA is referenced to mean sea level (QNH) and DH to the threshold elevation (QFE). The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight-path.

Runway Visual Range (RVR) is the maximum distance a pilot 15 ft above the runway in the touchdown area can see marker boards by day or night when looking in the direction of take-off or landing. (ref. Meteorology book).

Missed Approach Point (MAPt). That point in an instrument approach procedure at or before which the prescribed missed approach procedure must be initiated to ensure minimum obstacle clearance.

Missed Approach Procedure. The procedure to be followed if the approach cannot be continued. (Ref. ICAO Doc 9365-AN/910, 2nd Ed., 1991)

t. ALS out = approach lights out of service; TDZ or CL out = Touchdown lights or centre line lights out of service.

u. 3°; 803 ft/min

v. The MAP or MAPt is at .5 NM from the ILL ILS DME, which is .5 NM from the threshold.

w. 800 m and 600 m.

x. Visibility is the ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and night. (ICAO Doc 4444-RAC 501 13th Ed., 1996).

Example 3 (SID)

a. **BPK 6F, BPK 6G and BPK 6H.**

b. After take-off from runway 23 fly straight ahead; at a range of 2 NM from the LON Distance Measuring Equipment (DME) turn right and intercept the 122°(M) bearing **from** the BUR Non-directional Beacon (NDB), i.e. the bearing of 302°(M) to the NDB.

c. X = a non-compulsory airspace fix; 6 NM direct from the LON DME. 7 NM along the curved track.

d. 421 kHz.

e. i) Above 3500 ft but not above 6000 ft.
ii) Above 4000 ft but not above 6000 ft.
iii) At 6000 ft.

f. Ground distance = 32 NM; at 4 NM/min ETA = 0613 + 8 min; Ans. 0621UTC.

g. Speed limit: 250 kt IAS below FL100 unless otherwise cleared by ATC.

h. At 6 NM from the LON DME turn right to intercept the 058°(M) track to the CHT NDB (i.e. 238°(M) bearing from the NDB). At CHT intercept the 248 radial from BPK VOR/DME to fly inbound to the beacon.

i. 1080 ft (QNH), 1000 ft (QFE).

j. Maintain a minimum climb gradient of 243 ft/NM (4%) to 4000 ft.

k. 972 ft/min.

l. 2100 ft; 1000 ft.

m. Transition Level is given by ATC; Transition Altitude is 6000 ft.

n. 118.82 MHz.

o. 25 NM radius, unless annotated otherwise, centred on the airport.

Answer Airways Exercise 1 (LOG)

FROM	TO	AWY/ SID/STAR	FL	VRN.	W/V (MAG)	TR. (MAG)	TR. (TRUE)	HDG. (MAG)	TAS	WC	GS	DIST	EET	ETA
EGLL	D12 LON	MID 3G	↗	4W								14	6	0629
D12 LON	MID (TOC)	MID 3G	↗	4W		202	197				340	16	3	0632
MID (TOC)	BOGNA	A1	250	4W	305/85	150	146	155	390	+73	463	25	3	0635
BOGNA	HARDY	ATS	250	4W	305/85	120	116	119	390	+83	473	32	4	0639
HARDY	UIR BDY	UA47	250	4W	305/60	146	142	149	390	+55	445	9	1	0640
UIR	DPE	UA47	250	4W	305/60	146	142	149	390	+55	445	33	4.5	0644.5
DPE	SOKMU	STAR	ATC	3W		167	164				370	37	6	0650.5
SOKMU	MERUE(TOD	DPE	ATC	3W		100	097				300	17	3.5	0654
MERUE(TOD)	LFPG	1W	ATC	3W								40	12	0706
											TOTALS	223	43	

Answers Exercise 1

1. Speed limit: 250 kt IAS below FL100 unless otherwise cleared by ATC.

2. Initial climb straight ahead to 580’ (500’ QFE). Cross appropriate Noise Monitoring Terminal at a minimum of 1080’ (1000’ QFE), thereafter maintain a minimum climb gradient of 243’/NM (4%) to 4000’.

3. 709 ft/min.

4. above 3000’, above 4000’, above 5000’, at 6000’.

5. Do not climb above the altitudes shown in the SIDs until specifically cleared by ATC to do so.

6. AREAS OF INTENSE AIR ACTIVITY (AIAA) not otherwise protected by regulated airspace, with an exceptionally high intensity of civil and/or military flights or where aircraft, singly or in combination with others, regularly participate in unusual manoeuvres. For pilots unable to avoid these areas Lower Airspace Radar Service (LARS) is available from the nearest units.

7. OXFORD AIAA from the ground to 5000’.

8. Benson Military Air Traffic Zone (MATZ). See top right-hand corner of chart for dimensions and details.

9. i) 125.62 MHz (By ATC).
ii) 118.7 MHz, 118.5 MHz, 124.47 MHz (By ATC).
iii) 121.9 MHz Delivery, 121.97 Pre-taxi procedure clearance (Cpt).
iv) 113.75 MHz, 115.10 MHz. 123.9 MHz.
The * indicates part-time operation.

10. i) A VOR and associated DME and a non-compulsory reporting point at Daventry. A medium frequency NDB, 335 kHz, and a non-compulsory reporting point at Westcott.
ii) Inbound on airway centre line, left-hand pattern.
iii) When Daventry VOR is unserviceable the alternate procedure is inbound 190°(M) to the Westcott NDB, right-hand pattern.

11. A Lower Airspace Radar Service is available at Dunsfold within unregulated airspace up to FL95 within 30 NM of the airport and within limits of radar/radio coverage. Refer to E(LO) charts for frequencies.

12. The WEALD (N5119.8 E00002.2) ALTERNATE HOLDING, available when Biggin VOR unserviceable, is based upon BOV VOR/DME, inbound on the 141 radial from 37 NM to 32 NM from the DME, right-hand pattern.

13. London Control Zone from ground level to 2000’ above airfield level (see note on Aerodrome Traffic Zones bottom right of chart).

14. Normally for Gatwick arrivals.

15. **FL90 = Minimum En Route Altitude (MEA)** expressed as a Flight Level. An MEA is the lowest published altitude between radio fixes that meets obstacle clearance requirements between those fixes and in many countries assures acceptable navigational signal coverage. The MEA applies to the entire width of the airway, segment or route between the radio fixes defining the airway, segment or route.

    1900a = the Jeppesen Route Minimum Off-route Altitude (MORA). This altitude provides reference point clearance within 10 NM of the route centre line (regardless of route width) and end fixes. MORAs clear all reference points by 1000’ in areas where the highest reference points are 5001’ AMSL or lower and 2000’ where reference points are 5001’ or higher.

16. **19 = Grid Minimum Off-route Altitude (Grid MORA).** An altitude derived by Jeppesen or provided by State Authorities. The Grid MORA altitude provides terrain and man-made structure clearance within the section outlined by latitude and longitude lines. MORA does not provide for navaid signal, or communication, coverage. See page 6 JM Chart Glossary for terrain clearance criteria.

17. LOGAN; N5144.9 E00136.5.

18. 1 inch = 20 NM; FL200.

19. UK: FL245 to FL660. France: FL195 to FL660.

20. FL460.

21. FL260.

22. 129.35 MHz, 131.25 MHz; PARIS UAC.

23. 5°W.

24. A compulsory reporting point overhead the DIEPPE VOR (no DME) frequency 115.8 MHz; the flag is aligned with local magnetic north.

25. CRUISING LEVELS AVAILABLE ONLY: UR1 between Midhurst and ORTAC. Northbound FL250 etc .... see box N4930 E/W0000.

26. 1 inch = 10 NM.

27. 121.15/119.85 MHz.

28. Aircraft are controlled by PARIS CONTROL, with radar available, frequency 127.3 MHz.

29. 3°W.

30. 068°(M), 59.5 NM.

31. 3000 ft.

32. HOLDING PATTERNS. Refer to respective STAR/ARRIVAL charts for holding information. (see south of DIEPPE).

33. 128.0 MHz; TRANS. LEVEL by ATC; TRANS ALT 4000’.

34. FL150 to 240 - inbound on the 151°(M) track, based upon the 331 radial from PON, right-hand turn at its intersection with the 250 radial from ABB. Maximum 240 IAS, 1.5 min base legs.

35. DPE 1H, 1P; DVL 1W above FL195; DVL 1H above FL195; CAN 1H FL130 maximum; LGL 1H; CHW 1H and 1W above FL195.

36. 334 radial from PON VOR /280 radial 26 NM DME from CRL VOR/DME.

37. Non-compulsory airspace fix.

38. 3 NM west of CRL cross at FL110 and descend to 4000’ on QNH.

39. Cross at and maintain 4000’ QNH.

40. 2260’ QNH/1873’ QFE; 5.7 NM.

41. Minimum Holding Altitude (MHA) 3000’ .

42. 820’ QNH/433’ QFE. A specified altitude or height in a non-precision approach or circling approach below which descent may not be made without visual reference. (ICAO).

43. N4900.0 E00233.9.

44. 13 829 ft/4215 m and 11 811 ft/3600 m. (see Airport chart)

45. Ceiling and visibility 4000 ft and 5000 m or more; cross-wind less than 25 kt. When in operation it will be transmitted on ATIS and RNAV systems shall be FMS or multi-sensor type. (see Airport chart).

Answer Airways Exercise 2 (LOG)

FROM	TO	AWY/	FL	VRN.	W/V	TR.	TR.	HDG.	TAS	WC	GS	DIST	EET	ETA
LFPG	D18 BT		↗	3W		331	328				185	18.5	6	0829
D18 BT	TOC	ABB 8A	↗	3W		349	346				360	36	6	0835
TOC	ABB	A20	240	3W	303/70	349	346	343	450	-50	400	20	3	0838
ABB	NASDA	A20	240	3W	303/70	321	318	318	450	-67	383	36	5.5	0843.5
NASDA	CLIFF	A20	240	3W	303/70	319	316	317	450	-68	382	26	4	0847.5
CLIFF	TIGER(TO	STAR	240	4W	304/70	319	315	317	450	-68	382	16	2.5	0850
TIGER	D12 BIG	BIG	↘	4w		319	315					10	3	0853
D12 BIG	BIG	2A	↘	4W		319	315					12	4	0857
BIG	EGLL	"	↘	4W								30.5	12	0909
										TOTALS		205	46	

Answer Airways Exercise 2

1. E(LO)1 1 inch = 20 NM; E(LO)2 1 inch = 15 NM.

2. E(LO)1, 2, 7, 8, 9 and 10.

3. UK class (G) up to FL245; France class (G, D) up to FL195.

4. April to October, UTC + 2 hours.

5. 2040UTC + 0400 = 0040 31/3/97.

6. G = guard only. * = Part-time operation. X = On request.

   R = radar capability. C = clearance delivery. Cpt =Clearance (pre-taxi procedure)

7. 121.500 MHz.

8. a. EGVN.
   b. Panel 3C E(LO)1 and panel 7A E(LO) 2.
   c. Brize Norton Airbase; Brize Approach 133.75 MHz (part-time operation), 119.0 MHz on request. Zone Radar Service (part-time operation) 134.3 MHz. Tower and Ground 126.5 MHz, part-time operation and on request.

9. Coverage of appropriate Area Charts.

10. Single Sideband suppressed carrier wave HF (Short-wave) communications.

11. b.

12. a. E(LO)2; see N5030 W00730.
    b. E(LO)2; see N5015 W00730.

13. From the ground to 2000’ above aerodrome level (AAL). (see N5045 W00630).

14. See E(LO)2 N5130 W00615.

15. Airways within the UK are class A; Advisory Routes are class F. (see N5125 W00440).

16. See N4945 W00745.

17. Its vertical dimension is from the ground to 5000’. It is operative Monday - 0800LT to Friday 1800LT and when notified; controlled by Portland Approach.

18. Exeter civil airport, elevation 102’. Aerodrome Traffic Zone from the ground to 2000’ AAL; en route radar service available. NDB(Locator) call sign Echo X-ray, frequency 337 kHz, part-time transmission. ILS available.

19. Paris LFFF; London EGTT.

20. The overall distance from ABB VOR to BIG VOR is **100** NM.
A20 is the ATS route designator within the **one-way arrow** symbol. The distance between ABB VOR and NASDA is **36** NM.

FL70 = The Minimum En Route IFR Altitude (MEA): The lowest published altitude between radio fixes that meets obstacle requirements between those fixes and in many countries assures acceptable navigational signal coverage. The MEA applies to the **width of the airway**, segment or route between the radio fixes defining the airway segment or route.

2100a = The **Minimum Off-route Altitude**. This is an altitude derived by Jeppesen which provides known obstruction clearance **within 10 NM** of the route centre line.

❺ = A20 normally one-way westbound for airfields and FL listed. at N50 35 W00615.
The **blue thickly dashed line** = AREA CHART coverage for LONDON, UK EGLL AREA.

21. The semi-circle is a bypass symbol, i.e CLIFF does not apply to G27, only to A20 and the ATS route to SFD VOR.

22. 2400′. See page 6 Jeppesen Chart Glossary.

23. SLP = Speed Limiting Point; its symbol is the shaded square. X = non-compulsory airspace fix.

24. Maintain maximum IAS of 250 kt from a position 3 minutes before the holding facility, or the SLP position shown on the chart.

25. FL150 by TIGER. ACTUAL DESCENT CLEARANCE WILL BE AS DIRECTED BY ATC.

26. Holding speed in the LONDON TMA up to and including FL140 is maximum IAS 220 kt. At FL 150 and above standard ICAO holding speeds apply.

27. SFD VOR 076, LYD VOR 222, BIG VOR 139.

28. Noise monitoring point.

29. MAX IAS 250 kt below FL100 unless otherwise instructed by ATC.

30. ABB 8A.

31. Minimum climb gradient 5.5% up to FL150. Intercept the VOR CGN 268 radial; at 1.5 NM from CGN DME turn right.

32. 1281 ft/min.

33. See LONDON, UK NOISE HEATHROW.
97dba 0700 - 2300LT; 89dba 2300 - 0700LT.

34. 160 kt = CAT D aircraft (see page 1 Glossary)

DH 100′ DA 177′. Radio Altitude (RA) 100′; RVR 350 m. Touchdown Zone (TDZ) or Centre line Lights (CL) out, the RVR = 550 m, with Autoland = 300 m.

35. In the event of complete radio failure climb STRAIGHT AHEAD (MAX IAS 185 kt) to D10.0 LON VOR, then turn left to EPM NDB not above 3000’ (2920’) thence leave EPM NDB on a track .... etc.

36. a. 119.72 MHz
    b. 119.2/119.9 MHz
    c. CHT NDB Minimum Holding Altitude (MHA) 4000’ and EPM NDB 3000’ MHA.
    d. 1030’ QNH, 950’ QFE; 730’ QNH, 650’ QFE. i.e. 300 ft/NM.
    e. 1180’ QNH, 1104’ QFE.

Chapter

11

Airways - Miscellaneous Charts

Atlantic Polar High Altitude

En Route Chart 5AT(HI) - Introduction

This chart is used primarily for planning routes and high altitude polar navigation between Europe and North America. All operations between Europe and the Canadian Arctic Control Area, between FL280 and FL390 inclusive, are strongly recommended to flight plan in accordance with the POLAR TRACK STRUCTURE (PTS) during:

- 1200 - 1800Z for traffic to Alaska.
- 0000 - 0600Z for traffic to Europe.

Reference: NORTH ATLANTIC MINIMUM NAVIGATION PERFORMANCE SPECIFICATION (MNPS) AIRSPACE MANUAL EIGHTH EDITION states that:

The PTS consists of 10 fixed tracks in the Reykjavik Control Area (CTA) and 5 fixed tracks through Bodø Oceanic Control Area (OCA), which are a continuation of the relevant PTS tracks in the Reykjavik CTA.

Projection

Its projection is **POLAR STEREOGRAPHIC**:

- Bearings are correct.
- Great Circles are straight lines in Polar Regions.
- Scale is constant and correct in Polar Regions.

Track Direction/Magnetic Variation/Distance

Track direction is given or measured as: **TRUE (T), MAGNETIC (M), GRID (G)**. Grid navigation is covered later in the chapter.

The lines of equal **magnetic variation**, isogonals, are valid for 1995. On this chart the North Magnetic Pole is located approximately at N78 W100. There is a rapid change of magnetic variation in this area and the directive force, which aligns a compass needle with the magnetic meridian, reduces to zero as the magnetic pole is approached. Thus, in high latitudes magnetic reference for direction is impractical. Also, VOR beacons cannot be referenced to local magnetic north.

Example:
Resolute Bay VOR, 112.1 MHz, YRB (N7443.7 W09455.4) is aligned with local true north.

Distances are printed parallel to the track segments. Other distances can be measured using the nearest meridian scale, or the scale printed at the top, left and right edges of the chart.

Note that 1inch = 100 NM.

Example 1

STN(N5812.4 W00611.0) UN615, MATIK(N6100.0 W00804.0) PTS 1, N6600.0 W01230.0 [66PR].

a. The **Magnetic** track and distance STN to MATIK is ....

b. The **Magnetic** track MATIK to STN is ....

c. The **True** track and distance MATIK to [66PR] are ....

d. The **True** track [66PR] to MATIK is ....

e. The **Grid** track and mean magnetic variation MATIK to [66PR] are ....

f. The **Grid** track and distance [66PR] to MATIK are ....

Example 2

a. The magnetic variation at KARLL(N7000.0 W15100.0) is ....

b. The magnetic variation at EUREKA NDB, YEU, 205 kHz (N7959.5 W08553.9) is ....

It can be seen that on the sector MATIK to [66PR] the return track 156°(T) is not a reciprocal of the outbound track 340°(T). However, the return track 169°(G) is almost the reciprocal of the outbound 348°(G). (The 1° difference is due to the fact that the track between the two points is not a straight line).

Therefore, to measure and fly a track that has an unchanging direction GRID NORTH must be used as the datum.

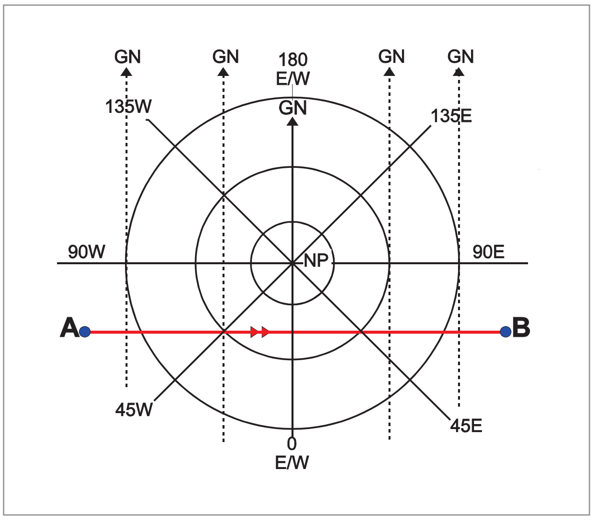


Figure 11.1 North Polar stereographic chart

Grid Navigation

The use of true and/or magnetic references for navigation in high latitudes is impractical due to:

- The rapid convergence of the meridians as latitude increases causing true track direction to change rapidly over short distances.
- The rapid change of magnetic variation over short distances.
- The degraded directional capability of magnetic compasses.

Therefore, to measure and maintain a track that has a constant direction GRID NORTH is used as a datum.

On this chart (and similar Polar Stereographic charts) the Greenwich Meridian is selected as the grid north datum; it is highlighted by a thick blue line and paralleled East and West at 300 NM intervals.

Example 3

(Reference Jeppesen chart 5AT(HI))

Track from A (N8500.0 E04000.0) to B (N8500.0 W04000.0).

a. The true track direction at A is ....

b. The true track direction at N8500 E/W0000 is ....

c. The true track into B is .... (*Note the change of direction over 388 NM*)

To obtain a constant track direction the grid north datum is used.

d. The grid track A to B is ....

The angular difference between True and Grid direction at any point on a grid chart is known as **Convergence**:

TRUE NORTH - WEST OF GRID NORTH = WESTERLY CONVERGENCE.

TRUE NORTH - EAST OF GRID NORTH = EASTERLY CONVERGENCE.

Hence:
CONVERGENCE WEST, TRUE BEST (GRID LEAST)
CONVERGENCE EAST, TRUE LEAST (GRID BEST)

Conveniently, on a POLAR STEREOGRAPHIC chart:

CONVERGENCE = LONGITUDE WITH SIGN CHANGED

Thus with reference to *Figure 11.1*:

LONGITUDE at A = 40°E = 40°W CONVERGENCE
LONGITUDE at B = 40°W = 40°E CONVERGENCE

Therefore:

The Grid Track at A (Longitude 40°E) = 310°(T) - 40°W Convergence = 270°(G).

The Grid Track into B (Longitude 40°W) = 230°(T) + 40°E Convergence = 270°(G).

Where the track crosses the Greenwich Meridian Convergence = 0°.

True and Grid tracks are the same - 270°

The bottom right-hand corner of panel 9 of the chart provides a simplified method of calculating a GRID BEARING:

+ LONGITUDE WEST

GRID BEARING = TRUE BEARING

- LONGITUDE EAST

Exercise 1

1. **The boundary surrounding the islands at N71 15 E/W180 is:**

    a. an FIR boundary
    b. a time zone boundary
    c. an international boundary
    d. part of the International Date Line

Answer questions 2 to 7 using the Jeppesen chart 5AT(HI) and the following route:
A (N8500.0 W16000.0) to B (N8000.0 W16400.0) to C (N7500.0 W16450.0)

2. **The total distance is:**

    a. 302 NM
    b. 602 km
    c. 605 NM
    d. 602 NM

3. **The highest Grid MORA for the route is:**

    a. 1000 ft
    b. 1600 ft
    c. 160 ft
    d. 1600 m

4. **The constant track direction from A to B is:**

    a. 168°(G)
    b. 148°(M)
    c. 348°(G)
    d. 186°(T)

5. **Which of the following is correct?**

    a. The airspace below FL230 is uncontrolled
    b. The airspace is uncontrolled inclusive of FL230 and below
    c. The airspace is controlled from ground level up to FL230
    d. The airspace is controlled from FL220 inclusive and above

6. **The boundary along latitude N75 indicates:**

    a. an Upper Information Region
    b. an Air Defence Identification Zone
    c. an international boundary
    d. a QNH boundary

7. **The grid track from N7000.0 W16630.0 to N7456.8 W14100.0 is:**

    a. 212°
    b. 032°
    c. 056°
    d. 043°

8. **The (R) at N69 W158 means that:**

a. there is an en route radar capability on 135.3 MHz
b. radar control is available on 135.3 MHz
c. there is a VDF station at Barrow
d. there is a remote air/ground antenna at Barrow for direct communications with Anchorage Control Centre

9. **Given.**
Longitude W30 **Variation 30°W** **True bearing 337°**

The Grid Bearing is:

a. 307°
b. 007°
c. 037°
d. 337°

Answers - Examples

Example 1

a. 350° 177 NM

b. 170°

c. 340° 322 NM

d. 156°

e. 348° 13°W

f. 169° 322 NM

Example 2

a. 28°E

b. 92°W

Example 3

a. 310°

b. 270°

c. 230°

d. 270°

Answers to Exercise 1

1	2	3	4	5	6	7	8	9
b	d	b	c	a	b	a	d	b

Plotting Charts - Introduction

There are three charts:

- NORTH CANADA (NCP)
- NORTH ATLANTIC (NAP)
- MID ATLANTIC (MAP)

Each chart is designed for plotting routes and positional information. In the final examination students should expect one simple plotting question, at least, based upon one of the charts.

Plotting Charts - Projection

The chart is a **LAMBERT CONFORMAL CONIC PROJECTION**:

- Scale is considered to be constant.
- For practical purposes straight lines drawn on the chart are considered to be GREAT CIRCLES.
- Bearings are correct.
- 1 inch = 120 NM.

Exercise 2

(Use NCP chart)

"ACA865 is cleared to Toronto via North Atlantic Track Echo from 55N 010W to maintain FL320, Mach. 82." The forecast wind velocity and COAT at FL320 are 020°/110 kt and -60°C.

Plot the part-route:- London, N55 W010, N57 W020 and N57 W030, and answer the following:

(Tolerances for distances within 1%)

1. The route distance London to N57 W030 is ....
2. The mean Great Circle track London to N57 W030 is .... (T)
3. The mean magnetic variation N55 W010 to N57 W020 is ....
4. The mean Great Circle track N57 W020 to N57 W030 is .... (T)
5. The initial heading from N55 W010 is .... (M)
6. The aircraft's ATA at N55 W010 is 1038Z. The ETA at N57 W020 is ....
7. The aircraft's ATA at N57 W020 is 1126Z. The ETA at N57 W030 is ....
8. The aircraft is cleared to be at N57 W030 at 1211Z. Its revised Mach No. is ....

   The aircraft's ATA at N57 W030 is 1211Z. At 1201Z Gander Oceanic re-clears the aircraft from N57 W030 to N55 W040 at FL320, Mach .82. The forecast wind velocity and COAT are 350°/90 kt and -64°C. Answer questions 9 and 10.

9. The mean Great Circle track and distance from N57 W030 to N55 W040 are .... (T) and ....
10. The ETA at N55 W040 is ....
11. At CARPE (N5305.0 W05405.0) the aircraft leaves the .... CTA /................ FIR and enters .... CTA/................... FIR.
12. The distance from CARPE to REDBY (N5215.0 W05636.1) is .... NM.
13. What does RVSM means?
14. What does MNPS means?

Answers - Exercise 2

1. 1087 NM.

2. 288°(T).

3. 12°W.

4. 270°(T).

5. 318°(M).

6. 1126Z.

7. 1206Z.

8. Mach .72.

9. 250°(T); 358 NM

10. 1256Z.

11. GANDER OCEANIC CTA/CZQX; GANDER DOMESTIC CTA/CZQX.

12. 103 NM.

13. Reduced Vertical Separation Minima.

    (The equipment required is **two** fully serviceable **independent** altitude measurement systems; **one** automatic altitude-control system and **one** altitude alerting device. A functioning Mode C SSR Transponder is also required for flight through radar controlled RVSM transition airspace. When checking altimeters, pre-flight or in-flight, **at least two primary altimeters must agree at all times within plus or minus 200 ft.**)

14. North Atlantic Minimum Navigation Performance Specification.

    Aircraft must be equipped with the following:

- **Two** fully serviceable Long Range Navigation Systems (LRNS). An LRNS may be one of the following:
    - One Inertial Navigation System (INS);
    - One Global Navigation Satellite System (GNSS); or
    - One navigation system using inputs from one or more IRS or any other sensor complying with the MNPS requirement.
- Each LRNS must be capable of providing to the flight crew a continuous indication of the aircraft position relative to track.
- It is highly desirable that the navigation system employed for the provision of steering guidance is capable of being coupled to the auto-pilot.

North Atlantic & Central North Atlantic

Blow-up Plotting Chart - Introduction

Both charts are Lambert Conical Conformal projections designed for:

- ETOPS. (This chart has been produced for an Airbus 330.)
- EQUAL TIME POINT(ETP)/CRITICAL POINT (CP) calculation and plotting.
- Position and route plotting.

The **NORTH ATLANTIC PLOTTING CHART** has a scale of 1 inch = 200 NM; its bottom right-hand corner contains an EQUAL TIME POINT (ETP)/CRITICAL POINT (CP) graph with instructions for its use.

On the obverse is the **CENTRAL NORTH ATLANTIC BLOW-UP AREA**

Scale 1 inch = 120 NM.

The ETP graph and instructions apply to this chart also.

North Atlantic & Central North Atlantic

Blow-up Plotting Chart - Range and Time Circles

Both charts show still air range/time circles of 820 NM/120 MIN (410 kt TAS) and 1220 NM/180 MIN (406 kt TAS) centred upon suitable diversion airfields such as Shannon (EINN), Lajes (LPLA), Gander (CYQX) and Keflavik (BIKF). These airfields are open 24 hours a day and can provide appropriate facilities for all types of aircraft.

Example 4
On the CENTRAL NORTH ATLANTIC BLOW-UP AREA chart:

a. Plot the route:

Shannon (EINN) N5242 W 00855, to Gander (CYQX) N4856 W05434, to Keflavik (BIKF) N6359 W02236, to Shannon.

b. Identify the 120 MIN and 180 MIN range circles from each airfield.

c. The midpoint line cuts the Shannon/Gander track at position .... and is .... NM from each.

d. The midpoint line cuts the Gander/Keflavik track at position .... and is .... NM from each.

e. The midpoint line cuts the Keflavik/Shannon track at position .... and is .... NM from each.

It should be noted that any point on the extended MIDPOINT LINE, either side of the MIDPOINT, will be equidistant from either airfield and will be the STILL AIR ETP/CP.

At 90° to either side of each MIDPOINT LINE is a graticule which is used to adjust the STILL AIR ETP/CP, either in the continuing (ON) or returning (HOME) direction, for the prevailing wind pattern.

Example 5
Use the CENTRAL NORTH ATLANTIC BLOW-UP AREA chart, and the ETP graph when required.

Given:

Route Shannon to Gander at Example 4

Cruise FL310; All-engine TAS 426 kt

Engine-out stabilizing height FL240; Engine-out TAS 370 kt

Wind Components

	MIDPOINT to GANDER	MIDPOINT to SHANNON
FL310	-80 kt	+50 kt
FL240	-40 kt	+20 kt

Calculate the distance and time to the all-engine ETP/CP between Shannon and Gander.

a. The equi-time number is ....

b. The number of miles from the midpoint is .... NM.

c. The distance to the ETP/CP from Shannon is .... NM.

d. The time to the ETP/CP is .... min.

Cross-check using the formula:

e. The distance X to the ETP/CP from EINN = $\dfrac{\times}{+}$

= .... NM.

f. The time to the ETP/CP = ... min.

Example 6

Given:

Route Shannon to Gander at Example 4

Cruise FL310

All-engine TAS 426 kt

Engine-out stabilizing height FL240

Engine-out TAS 370 kt

Wind Components

	MIDPOINT to GANDER	MIDPOINT to SHANNON
FL310	-80 kt	+50 kt
FL240	-40 kt	+20 kt

Using the same chart and route calculate the distance and time to the engine-failure ETP/CP.

a. The equi-time number is ....

b. The number of miles from the midpoint is .... NM.

c. The distance to the ETP/CP from Shannon is .... NM.

d. The time to the ETP/CP is .... min.

Cross-check using the formula:

e. The distance from the ETP/CP, X = $\dfrac{\times}{+}$

= .... NM.

f. The time to the ETP/CP = ... min.

Answers

Example 4

a.	Plotted on chart	
b.	N5310 W03248	857.5 NM
c.	N5726 W04142	683 NM
d.	N5832 W01440	399.5 NM

Example 5

a. +8
b. 137 NM
c. 994.5 NM
d. 158.5 min
e. 993 NM
f. 158.5 min

Example 6

a. +4
b. 68.5 NM
c. 926 NM
d. 148 min
e. 929 NM
f. 148 min

Atlantic Orientation Charts - AT(H/L) 1 & 2 - Introduction

These charts are used for route planning and en route navigation between major transatlantic aerodromes. Both charts are Lambert Conformal Conic Projections. The scale of the AT(H/L)1 is 1 inch = 132 NM; AT(H/L)2 is 1 inch = 136 NM.

AT(H/L) 1 & 2 - Distance Measurement

Distance is obtained by:

- Extracting the values which are printed parallel to the published tracks and/or sectors thereof.
- Using the nautical mile scale at the left and right-hand margins.
- Using the adjacent meridian scale.

AT(H/L) 1 & 2 Information

- The front panel shows:
    - The **coverage** of the chart pictorially
    - **NAVAID LEGEND**
    - **SELECTED VOLMET BROADCAST IN RADIO-TELEPHONY (RTF)**
- **Navaid** information, listed alphabetically, is provided at Panel 1 AT(H/L)1 and panel 8 AT(H/L)2.
- **NORTH ATLANTIC & CANADA MINIMUM NAVIGATION PERFORMANCE SPECIFICATION (MNPS).**

    NAT ORGANIZED TRACK SYSTEM (NAT OTS)

    NORTH ATLANTIC COMMUNICATION

    COMMON PROCEDURES FOR RADIO COMMUNICATION FAILURES
    Information on above is at panel 7 and 8 AT(H/L)1.

- **NORTH ATLANTIC CROSSING CLEARANCE PROCEDURES & FREQUENCIES** information is published at panel 9 AT(H/L)1.
- **POSITION REPORTING PROCEDURES**

    STANDARD AIR-GROUND MESSAGE TYPES & FORMATS

    INCREASED WEATHER REPORTING

    SPECIAL PROCEDURES FOR IN-FLIGHT CONTINGENCIES IN MNPS/RSVM AIRSPACE

- **TRANSPONDER OPERATION**

- **IN-FLIGHT CONTINGENCY PROCEDURES FOR WAKE VORTEX etc.**
  Information on above is at Panel 1 AT(H/L)2.

Exercise 3

Given:

Chart	AT(H/L) 1 & 2.
Route	OMOKO (N4850 W01200), ATS route T16.
Destination	Porto Santo (LPPS) N3304 W01621.
Diversion	Santa Maria (LPAZ) N3658 W02510.

Answer questions 1 to 12.

1. The total distance from OMOKO to the intersection with the ATS route between N3800 W02000 to KOMUT is:

a. 600 NM
b. 643 NM
c. 703 NM
d. 853 NM

2. For this route the correct highest IFR ICAO level between FL280 and FL310 inclusive is:

a. FL280
b. FL290
c. FL310
d. FL300

3. With reference to Porto Santo's navaid the following is correct:

a.	VOR/DME	Ident SNT	frequency 114.9 kHz
b.	VOR/DME	Ident SNT	frequency 114.7 MHz
c.	VOR/DME	Ident SNT	frequency 114.9 MHz
d.	VOR/DME/TACAN	Ident SNT	frequency 114.9 MHz

4. The mean Great Circle track Porto Santo to Santa Maria is:

a. 309°(M)
b. 295°(T)
c. 310°(T)
d. 298°(T)

5. The mean magnetic variation Porto Santo to Santa Maria is:

a. 8°W
b. 12°W
c. 11°W
d. 10°W

6. The distance Porto Santo to N3500 W02000 is:

a. 215 NM
b. 494 NM
c. 115 NM
d. 220 NM

7. **The night-time Weather FORECAST for Santa Maria is obtained from:**

a. Shannon VOLMET on HF frequencies of 3.413 MHz, 5.505 MHz and 8.957 MHz at H + 45 to 50 min
b. Shannon VOLMET on a VHF frequency of 341.3 MHz at H + 45 to 50 min
c. Shannon VOLMET HF frequencies of 3.413 kHz 5.505, kHz and 8.957 kHz at H + 45 to 50 min
d. Shannon VOLMET on a long wave transmission, frequency of 3.413 MHz at H + 45 to 50 min

8. **The daytime MET Report for Santa Maria is obtained from:**

a. Shannon VOLMET on a VHF frequency of 132.64 MHz at H + 15 to 20 min
b. Shannon VOLMET on HF frequencies of 13.264 MHz, 5.505 MHz and 8.957 MHz at H + 15 to 20 min and H + 45 to 50 min
c. Shannon VOLMET on an HF frequency of 13.264 kHz, 5.505 kHz and 8.95 7 kHz at H + 15 to 20 min and H + 45 to 50 min
d. Shannon VOLMET on a short wave transmission of 132.64 MHz 550.5 MHz and 895.7 MHz at H + 15 to 20 min

9. **The route, if flown at FL290, is:**

a. not within MNPS airspace
b. within MNPS airspace
c. within MNPS/RVSM airspace
d. within RVSM airspace only

10. **Given:**
Suitable airfields:
Santiago (N4254 W00825)
Porto Santo (N3304 W01620)
Santa Maria (N3658 W02510)
Twin turbo-jet passenger aircraft
Normal one-engine inoperative Cruise TAS of 400 kt

a. The aircraft requires ETOPS authorization
b. ETOPS authorization is not required south of N45
c. The aircraft does not require ETOPS authorization
d. The aircraft does not require ETOPS authorization during daylight hours

11. **If an aircraft's ETA at Porto Santo is 1430 UTC its Standard Time of arrival:**

a. 1530
b. 1330
c. 1630
d. 1230

12. **The North Atlantic Remote and Oceanic Areas Air to Air frequency is:**

a. 131.80 kHz
b. 121.50 MHz
c. 131.80 MHz
d. 127.90 MHz SELCAL

13. **An aircraft in mid-Atlantic at 1400LMT on Midsummer's Day wishes to contact New York Area Control Centre. The listed frequencies are:**

3016	13306
5598	17496
8906	

The frequency(s) most likely to be tried in order to obtain eventual two-way communication are:

a. 3.016 kHz, 5.598 kHz or 8.906 kHz
b. 13.306 MHz or 17.496 MHz
c. 13.306 kHz or 17.946 kHz
d. 3.016 MHz or 5.598 MHz

14. **The MACH NUMBER TECHNIQUE for the North Atlantic Track System (NAT OTS) is based upon:**

a. True Mach Number
b. Indicated Mach Number
c. M_{MO}
d. M_{NE}

15. **Flights certified as complying with MNPS and RVSM should insert , after "S" in item 10 of their ICAO Flight Plan, the letter(s):**

a. W
b. X
c. XR
d. XW

Answers - Exercise 3

1	2	3	4	5	6	7	8	9	10	11	12
c	b	c	d	d	a	a	b	b	c	a	c

13	14	15
b	a	d

Chapter

12

ATC Flight Plan

Introduction

References: ICAO Doc 4444-RAC/501; UK AIP ENR 1.10-FLIGHT PLANNING (25 Jul 13)

What is an ATC Flight Plan?

It is simply advance notice of a pilot's intentions for a flight in terms of route (including departure and destination), cruising level and speed and information about the crew and passengers. It is in a set format to ensure completeness of information and compatibility with electronic data transfer between ATS and other units.

Students are required to understand, and answer questions on, all aspects of ATC Flight Plans, both individual and Repetitive Flight Plans (RPLs).

- Type of plan - individual or repetitive
- The format of an ICAO flight plan.
- The information required for the plan.
- How to complete, file, cancel or amend a flight plan.

Definitions

Flight plan: Specified information provided to air traffic service units, relative to an intended flight or portion of a flight of an aircraft.

Repetitive flight plan (RPL): A flight plan related to a series of frequently recurring, regularly operated individual flights with identical basic features, submitted by an operator for retention and repetitive use by ATS units. These flights must be operated on the same day(s) of consecutive weeks and on at least 10 occasions, or every day over a period of at least 10 consecutive days. The elements of each flight shall have a high degree of stability.

Filed flight plan: The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes.

Current flight plan: The flight plan, including changes, if any, brought about by subsequent clearances.

Estimated elapsed time: The estimated time required to proceed from one significant point to another.

Estimated off-block time: The estimated time at which the aircraft will commence movement associated with departure.

Estimated time of arrival: For IFR flights, the time at which it is estimated that the aircraft will arrive over that designated point, defined by reference to navigational aids, from which it is intended that an instrument approach will be commenced, or, if no navigational aid is associated with the aerodrome, the time at which the aircraft will arrive over the aerodrome. For VFR flights, the time at which it is estimated the aircraft will arrive over the aerodrome.

(Extract from **ICAO DOC 4444** (PANS-RAC) Dated 22 Nov 07)

Annexes to This Chapter

- **Annex 1** to this chapter is a copy of Part II, Chapter 8, Doc 4444, relating to the rules for ATC flight plans.

- **Annex 2** to this chapter, **INSTRUCTIONS FOR THE COMPLETION OF THE FLIGHT PLAN FORM**, is an extract of Appendix 2, Doc 4444.

These annexes should be studied carefully as they may be a source of examination questions.

Specimen CA48

Reference *Figure 12.1* and Annex 2 to this chapter.

The numbered items at *Figure 12.1* should be referred to in conjunction with the apposite instructions at Annex 2.

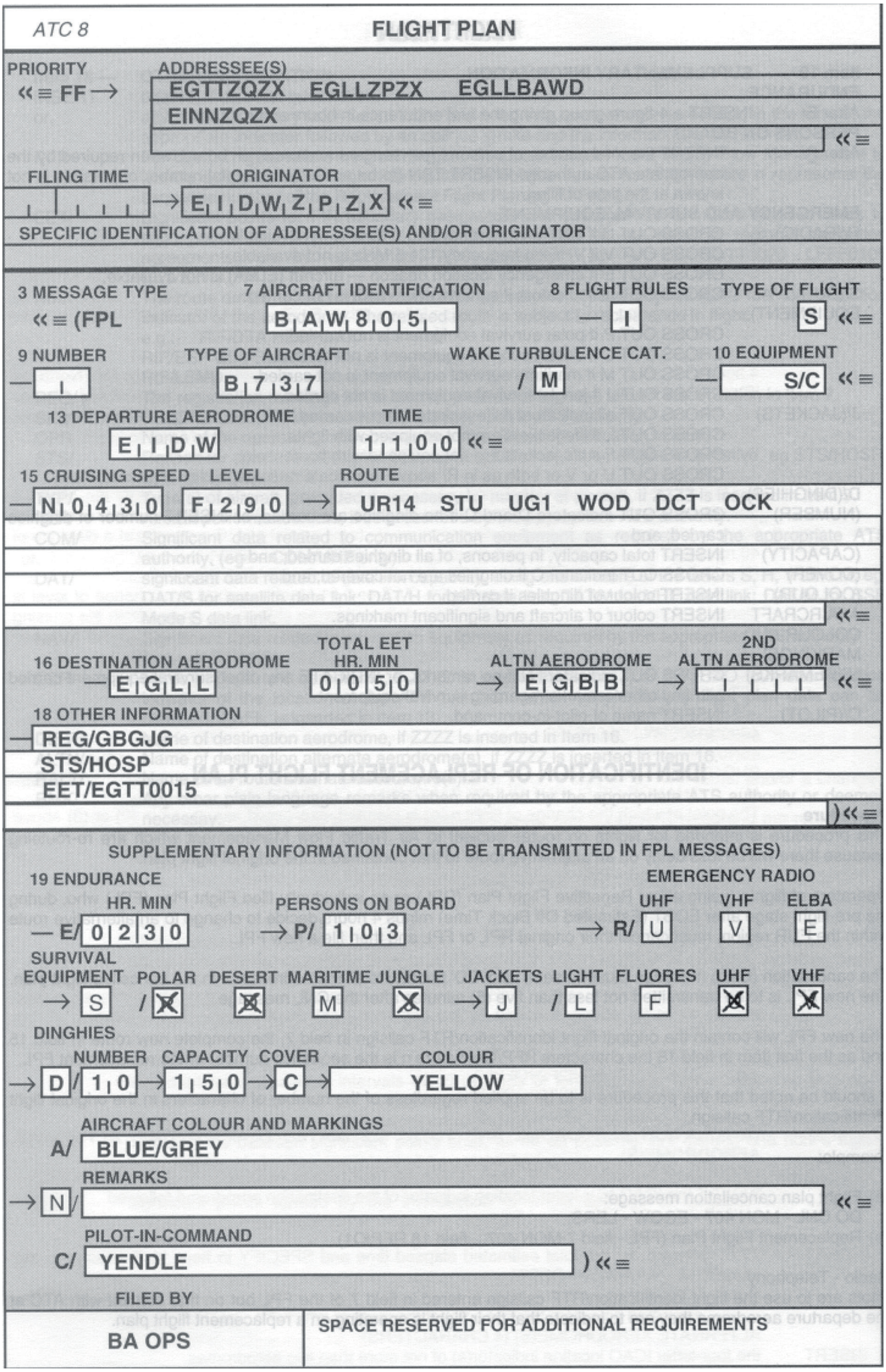
For example: Item 7 **AIRCRAFT IDENTIFICATION** in *Figure 12.1*
Briefly, the instructions for **ITEM 7: AIRCRAFT IDENTIFICATION** at Annex 2, state that the aircraft identification should not exceed 7 characters and can be either the registration markings of the aircraft or the ICAO designator for the operating agency.

ITEMS 7, 8, 9, 10, 13, 16, 18, and **19** can be readily understood from the instructions.

ITEM 15: ROUTE is more complex and will be discussed later.

Decode of Specimen Flight Plan

The aircraft identification is **BAW805**, (Speedbird 805 being the radio-telephony identification). IFR Scheduled flight for a Boeing 737, which creates a Medium wake turbulence. The aircraft has a serviceable Standard communication/navigation/approach aid equipment for the route and a serviceable SSR transponder with 4096 codes and Mode **C.** The departure airfield is **EIDW**, (Dublin) with an estimated off-block time of **1100** UTC. The first cruising speed is 430 kt TAS, **N0430**, at Flight Level 290, **F290**.



ATC 8 FLIGHT PLAN

PRIORITY
«≡ FF →

ADDRESSEE(S)
EGTTZQZX EGLLZPZX EGLLBAWD
EINNZQZX
«≡

FILING TIME
ORIGINATOR
→ E I D W Z P Z X «≡

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR

3 MESSAGE TYPE
«≡ (FPL

7 AIRCRAFT IDENTIFICATION
B A W 8 0 5

8 FLIGHT RULES
— I

TYPE OF FLIGHT
S «≡

9 NUMBER
—

TYPE OF AIRCRAFT
B 7 3 7

WAKE TURBULENCE CAT.
/ M

10 EQUIPMENT
— S/C «≡

13 DEPARTURE AERODROME
E I D W

TIME
1 1 0 0 «≡

15 CRUISING SPEED
— N 0 4 3 0

LEVEL
F 2 9 0

ROUTE
→ UR14 STU UG1 WOD DCT OCK

«≡

16 DESTINATION AERODROME
— E G L L

TOTAL EET
HR. MIN
0 0 5 0

ALTN AERODROME
→ E G B B

2ND ALTN AERODROME
→ «≡

18 OTHER INFORMATION
— REG/GBGJG
STS/HOSP
EET/EGTT0015
) «≡

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)

19 ENDURANCE
HR. MIN
— E/ 0 2 3 0

PERSONS ON BOARD
→ P/ 1 0 3

EMERGENCY RADIO
UHF VHF ELBA
→ R/ U V E

SURVIVAL EQUIPMENT
→ S

POLAR
/ ~~P~~

DESERT
~~D~~

MARITIME
M

JUNGLE
~~J~~

JACKETS
→ J

LIGHT
/ L

FLUORES
F

UHF
~~U~~

VHF
~~V~~

DINGHIES
NUMBER
→ D / 1 0

CAPACITY
→ 1 5 0

COVER
→ C

COLOUR
→ YELLOW

AIRCRAFT COLOUR AND MARKINGS
A/ BLUE/GREY

REMARKS
→ N / «≡

PILOT-IN-COMMAND
C/ YENDLE) «≡

FILED BY
BA OPS

SPACE RESERVED FOR ADDITIONAL REQUIREMENTS

Figure 12.1 Specimen ATC flight plan

The aircraft plans to join the airway **UR14** and fly along it to the Strumble VOR, call sign **STU**, where it changes to airway **UG1**, and thence to the navigation facility at Woodley, call sign **WOD**. From WOD it plans to fly direct, **DCT**, to Ockham VOR, call sign **OCK**.

The destination aerodrome is London Heathrow, **EGLL**, with a total planned flight time of 50 minutes, 0050; the alternate airfield is Birmingham, **EGBB**.

The aircraft registration is **GBGJG**, and it requires special handling as it is a Hospital, **HOSP**, aircraft. The estimated elapsed time, EET, to the London FIR boundary, **EGTT**, is 15 minutes, **0015**, after take-off.

Item 19: Supplementary Information

(**NOT TO BE TRANSMITTED IN FPL MESSAGE**). This information is only required when an aircraft is overdue and the emergency services have been alerted.

The total endurance of the aircraft is 2 h 30 min, **0230**, and there are **103** persons on board.

The aircraft is fitted with separate emergency UHF, **U** and VHF, **V**, radio, together with a crash activated emergency locator beacon, **E**.

The aircraft is carrying maritime, **M**, survival equipment and life jackets, **J**, fitted with a sea activated light, **L**, and fluorescent dye, **F**.

The aircraft also carries **10** inflatable dinghies, **D**, whose total capacity is **150** people; the colour of dinghies' covers, **C**, is yellow.

The aircraft has blue and grey markings and the pilot in command is Yendle.

Item 15

This is the most complex. Details are required of the aircraft's route, change of **route, speed, level and/or flight rules**; sub-items must be in capital letters and separated by a space. The following aide-memoire may be of use for filling in the ROUTE details which start after the arrow.

- **ATS ROUTE** (2 to 7 characters)
  - Enter the coded designator assigned to the route or route segment e.g. UB37, R14.
  - Where appropriate enter the coded designator assigned to a standard instrument departure route (SID) or standard arrival route (STAR) e.g. OCK 1C, MAY 1J.
- **POINTS OF CHANGE** (2 TO 11 CHARACTERS)

  Enter:

  - The **coded designator** (2 to 5 characters) assigned to the point, e.g. EX, MAY, LOVEL, PORGY, SCROD.

If there are no coded designators use:

- **LATITUDE/LONGITUDE**

DEGREES (7 characters)	**DEGREES/MINUTES (11 characters)**
56N105W	4715N16005E
50N075E	6010N06206W or,

- **BEARING AND DISTANCE** from a navigation aid:
  For example SAM090035 indicates a point 35 NM on a bearing of 090°(M) from Southampton VOR.

Use of DCT (Direct)

- If a **departure airfield is located or connected** to the ATS route then the **coded designator** of that route will be the first entry. If it is **not on** or **connected to** the ATS route the first entry will be **DCT** followed by the **joining point**, followed by the **designator** of the ATS route. (*Figure 12.2*)

- If the **destination airfield** is **not on** or **connected to** an ATS route the last entry will be **DCT**. (*Figure 12.3*)

- Use DCT between coded designators not connected by ATS routes.

- Use DCT between a designated reporting point and a position, denoted by a latitude and longitude or a bearing or distance from a navaid, which is outside the ATS route.

- Use DCT between a latitude and longitude, or a navaid bearing and distance, and a designated reporting point on an ATS route.

- DCT is not required between successive points defined by latitude and longitude or a bearing and distance from a navaid. (*Figure 12.4*)

- **Only points of change** are to be entered in item 15. Insert each point at which there is a change of:

  - Route.

  - Speed or level. A **change of speed is 5% of TAS or 0.01 Mach or more.** If there is a change of level or speed both must be entered even though only one has changed. (See *Figure 12.5*).

  - Flight rules.

- Follow the point of change with the designator of the ATS route **even if it is the same as that before the change**, or by DCT if the next point is outside the ATS route.

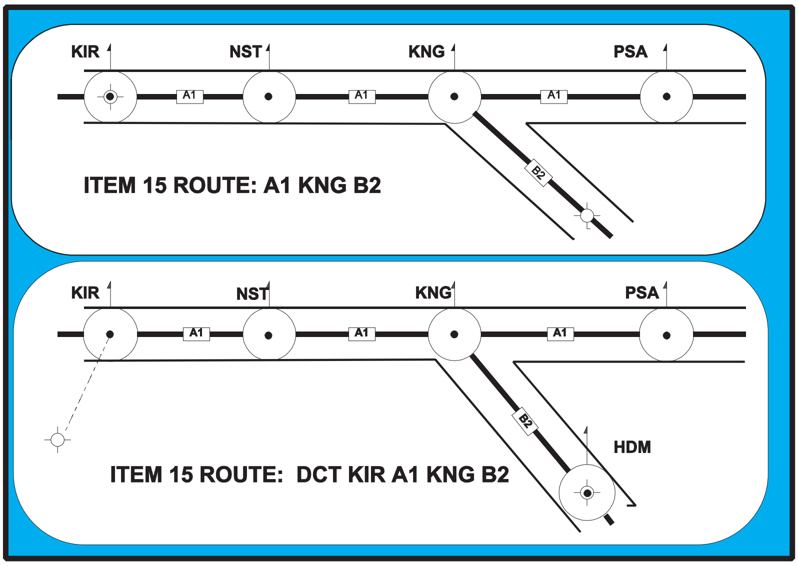


Figure 12.2 Use of DCT

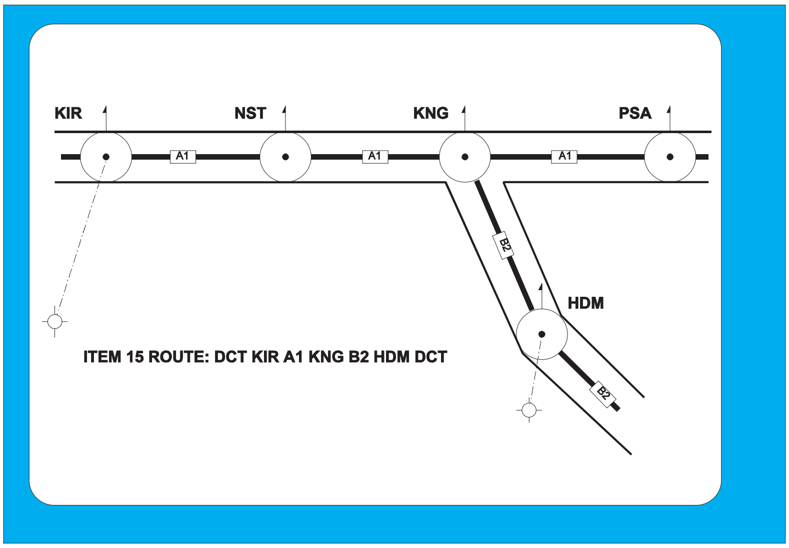


Figure 12.3 Use of DCT

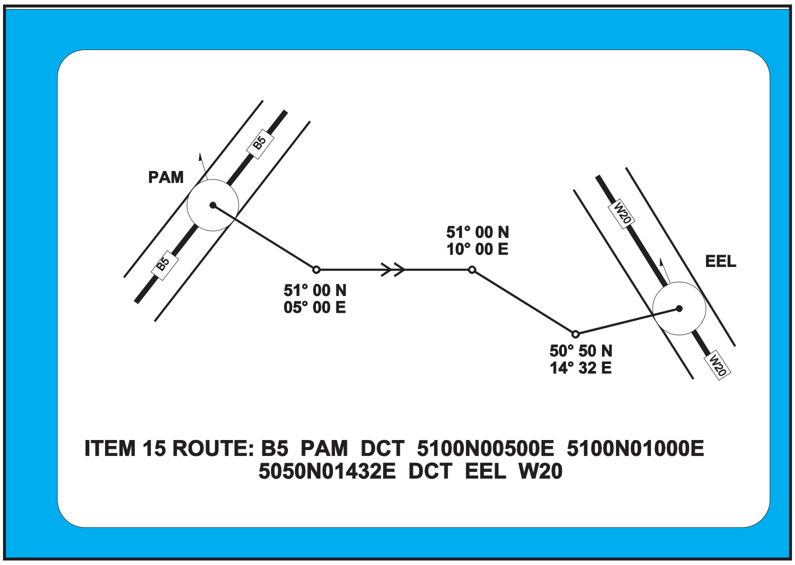


Figure 12.4 Use of DCT - leaving & re-joining airways

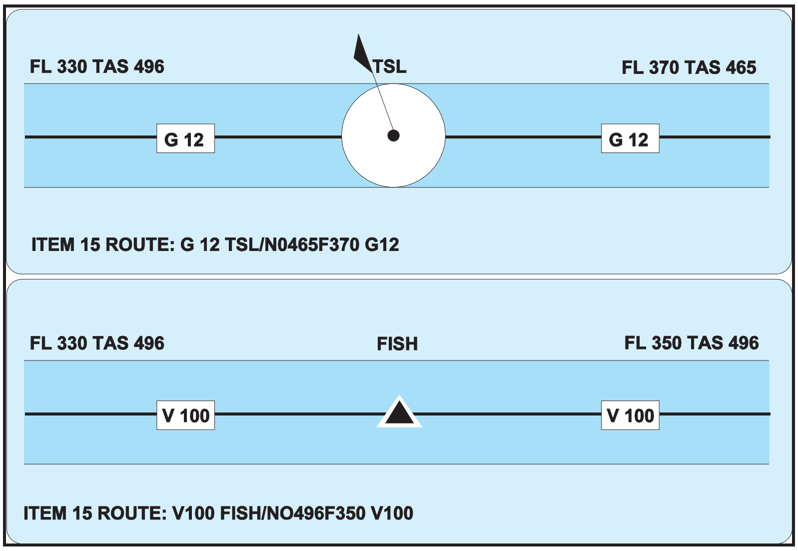


Figure 12.5 Change of speed and/or level

1. **ICAO model flight plan form**

FLIGHT PLAN
PLAN DE VOL

PRIORITY / Priorité
<<≡ FF →
ADDRESSEE(S) / Destinataire(s)
<<≡

FILING TIME / Heure de dépôt
→ ORIGINATOR / Expéditeur
<<≡

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR
Identification précise du(des) destinataire(s) et/ou de l'expéditeur

3 MESSAGE TYPE / Type de message
<<≡ (FPL
7 AIRCRAFT IDENTIFICATION / Identification de l'aéronef
8 FLIGHT RULES / Règles de vol
TYPE OF FLIGHT / Type de vol
<<≡

9 NUMBER / Nombre
TYPE OF AIRCRAFT / Type d'aéronef
WAKE TURBULENCE CAT. / Cat. de turbulence de sillage
/
10 EQUIPMENT / Équipement
/ <<≡

13 DEPARTURE AERODROME / Aérodrome de départ
TIME / Heure
<<≡

15 CRUISING SPEED / Vitesse croisière
LEVEL / Niveau
→ ROUTE / Route

<<≡

16 DESTINATION AERODROME / Aérodrome de destination
TOTAL EET / Durée totale estimée
HR. MIN
→ ALTN AERODROME / Aérodrome de dégagement
→ 2ND. ALTN AERODROME / 2ème aérodrome de dégagement
<<≡

18 OTHER INFORMATION / Renseignements divers

)<<≡

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)
Renseignements complémentaires (À NE PAS TRANSMETTRE DANS LES MESSAGES DE PLAN DE VOL DÉPOSÉ)

19 ENDURANCE / Autonomie
HR. MIN
– E /
→ P / PERSONS ON BOARD / Personnes à bord
EMERGENCY RADIO / Radio de secours
→ R / UHF U VHF V ELT E

SURVIVAL EQUIPMENT/Équipement de survie
POLAR / Polaire, DESERT / Désert, MARITIME / Maritime, JUNGLE / Jungle
→ S / P D M J

JACKETS/Gilets de sauvetage
LIGHT / Lampes, FLUORES / Fluores, UHF, VHF
→ J / L F U V

DINGHIES/Canots
NUMBER / Nombre, CAPACITY / Capacité, COVER / Couverture, COLOUR / Couleur
→ D / → → C → <<≡

AIRCRAFT COLOUR AND MARKINGS
Couleur et marques de l'aéronef
A /

REMARKS
Remarques
→ N / <<≡

PILOT-IN-COMMAND
Pilote commandant de bord
C /)<<≡

FILED BY/Déposé par

SPACE RESERVED FOR ADDITIONAL REQUIREMENTS
Espace réservé à des fins supplémentaires

Figure 12.6 Exercise 1

For the following exercises use Jeppesen High Altitude Chart E(HI) 4/5 CAA FOR CPL/ATPL

Exercise 1

A non-scheduled flight is to be made from CAMBRIDGE (N5212 E00013) EGSC to MUNICH (N4808 E01144) EDDM.

Route:	To join the upper airways system at LAMBOURNE (N5139 E00006) then airway UB3 - DOVER -UGI - NATTENHEIM - UB6 - MUNICH.
Flight Details:	Off-block time 0920UTC Airborne time 0930UTC Allow 15 min from airborne to join airways at LAMBOURNE. LAMBOURNE to SPRIMONT: TAS 330 kt; wind component +15 kt Cruise FL250. SPRIMONT to MUNICH: TAS 350 kt; wind component +20 kt Cruise FL290
Aircraft Type:	Boeing 737 (B737)
Aircraft Weight:	45 000 kg
Operator:	CAMMAIR
Identification:	G-GRAD
Radio & Navigation Equipment:	Standard + UHF R/T
SSR Equipment:	Transponder Mode ‘A’, 4096 codes + Mode ‘C’
Flight Rules:	IFR
Type of Flight:	Non-scheduled air transport
Alternate:	STUTTGART (EDDS)
ATC	Require elapsed time to BRUSSELS FIR boundary.

Supplementary Information
Sufficient fuel for 2½ hours flight.
Passengers 119 + 5 crew.
ELBA (Emergency Location Beacon) is available.
Life jackets are available equipped with emergency lights and UHF capability.
Four covered life rafts (dinghies) are carried with an individual capacity of 32 persons.
The dinghies are coloured yellow.
The aircraft is coloured white with red markings.
No supplementary equipment is carried.

1. **ICAO model flight plan form**

FLIGHT PLAN
PLAN DE VOL

PRIORITY
Priorité
<<≡ FF →

ADDRESSEE(S)
Destinataire(s)

<<≡

FILING TIME
Heure de dépôt
→
ORIGINATOR
Expéditeur
<<≡

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR
Identification précise du(des) destinataire(s) et/ou de l'expéditeur

3 MESSAGE TYPE
Type de message
<<≡ (FPL

7 AIRCRAFT IDENTIFICATION
Identification de l'aéronef
—

8 FLIGHT RULES
Règles de vol
—

TYPE OF FLIGHT
Type de vol
<<≡

9 NUMBER
Nombre
—

TYPE OF AIRCRAFT
Type d'aéronef

WAKE TURBULENCE CAT.
Cat. de turbulence de sillage
/

10 EQUIPMENT
Équipement
— /
<<≡

13 DEPARTURE AERODROME
Aérodrome de départ
—

TIME
Heure
<<≡

15 CRUISING SPEED
Vitesse croisière
—

LEVEL
Niveau

ROUTE
Route
→

<<≡

16 DESTINATION AERODROME
Aérodrome de destination
—

TOTAL EET
Durée totale estimée
HR. MIN

ALTN AERODROME
Aérodrome de dégagement
→

2ND. ALTN AERODROME
2ème aérodrome de dégagement
→
<<≡

18 OTHER INFORMATION
Renseignements divers
—

)<<≡

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)
Renseignements complémentaires (À NE PAS TRANSMETTRE DANS LES MESSAGES DE PLAN DE VOL DÉPOSÉ)

19 ENDURANCE
Autonomie
HR. MIN
— E /

PERSONS ON BOARD
Personnes à bord
→ P /

EMERGENCY RADIO
Radio de secours
UHF VHF ELT
→ R / U V E

SURVIVAL EQUIPMENT/Équipement de survie
POLAR DESERT MARITIME JUNGLE
Polaire Désert Maritime Jungle
→ S / P D M J

JACKETS/Gilets de sauvetage
LIGHT FLUORES UHF VHF
Lampes Fluores
→ J / L F U V

DINGHIES/Canots
NUMBER CAPACITY COVER COLOUR
Nombre Capacité Couverture Couleur
→ D / → → C → <<≡

AIRCRAFT COLOUR AND MARKINGS
Couleur et marques de l'aéronef
A /

REMARKS
Remarques
→ N / <<≡

PILOT-IN-COMMAND
Pilote commandant de bord
C /)<<≡

FILED BY/Déposé par

SPACE RESERVED FOR ADDITIONAL REQUIREMENTS
Espace réservé à des fins supplémentaires

Figure 12.7 Exercise 2

Exercise 2

A non-scheduled flight is to be made from VENICE (N4530 E01221) LIPZ to TOULOUSE BLAGNAC (N4337 E00123) LFBO.

Route:	To join upper airways system at VICENZA (N4538 E01141) then UB4 - ST PREX - UB28 - PASSIERY - UB16 - LA TOUR - UG5 - GAILLAC- TOULOUSE BLAGNAC.
Flight Details:	Off blocks 0630 UTC Airborne 0645 UTC Allow 10 min from airborne to join airways at VICENZA, and 10 minutes GAILLAC to TOULOUSE VICENZA to SPR: TAS 450 kt; wind component -40 Flight level 310. SPR to GAI TAS 470 kt; wind component -15 Flight level 310.
Aircraft Type:	Airbus 310 (EA31)
Aircraft Weight:	Above 136 000 kg
Aircraft Registration:	G-BUSB
Operator:	British Airways
Identification:	BAW 780
Selcal Code:	HBSJ
Radio & Navigation Equipment:	Standard plus inertial navigation and RNP equipment.
SSR Equipment:	Transponder Mode ‘A’ - 4096 codes plus Mode ‘C’.
Flight Rules:	IFR
Type of Flight:	Non-schedule air transport
Alternate:	MARSEILLE (LFML)
ATC	Require times to AOSTA and PASSEIRY.

Supplementary Information:
Enough fuel for 6½ hours flying
Passengers TBN
Crew 12
ELBA (Emergency Locator Beacon) carried
Life jackets available equipped with emergency lights and VHF/UHF radio
Life rafts: 15 with yellow covers; each life raft capacity 20 people
Aircraft colour is blue and grey
No supplementary survival equipment is carried.

1. ICAO model flight plan form

FLIGHT PLAN
PLAN DE VOL

PRIORITY
Priorité
<<≡ FF →

ADDRESSEE(S)
Destinataire(s)

<<≡

FILING TIME
Heure de dépôt

ORIGINATOR
Expéditeur

→ <<≡

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR
Identification précise du(des) destinataire(s) et/ou de l'expéditeur

3 MESSAGE TYPE
Type de message
<<≡ (FPL

7 AIRCRAFT IDENTIFICATION
Identification de l'aéronef
—

8 FLIGHT RULES
Règles de vol
—

TYPE OF FLIGHT
Type de vol
<<≡

9 NUMBER
Nombre
—

TYPE OF AIRCRAFT
Type d'aéronef

WAKE TURBULENCE CAT.
Cat. de turbulence de sillage
/

10 EQUIPMENT
Équipement
— / <<≡

13 DEPARTURE AERODROME
Aérodrome de départ
—

TIME
Heure
<<≡

15 CRUISING SPEED
Vitesse croisière
—

LEVEL
Niveau

ROUTE
Route
→

<<≡

TOTAL EET
Durée totale estimée
HR. MIN

16 DESTINATION AERODROME
Aérodrome de destination
—

ALTN AERODROME
Aérodrome de dégagement
→

2ND. ALTN AERODROME
2ème aérodrome de dégagement
→ <<≡

18 OTHER INFORMATION
Renseignements divers
—

) <<≡

SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)
Renseignements complémentaires (À NE PAS TRANSMETTRE DANS LES MESSAGES DE PLAN DE VOL DÉPOSÉ)

19 ENDURANCE
Autonomie
HR. MIN
— E /

PERSONS ON BOARD
Personnes à bord
→ P /

EMERGENCY RADIO
Radio de secours
UHF VHF ELT
→ R / U V E

SURVIVAL EQUIPMENT/Équipement de survie
POLAR
Polaire
DESERT
Désert
MARITIME
Maritime
JUNGLE
Jungle
→ S / P D M J

JACKETS/Gilets de sauvetage
LIGHT
Lampes
FLUORES
Fluores
UHF
VHF
→ J / L F U V

DINGHIES/Canots
NUMBER
Nombre
CAPACITY
Capacité
COVER
Couverture
COLOUR
Couleur
→ D / → → C → <<≡

AIRCRAFT COLOUR AND MARKINGS
Couleur et marques de l'aéronef
A /

REMARKS
Remarques
→ N / <<≡

PILOT-IN-COMMAND
Pilote commandant de bord
C /) <<≡

FILED BY/Déposé par

SPACE RESERVED FOR ADDITIONAL REQUIREMENTS
Espace réservé à des fins supplémentaires

Figure 12.8 Exercise 3

Exercise 3

LONDON/STANSTED TO BIARRITZ

A non-scheduled flight is to be made from STANSTED (EGSS, N5153 E00014) to BIARRITZ (LFBZ, N4328 W00132)

Route:	Direct (DCT) to LAM, airways to BTZ and then as directed to land at BIARRITZ. **Airway UA34 is not available for this flight.**
Flight Details:	Off blocks 1515 UTC on a Tuesday. Take-off 1525 UTC Allow 15 minutes flight time Stanstead to LAM and 20 minutes from ENSAC for descent and approach to BIARRITZ Lowest Flight Levels above FL250 to be used TAS 310 kt Forecast wind 200°(M)/45 kt
Aircraft Type:	Boeing 737 (B737)
Aircraft Weight:	42 000 kg
Aircraft Registration:	G-WIZZ
Operator:	EASYJET
Identification:	BAW 780
Selcal Code:	HBSJ
Radio & Navigation Equipment:	Standard Mode C Transponder
SSR Equipment:	Transponder Mode 'A' - 4096 codes plus Mode 'C'.
Flight Rules:	IFR
Type of Flight:	Non-scheduled
Alternate:	LIMOGES (LFBL)

Using the above data identify the route and complete Items 7 and 18 of the flight plan.

Exercise 4

1. **Under what circumstances may an Aircraft Operator (AO) submit Repetitive Flight Plans (RPLs) rather than individual flight plans?**
When ..... flights are operated regularly on the same day(s) of consecutive weeks and on at least ...... occasions or every day over a period of at least ..... consecutive days. The elements of each flight shall have a high degree of .....

   a. IFR, ten, ten, stability
   a. VFR, seven, seven, familiarity
   b. IFR, seven, seven, familiarity
   c. VFR, ten, ten, stability

2. **What are the reasons for the format of the ICAO Flight Plan?**

   a. The format is internationally agreed, is printed in two languages, usually English and the language of the State concerned, to help ensure correct completion which is essential for electronic data transfer
   b. It is designed to fit into a standard pilot's bag, and have plenty of room for flight data
   c. The format ensures that minimum writing is required, to reduce pilot workload in flight
   d. The format is agreed between EC member states, for use in Europe only

3. **Which sections of a CA48 are not normally transmitted to other ATSUs?**

   i Addressees
   ii Items 3 to 18 - the main body of the message
   iii Supplementary information

   a. i only
   b. i and ii
   c. iii only
   d. None, all are always transmitted

4. **Normally, flight plans should be filed on the ground at least .... before clearance to start up is requested. Exceptionally, when it is not possible to meet this requirement, operators should .... and never ....**

   a. 30 minutes, give as much notice as possible, less than 60 minutes
   b. 60 minutes, give as much notice as possible, less than 30 minutes
   c. 3 hours, cancel the flight, cause such trouble again
   d. 3 hours, give as much notice as possible, 30 minutes

5. **Flight plans for flights affected by Air Traffic Flow Management (ATFM) rules, and in areas such as the North Atlantic, must be filed at least .... before EOBT.**

   a. 3 hours
   b. 1 hour
   c. 30 minutes
   d. Never less than 10 minutes

6. In the event of a delay in excess of .... of .... for a controlled flight, or a delay of .... for an uncontrolled flight for which a flight plan has been submitted, the flight plan should be amended or a new flight plan submitted and the old plan cancelled, whichever is appropriate.

a. 30 minutes, Estimated Off-block Time, 3 hours
b. 30 minutes, planned take off time, 1 hour
c. 60 minutes, planned take off time, 3 hours
d. 30 minutes, EOBT, 1 hour

7. If a pilot lands at an aerodrome other than the destination specified in the flight plan, he must:

a. ensure that all ATSUs which were addressees on the flight plan are notified of his landing
b. ensure that the ATSU at the original destination is informed within 60 minutes
c. ensure that the ATSU at the original destination is informed within 30 minutes
d. report to ATC to apologize

8. A current flight plan is:

a. The flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes
b. The flight plan, including changes, if any, brought about by subsequent clearances
c. The flight plan, including changes, if any, cleared prior to take off
d. The flight plan, including changes, if any, cleared prior to the aircraft's present position

9. A filed flight plan is:

a. the flight plan as filed with an ATS unit by the pilot or a designated representative, without any subsequent changes
b. the flight plan, including changes, if any, brought about by subsequent clearances
c. the flight plan, including changes, if any, cleared prior to take-off
d. the flight plan, including changes, if any, cleared prior to the aircraft's present position

10. ATC must be informed of changes which occur to the flight plan speed and ETA. Many nations stipulate their own limits but PANS-RAC require changes of ..... in TAS and .... of ETA be notified. Which answer fills the blanks correctly?

a. 3% 5 minutes
b. 5 kt 30 minutes
c. 5% More than 2 minutes
d. 3 kt 3 minutes

11. **A flight has filed a flight plan for a route starting on ATS routes and later leaving controlled airspace. It is "cleared via flight plan route". This means the flight is cleared to follow:**

    a. the flight planned route until leaving ATS routes and must then obtain further clearance
    b. the complete route without further ATC clearance
    c. the flight planned route only until the next FIR boundary
    d. the flight planned route only as far as the limit of control of the current ATS unit

12. **Who is responsible for processing a flight plan?**

    a. The ATS unit first receiving a flight plan
    b. The ATS unit in whose FIR the aircraft will fly first
    c. The ATS unit responsible for the aerodrome of departure
    d. The ATS unit responsible for takeoff clearance at the departure aerodrome

A trip time of 150 minutes has been calculated for a flight with an EOBT of 1000 UTC and an expected take-off time of 1020 UTC. The aircraft has a fuel reserve of 30%. Use this information to answer the following questions.

i 1000
ii 1020
iii 150
iv 195
v 0230
vi 0315

13. **What should be filled in at Item 13 of the flight plan?**

    a. i
    b. ii
    c. v
    d. vi

14. **What should be filled in at Item 16 of the flight plan?**

    a. iii
    b. iv
    c. v
    d. vi

15. **What should be filled in at Item 19 of the flight plan?**

    a. iii
    b. iv
    c. v
    d. vi

16. With reference to changes to RPLs. In the event that the destination airfield is changed the following action is taken:

a. The change is notified as early as possible and not later than 30 minutes before departure to the ATS reporting office responsible for the departure aerodrome
b. The change is notified as early as possible before departure to the ATS reporting office responsible for the departure aerodrome
c. The RPL shall be cancelled for the day concerned and an individual flight plan shall be submitted
d. The change may be notified by radio-telephony on initial contact with the ATS unit

Answers

Exercise 1

Item 7: GGRAD
Item 8: I, N
Item 9: Blank, B737, M
Item 10: SU/C
Item 13: EGSC, 0920
Item 15: N0330F250 ➔DCT LAM UB3 DVR UG1 SPI/N0350F290 UGI NTM UB6 MUN
Item 16: EDDM, 0140, EDDS
Item 18: EET/EBUR0029 OPR/CAMMAIR
Item 19: E/0230 P/124 R/Cross out U and V
Survival Equipment: Cross out P,D, J ➔ Jackets: Cross out F and V
➔ D/04 ➔ 128, ➔YELLOW
A/WHITE RED
Cross out N using an X

Exercise 2

Item 7: BAW780 ITEM 8: I, N ITEM 9: BLANK, EA31, H
Item 10: SIR/C ITEM13: LIPZ, 0630
Item 15: N0450F310 ➔ DCT VIC UB4 SPR UB28 PAS UB16 TDP UG5 GAI DCT TOU
Item 16: LFBO,0128, LFML
Item 18: EET/AOSTA0037 PAS0048 REG/GBUSB SEL/HBSJ
Item 19: E/0630 P/TBN R/Cross out U and V
Survival Equipment: Cross out P, D and J ➔ Jackets: Cross out F
➔ D/15 ➔ 300 ➔ YELLOW
A/ BLUE GREY
Cross out N using an X

Exercise 3

Item 7: GWIZZ ITEM 8: I, N ITEM 9: BLANK, B737, M
Item 10: S/C ITEM 13: EGSS, 1515
Item 15: N0310F260 ➔ DCT LAM UR1 ORTAC/N0310F270 UR14 DIN UA25 CGC UB19 ENSAC DCT
Item 16: LFBZ,0225, LFBL
Item 18: OPR/EASYJET
N.B. Initial FL260 acceptable.

Exercise 4

1	2	3	4	5	6	7	8	9	10	11	12
a	a	c	b	a	d	c	b	a	c	b	a

13	14	15	16
a	c	d	c

Annex 1 - Flight Plan

Extract from ICAO DOC 4444 (PANS - RAC) Dated 22 Nov 2007

Flight plan form

A flight plan form based on the model in Appendix 2* should be provided for and used by operators and air traffic services units for the purpose of completing flight plans.

(* Appendix 2 in this instance is found at page A2-1 PANS-RAC Doc 4444. Copies are also included in this chapter.) Note: A different form may be provided for use in completing repetitive flight plan listings.

The flight plan form should be printed and should include an English text in addition to the language(s) of the State concerned. Note: The Model Flight Plan Form in Appendix 2 is printed in English and one other of the languages of the Organization for illustration purposes.

Operators and air traffic services units should comply with the instructions for completion of a flight plan form and a repetitive flight plan listing form given in Appendix 2.

Note: The instructions for completing a flight plan form given in Appendix 2 may be conveniently printed on the inside cover of flight plan form pads, or posted in briefing rooms.

An operator unable to satisfy a prescribed route or area RNP* should, prior to departure, advise ATC of the RNP* types the aircraft is certified to meet.

(* *Required Navigation Performance (RNP) is a statement of the navigation performance accuracy necessary for operation within a defined airspace. RNP type is a containment value expressed as a distance in NM from the intended position within which flights would be for at least 95% of the total flying time. For example RNP 4 represents a navigation accuracy of +/- 4 NM on a 95% containment basis*)

Submission of a Flight Plan

Prior to departure

Except when other arrangements have been made for submission of repetitive flight plans, a flight plan submitted prior to departure should be submitted in person or by telephone to the air traffic services reporting office at the departure aerodrome. If no such unit exists at the departure aerodrome, the flight plan should be submitted by telephone or typewriter, or if these means are not available, by radio to the unit serving or designated to serve the departure aerodrome.

In the event of a delay of thirty (30) minutes in excess of the estimated off-block time for a controlled flight or a delay of one hour for an uncontrolled flight for which a flight plan has been submitted, the flight plan should be amended or a new flight plan submitted and the old flight plan cancelled, whichever is applicable.

During flight

A flight plan to be submitted during flight should normally be transmitted to the aeronautical telecommunication station serving the air traffic services unit in charge of the flight information region, control area, advisory area or advisory route in or on which the aircraft wishes to fly. When this is not practicable, it should be transmitted to another aeronautical telecommunication station for retransmission as required to the appropriate air traffic services unit.

Note: If the flight plan is submitted for the purpose of obtaining air traffic control service, the aircraft is required to wait for an air traffic control clearance prior to proceeding under the conditions requiring compliance with air traffic control procedures. If the flight plan is submitted for the purpose if obtaining air traffic advisory service, the aircraft is required to wait for acknowledgement of receipt by the unit providing the service.

Acceptance of a Flight Plan

The first air traffic services unit receiving a flight plan, or a change thereto, shall:

- Check it for compliance with the format and data conventions
- Check it for completeness and, to the extent possible, for accuracy
- Take action, if necessary, to make it acceptable to the air traffic services, and
- Indicate acceptance of the flight plan or change thereto, to the originator

General

RPLs (Repetitive Flight Plans) shall not be used for flights other than IFR flights operated regularly on the same day(s) of consecutive weeks and on at least ten consecutive occasions or every day over a period of at least ten consecutive days. The elements of each flight plan shall have a high degree of stability.

Note: Permissible incidental changes to RPL data affecting the operation for one particular day are not intended to be a modification of the listed RPL.

RPLs shall cover the entire flight from the departure aerodrome to the destination aerodrome. RPL procedures shall be applied only when all ATS authorities concerned with the flights have agreed to accept RPLs.

The use by States of RPLs for international flight shall be subject to the provision that the affected adjacent States either already use RPLs or will use them at the same time. The procedures for use between States shall be the subject of bilateral, multilateral or regional air navigation agreement as appropriate.

Changes to RPL Listings

Changes of a permanent nature

Changes of a permanent nature involving the inclusion of new flights and the deletion or modification of currently listed flights shall be submitted in the form of amendment listings. These listings shall reach the air traffic services agency concerned at least seven days prior to the change becoming effective.

Changes of a temporary nature

Changes of a temporary, non-recurring nature relating to RPLs concerning aircraft type and wake turbulence category, speed and/or cruising level shall be notified for each individual flight as early as possible and not later than 30 minutes before departure to the ATS reporting office responsible for the departure aerodrome. A change of cruising level only may be notified by radio-telephony on initial contact with the ATS unit.

In the case of an incidental change in the aircraft identification, the departure aerodrome, the route and/or the destination aerodrome, the RPL shall be cancelled for the day concerned and an individual flight plan shall be submitted.

Whenever it is expected by the operator that a specific flight, for which an RPL has been submitted, is likely to encounter a delay of 30 minutes or more in excess of the off-block time stated in that flight plan, the ATS unit responsible for the departure aerodrome shall be notified immediately.

Note: Because of the stringent requirements of flow control, failure by operators to comply with this procedure may result in the automatic cancellation of the RPL for that specific flight at one or more of the ATS units concerned.

Whenever it is known to the operator that any flight, for which an RPL has been submitted, is cancelled, the ATS unit responsible for the departure aerodrome shall be notified.

Operator/pilot Liaison

The operator shall ensure that the latest flight plan information, including permanent an incidental changes, pertaining to a particular flight and duly notified to the appropriate agency, is made available to the pilot in command.

Annex 2

Extract from ICAO DOC 4444 (PANS - RAC) Appendix 2
Flight Plan

Instructions for the completion of the flight plan form:

General

Adhere closely to the prescribed formats and manner of specifying data.

Commence inserting data in the first space provided. Where excess space is available leave unused spaces blank.

Insert all clock times in *4 figures* UTC.

Insert all estimated elapsed times in 4 figures (hours and minutes).

Shaded area preceding item 3 to be completed by ATS and COM services, unless the responsibility for originating flight plan messages has been delegated.

Note: The term"aerodrome" where used in the flight plan is intended to cover also sites other than aerodromes which may be used by certain types of aircraft; e.g. helicopters or balloons.

Instructions for Insertion of ATS Data

Complete Items 7 to 18 as indicated hereunder.

Complete also Item 19 as indicated hereunder, when so required by the appropriate ATS authority or when otherwise deemed necessary.

Note: Item numbers on the form are not consecutive, as they correspond to Field Type numbers in ATS messages.

Item 7: Aircraft Identification

(MAXIMUM 7 CHARACTERS)

INSERT one of the following aircraft identifications, not exceeding 7 characters:

- The registration marking of the aircraft (e.g., EIAKO 4XBCD N2567GA) when:
    - In radio-telephony the call sign to be used by the aircraft will consist of this identification alone (e.g. OOTEK), or preceded by the ICAO telephony designator for the aircraft operating agency (e.g. SABENA OOTEK)
    - The aircraft is not equipped with radio, OR
- The ICAO designator for the aircraft operating agency followed by the flight identification (e.g. KLM511, NGA213, JTR25) when in radio-telephony the call sign to be used by the aircraft will consist of the ICAO telephony designator for the operating agency followed by the flight identification (e.g. KLM511, NIGERIA 213, HERBIE 25).
-

Note: *Provisions for the use of radio-telephony call signs are contained in ICAO Annex 10. Volume II Chapter 5 (not published herein). Designators and telephony designators for aircraft operating agencies are contained in ICAO 8585 - Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services (not published herein).*

Item 8: Flight Rules and Type of Flight
(ONE OR TWO CHARACTERS)

FLIGHT RULES
INSERT one of the following letters to denote the category of flight rules with which the pilot intends to comply:

I if IFR V if VFR

Y if IFR first
Z if VFR first
and specify in Item 15 the point or points where a change of flight rules is planned.

Type of Flight
INSERT one of the following letters to denote the type of flight when so required by the appropriate ATS authority:

S if scheduled air service
N if non-scheduled air transport operation
G if general aviation
M if military
X if other than any of the defined categories above.

Item 9: Number and Type or Aircraft and Wake Turbulence Category
NUMBER OF AIRCRAFT (1 OR 2 CHARACTERS)

INSERT the number of aircraft, if more than one.

TYPE OF AIRCRAFT (2 TO 4 CHARACTERS)

INSERT the appropriate designator as specified in ICAO Document 8643 - Aircraft Type Designators (not published herein); or if no such designator has been assigned, in case of formation flights comprising more than one type:

INSERT *ZZZZ*, and ***SPECIFY*** in Item 18, the (numbers and) type(s) of aircraft preceded by TYP/...

WAKE TURBULENCE CATEGORY (1 CHARACTER)

INSERT an oblique stroke followed by one of the following letters to indicate the wake turbulence category of the aircraft:

H - HEAVY, to indicate an aircraft type with a maximum certificated take-off mass of 136 000 kg or more;

M - MEDIUM, to indicate an aircraft type with a maximum certificated take-off mass of less than 136 000 kg but more than 7000 kg;

L - LIGHT, to indicate an aircraft type with a maximum certificate take-off mass of 7000 kg or less.

Item 10: Equipment

RADIO COMMUNICATION, NAVIGATION AND APPROACH AID EQUIPMENT
INSERT one letter as follows:

N if no COM/NAV/approach aid equipment for the route to be flown is carried, or the equipment is unserviceable; or S if standard COM/NAV/approach aid equipment for the route to be flown is carried and serviceable (*see Note 1*).

AND/OR

INSERT one or more of the following letters to indicate the COM/NAV approach aid equipment available and serviceable:

A (Not allocated)	M Omega
B (Not allocated)	O VOR
C LORAN C	P (Not allocated)
D DME	Q (Not allocated)
E (Not allocated)	R RNP type certification (Required Nav Performance) F
ADF	(see Note 5)
G (GNSS)	T TACAN
H HF RTF	U UHF RTF
I Inertial Navigation	V VHF RTF
J (Data Link)	W)
(See Note 3)	X) when prescribed by ATS
K (MLS)	Y)
L (ILS)	Z Other equipment carried (See Note 2)

NOTE:

1. *Standard equipment is considered to be VHF RTF, ADF, VOR, and ILS, unless another combination is prescribed by the appropriate ATS authority.*
2. *If the letter Z is used, specify in Item 18 the other equipment carried, preceded by COM/... and/or NAV ..., as appropriate.*
3. *If the letter J is used, specify in Item 18 the equipment carried, preceded by DAT/... followed by one or more letters as appropriate.*
4. *Information on navigation capability is provided to ATC for clearance and routing purposes.*
5. *Inclusion of R indicates that an aircraft meets the RNP type prescribed for the route segment(s), route(s) and/or area concerned.*

Surveillance Equipment

INSERT one or two of the following letters to describe the serviceable surveillance equipment carried:

SSR equipment: N Nil
A Transponder - Mode A (4 digits - 4096 codes)
C Transponder - Mode A (4 digits - 4096 codes and Mode C
X Transponder - Mode S without both aircraft identification and pressure-altitude transmission
P Transponder - Mode S, including pressure altitude transmission, but no aircraft identification transmission
I Transponder - Mode S, including aircraft identification transmission, but no pressure-altitude transmission
S Transponder - Mode S, including both pressure-altitude and aircraft identification transmission.
ADS equipment:
D ADS capability

Item 13: Departure Aerodrome and Time (8 Characters)

INSERT the ICAO four-letter location indicator of the departure aerodrome, or if no location indicator has been assigned,

INSERT ZZZZ and ***SPECIFY***, in Item 18, the name of the aerodrome preceded by DEP/……

OR, If the flight plan is received from an aircraft in flight,

INSERT AFIL, and ***SPECIFY***, in Item 18, the ICAO four-letter location indicator of the location of the ATS unit from which supplementary flight plan data can be obtained, preceded by DEP/…

THEN WITHOUT A SPACE

INSERT for a flight plan submitted before departure, the estimated off-block time,

OR, for a flight plan received from an aircraft in flight, the actual or estimated time over the first point of the route to which the flight plan applies.

Item 15: Route

INSERT *the first cruising speed* and the *first cruising level*, without a space between them.

THEN, following the arrow,

INSERT the route description.

- **CRUISING SPEED** (MAXIMUM 5 CHARACTERS)

INSERT the True Airspeed for the first or the whole of the cruising portion of the flight, in terms of:

Kilometres per hour, expressed as K followed by 4 figures (e.g. K0830); or

Knots, expressed as N followed by 4 figures (e.g. N0485); or

Mach Number, when so prescribed by the appropriate ATS authority, to the nearest hundredth of unit Mach, expressed as M followed by 3 figures (e.g. M082)

- **CRUISING LEVEL** (MAXIMUM 5 CHARACTERS)

INSERT the planned cruising level for the first or the whole portion of the route to be flown, in terms of:

Flight Level, expressed as F followed by 3 figures (e.g. F085, F330); or

Standard Metric Level in tens of metres, when so prescribed by the appropriate ATS authorities, expressed as S followed by 4 figures (e.g. S1130); or

Altitude in hundreds of feet, expressed as A followed by 3 figures (e.g. A045, A100); or

Altitude in tens of metres, expressed as M followed by 4 figures (e.g. M0840); or

For uncontrolled VFR flights, the letters VFR.

- **ROUTE (INCLUDING CHANGES OF SPEED, LEVEL AND/OR FLIGHT RULES)**

Flights Along Designated ATS Routes

INSERT, if the departure aerodrome is located on, or connected to the ATS route, the designator of the first ATS route;

OR, if the departure aerodrome is not on, or connected to the ATS route, the letters DCT followed by the point of joining the first ATS route, followed by the designator of the ATS route.

THEN

INSERT each point at which either a change of speed or level, a change of ATS route, and/or a change of flight rules is planned.

Note: When a transition is planned between a lower and upper ATS route and the routes are oriented in the same direction, the point of transition need not be inserted.

FOLLOWED IN EACH CASE

By the designator of the next ATS route segment, even if the same as the previous one;

OR, by DCT, if the flight to the next point will be outside a designated route, unless both points are defined by geographical co-ordinates.

Flights Outside Designated ATS Routes

INSERT points normally not more than 30 minutes flying time or 370 km (200 NM) apart, including each point at which a change of speed or level, a change of track, or a change of flight rules is planned;

OR, when required by appropriate ATS authority(ies).

DEFINE the track of flights operating predominantly in an east-west direction between 70°N and 70°S by reference to significant points formed by the intersections of half or whole degrees of latitude with meridians spaced at intervals of 10 degrees of longitude. For flights operating in areas outside those latitudes the tracks shall be defined by significant points formed by the intersection of parallels of latitude with meridians normally spaced at 20 degrees of longitude. The distance between significant points shall, as far as possible, not exceed one hour's flight time. Additional significant points shall be established as deemed necessary.

For flights operating predominantly in a north-south direction, define tracks by reference to significant points formed by the intersection of whole degrees of longitude with specified parallels of latitude which are spaced at 5 degrees.

INSERT DCT between successive points unless both points are defined by geographical co-ordinates or by bearing and distance.

- **ATS ROUTE** (2 to 7 CHARACTERS)

The coded designator assigned to the route or route segment including, where appropriate, the coded designator assigned to the standard departure or arrival route (e.g. BCN1, B1, R14, UB10, KODAP2A).

Note: Provisions for the application of route designators are contained in Annex 11, Appendix 1 (not published herein), whilst guidance material on the application of an RNP type to a specific route segment(s), route(s) or area, is contained on the Manual on Required Navigation Performance (RNP), Doc 9613 (not published herein).

- **SIGNIFICANT POINT** (2 to 11 CHARACTERS)

The coded designator (2 to 5 characters) assigned to the point (e.g. LN, MAY, HADDY); or if no coded designator has been assigned, one of the following ways:

Degrees only (7 characters)
2 figures describing latitude in degrees, followed by “N” (North) or “S” (South), followed by 3 figures describing longitude in degrees, followed by “E” (East) or “W” (West). Make up the correct number of figures where necessary, by insertion of zeros; e.g. 46N078W.

Degrees and minutes (11 Characters)
4 figures describing latitude in degrees and minutes followed by”N” (North) or “S” (South, followed by 5 figures describing longitude in degrees and tens and units of minutes, followed by “E” (East) or “W” (West). Make up the correct number of figures, where necessary, by insertion of zeroes; e.g. 4620N07805W.

Bearing and distance from a navigation aid
The identification of the navigation aid (normally a VOR), in the form of 2 or 3 characters,
THEN
the bearing from the aid in the form on 3 figures giving degrees magnetic,
THEN
the distance from the aid in the form of 3 figures expressing nautical miles. Make up the correct number of figures, where necessary, by insertion of zeros; e.g., a point 180° magnetic at a distance of 40 nautical miles from VOR “DUB” should be expressed as DUB180040.

- **CHANGE OF SPEED OR LEVEL** (MAXIMUM 21 CHARACTERS)

The point at which a change of speed (5% TAS or 0.01 Mach or more) or a change of level is planned, expressed exactly as above, followed by *an oblique stroke and both the cruising speed and the cruising level*, expressed exactly as previously, without a space between them, *even when only one of these quantities will be changed*.

Examples: LN/N0284A045
MAY/N0305F180
HADDY/N0420F330
4602N07805W/N0500F350
46N078W/M082F330
DUB180040/N0350M0840

- **CHANGE OF FLIGHT RULES** (MAXIMUM 3 CHARACTERS)

The point at which the change of flight rules is planned, expressed exactly as above as appropriate, *followed by a space and one of the following*:

VFR if from IFR to VFR IFR if from VFR to IFR

Examples: LN VFR
LN/N0284A050 IFR

- **CRUISE CLIMB** (MAXIMUM 28 CHARACTERS)

The letter "C" followed by an oblique stroke;

THEN
the point at which cruise climb is planned to start; expressed exactly as above, followed by an oblique stroke;

THEN
the speed to be maintained during cruise climb , expressed exactly as in a. above, followed by the two levels defining the layer to be occupied during cruise climb, each level expressed exactly as previously, or on the level above which cruise climb is planned followed by the letters "PLUS", without a space between them.

Examples:
C/48N050W/M082F290F350
C/48N050W/M082F290PLUS
C/52N050W/M220F580F620

Item 16: Destination Aerodrome and Total Estimated Elapsed Time, Alternate Aerodrome(s)

DESTINATION AERODROME AND TOTAL ESTIMATED ELAPSED TIME (8 Characters)
INSERT the ICAO four-letter location indicator of the destination aerodrome followed, without a space, by the total established time; or

If no location indicator has been assigned,

INSERT ZZZZ followed, without a space, by the total estimated elapsed time, and ***SPECIFY*** in Item 18 the name of the aerodrome, preceded by DEST/...

Note: For a flight plan received from an aircraft in fight, the total estimated elapsed time is the estimated time from the first point of the route to which the flight plan applies.

ALTERNATE AERODROME(S) (4 CHARACTERS)
INSERT the ICAO four-letter location indicator(s) of not more then two alternate aerodromes, separated by a space; or

if no location indicator has been assigned to the alternate aerodrome,
INSERT ZZZZ and ***SPECIFY*** in item 18 the name of the aerodrome, preceded by ALTN/....

Item 18: Other Information

INSERT 0 (zero) if no other information, or any other necessary information in the preferred sequence shown hereunder, in the form of the appropriate indicator followed by an oblique stroke and the information to be recorded:

EET/ Significant points or FIR boundary designators and accumulated estimated elapsed times to such points or FIR boundaries, when so prescribed on the basis of air navigation agreements, or by the appropriate ATS authority.

Examples:
EET/CAP0745 XYZ0830
EET/EINN0204

RIF/ The route details to the revised destination aerodrome, followed by the ICAO four-letter location indicator of the aerodrome. The revised route is subject to re-clearance in flight.

Examples:
RIF/DTA HEC KLAX
RIF/ESP G94 CLA APPH
RIF/LEMD

REG/ The registration markings of the aircraft, if different from the aircraft identification in Item 7.

SEL/ SELCAL Code, if so prescribed buy the appropriate ATS authority.

OPR/ Name of the operator, if not obvious from the aircraft identification in Item 7.

STS/ Reason for special handling by ATS; e.g. hospital aircraft, one engine inoperative; e.g. STS/HOSP, STS/ONE Eng INOP.

TYP/ Type(s) of aircraft, preceded if necessary by number(s) of aircraft if ZZZZ is inserted in Item 9.

PER/ Aircraft performance data, if so prescribed by the appropriate ATS authority.

COM Significant data related to link capability, using one or more of the letters S, H, V and M; e.g. DAT/S for satellite data link, DAT/H for HF data link; DAT/V for VHF data link; DAT/M for SSR Mode S data link.

DAT/ Significant data related to navigation equipment as required by the appropriate ATS authority.

NAV/ Significant data related to navigation equipment as required by the appropriate ATS authority.

DEP/ Name of departure aerodrome, if ZZZZ is inserted in Item 13, or the ICAO four-letter location indicator of the location of the ATS unit from which supplementary flight plan data can be obtained, if AFIL is inserted in Item 13.

DEST/ Name of destination aerodrome, if ZZZZ is inserted in Item 16. ALTN/Name of destination aerodrome(s), if ZZZZ is inserted in Item 16. RALT/Name of en route alternate aerodrome(s).

RMK/ Any other plain language remarks when required by the appropriate ATS authority or deemed necessary.

Item19: Supplementary Information

ENDURANCE

After **E**/ ***INSERT*** a 4-figure group giving the fuel endurance in hours and minutes.

PERSONS ON BOARD

After **P**/ ***INSERT*** the total number of persons (passengers and crew) on board, when required by the appropriate ATS authority. ***INSERT*** TBN (to be notified) if the total number of persons in not known at the time of filing.

EMERGENCY AND SURVIVAL EQUIPMENT

R/ (RADIO)

CROSS OUT U if UHF on frequency 243.0 MHz is not available.
CROSS OUT V if VHF on frequency 121.5 MHz is not available
CROSS OUT E if emergency locator transmitter (ELT) is not available.

S/ (SURVIVAL EQUIPMENT)

CROSS OUT all indicators if survival equipment is not carried.
CROSS OUT P if polar survival equipment is not carried.
CROSS OUT D if desert survival equipment is not carried.
CROSS OUT M if maritime survival equipment is not carried.
CROSS OUT J if jungle survival equipment is not carried.

J/ (JACKETS)

CROSS OUT all indicators if life jackets are not carried.
CROSS OUT L if life jackets are not equipped with lights.
CROSS OUT F if life jackets are not equipped with fluorescein.
CROSS OUT U or V or both as in R/ above to indicate radio capability of jackets, if any.

D/ (DINGHIES) (NUMBER)

CROSS OUT indicators D and C if no dinghies are carried, or
INSERT number of dinghies carried; and (CAPACITY)
INSERT total capacity, in persons, of all dinghies carried; and (COVER)
CROSS OUT indicator C if dinghies are not covered; and (COLOUR)
INSERT colour of dinghies if carried.
A/(AIRCRAFT COLOUR AND MARKINGS)
INSERT colour of aircraft and significant markings.

N/ (REMARKS)

CROSS OUT indicator N if no remarks, or ***INDICATE*** any other remarks regarding survival equipment.
C/ (PILOT)
INSERT name of pilot in command.

Filed by

INSERT the name of the unit, agency or person filing the flight plan.

Instructions for the Completion of a Repetitive Flight Plan (RPL) Listing Form

General

List only flight plans that will operate in accordance with IFR. (Flight rules I in FPL format). It is assumed that all aircraft are operating as scheduled flights (Type of flight S in FPL format). otherwise *notify* in Q (Remarks).

It is assumed that all aircraft operating on RPLs are equipped with 4096-code transponders with modes A and C. Otherwise, notify in Q (Remarks).

List flight plans in *alphabetical order of location indicator of the departure aerodrome*.

List flight plans for each departure aerodrome in chronological order of estimated off-block times

Adhere closely to the data conventions as per the Flight Plan form.

Insert all clock times in 4 figures UTC.

Insert all estimated elapsed times in 4 figures (hours and minutes).

Insert data on a separate line for each segment of operations with one or more stops; i.e. from any departure aerodrome to the next destination aerodrome even though call sign or flight number is the same for multiple segments.

Clearly identify additions and deletions in accordance with Item H. Subsequent listings shall list the corrected and added data, and deleted flight plans shall be omitted.

Number pages by indicating number of page and total number of pages in submission.

Utilize more than one line for any RPL where the space provided for items O and Q on one line is not sufficient.

A flight shall be cancelled as follows:

- Indicate a minus sign in item H followed by all other items of the cancelled flight

- Insert a subsequent entry denoted by a plus sign in item H and the date of the last flight in item J, with all other items of the cancelled flight unchanged.

Modifications of the flight shall be made as follows:

- Carry out the cancellation as detailed above
  and

- Insert a third entry giving the new flight plan(s) with the appropriate items modified as necessary, including the new validity dates in items I and J.

Instructions for insertion of RPL data

Item A: OPERATOR

Insert name of operator.

Item B: ADDRESSEE(S)

Insert name of agency(ies) designated by the States to administer RPLs for areas of responsibility concerned with the route of flight.

Item C: DEPARTURE AERODROME(S)

Insert location indicator(s) of departure aerodromes.

Item D: DATE

Insert on each page of submission the date (year, month, day) in a six figure group that the listing was submitted .

Item E: SERIAL NUMBER

Insert serial number of submission (2 numerics) indicating last two digits of year, a dash, and the sequential No. of the submission for the year indicated (start with numeral 1 each new year).

Item F: PAGE OF

Insert page number and total number of pages submitted.

Item G: SUPPLEMENTARY DATA AT

Insert name of contact where information normally provided under Item 19 of the FPL is kept readily available and can be supplied without delay.

Item H: ENTRY TYPE

Insert a minus sign (-) for each flight plan that is to be deleted from the listing.

Insert a plus sign (+) for each initial listing and, in the case of subsequent submissions, for each flight plan not listed in the previous submission.

Note: No information is required under this item for any flight plan which is unchanged from the previous submission.

Item I: VALID FROM

Insert first date (year, month, day) upon which the flight is scheduled to operate.

Item J: VALID UNTIL

Insert last date (year, month, day) upon which the flight is scheduled to operate as listed, or UFN if duration is unknown.

Item K: DAYS OF OPERATION

Insert number corresponding to the day of the week in the appropriate column; Monday = 1.

Insert 0 for each day of non-operation in the appropriate column.

Item L: AIRCRAFT IDENTIFICATION (Item 7 ICAO flight plan)

Insert aircraft identification to be used for the flight.

Item M: TYPE OF AIRCRAFT AND WAKE TURBULENCE CATEGORY (Item 9 ICAO flight plan)

Insert appropriate ICAO designator as specified in ICAO Doc 8643 - Aircraft Type Designators.

Insert H, M or L indicator as appropriate:

H - HEAVY to indicate an aircraft type with a maximum certificated take-off mass of 136 000 kg or more.

M - MEDIUM to indicate an aircraft type with a maximum certificated take-off mass of less than 136 000 kg but more than 7000 kg.

L - LIGHT to indicate an aircraft type with a maximum certificated take-off mass of 7000 kg or less.

Item N: DEPARTURE AERODROME AND TIME (Item 13 ICAO flight plan)

Insert location indicator of the departure aerodrome.

Insert the off-block time, i.e. the estimated time that the aircraft will commence movement associated with departure.

Item O: ROUTE (Item 15 ICAO flight plan)

Insert:

- Cruising speed; the true airspeed for the first part of the whole cruising portion of the flight in accordance with Item 15 (a) of the ICAO flight plan.

- Cruising level; the planned cruising level for the first or whole portion of the route in accordance with Item 15 (b) of the ICAO flight plan.

- Route; the entire route in accordance with Item 15 (c) of the ICAO flight plan.

Item P: DESTINATION AERODROME AND TOTAL ESTIMATED ELAPSED TIME (Item 16 of the ICAO flight plan)

Insert location indicator of the destination aerodrome.

Insert the total elapsed time.

Item Q: REMARKS

Insert items of information as required by the appropriate ATS authority, normally notified in Item 18 of the ICAO flight plan and any other information pertinent to the flight of concern to ATS.

Chapter

13

Point of Equal Time (PET)

Introduction

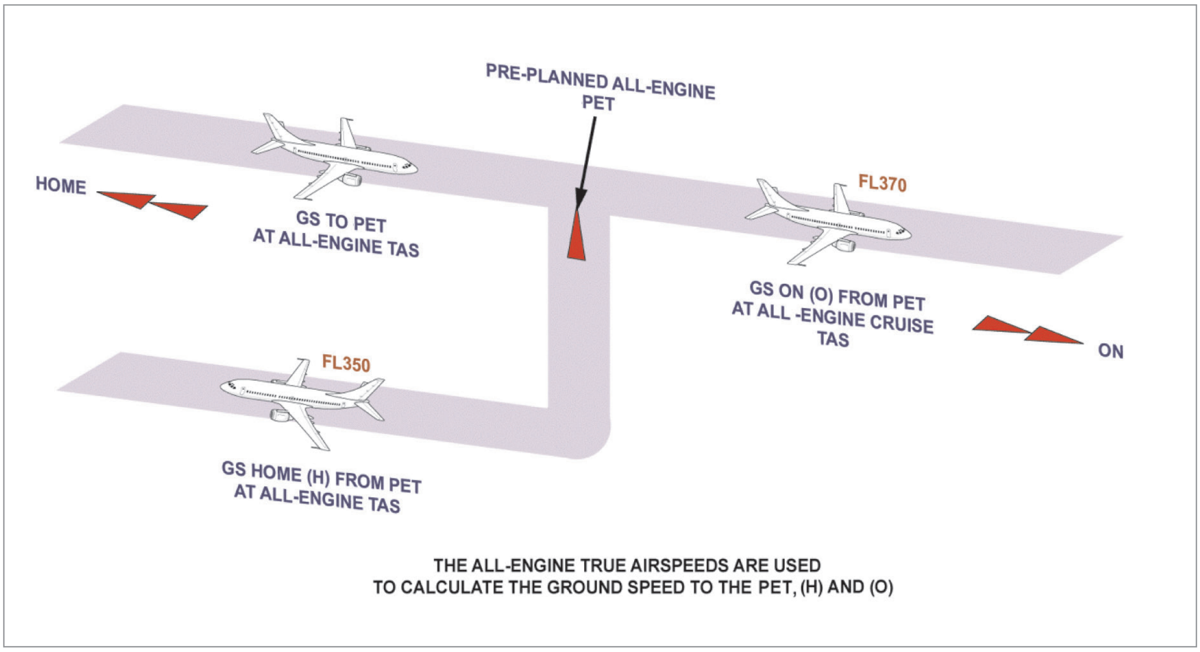


Figure 13.1 All-engine Point of Equal Time (critical point)

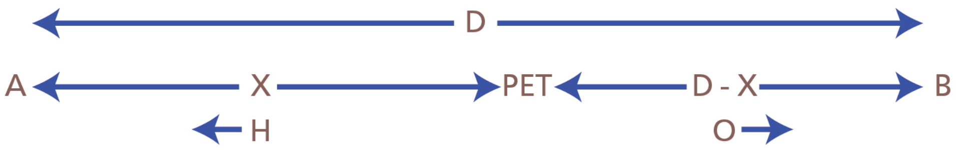
The Point of Equal Time (PET), or sometimes referred to as Critical Point (CP) or Equal Time Point (ETP), is that track position, in relation to two suitable airfields, from which it is **the same time** for an aircraft to fly to either. These two airfields could be the departure and destination airfields, or any two airfields situated suitably in relation to the aircraft's track.

The PET allows the pilot to decide quickly which of the two diversion airfields is the **closer in time** if there is a failure of an engine or a major system, or other event such as a serious illness on board. The fuel loaded for a flight (trip fuel, contingency allowance, holding and alternate fuel etc.) will be sufficient always for the aircraft to fly from the PET to either nominated airfield. **The PET is a time problem**. To make the time HOME from the PET equal to the time ON from the PET the two distances will be different, unless there is zero wind; in which case they are equal.

Routes over the oceans or remote parts of the world, where, in the event of an emergency, there is a scarcity of suitable en route diversions within reasonable flying time from any point on the proposed track, may necessitate the calculation of a PET between departure and destination airfields and those en route that are adequate.

For instance, a limit has been set on the distance a twin may be from an adequate airfield. This distance will be equal to one hour's flight time, in still air, at the normal one-engine-inoperative cruise speed. Any operation planned beyond this distance from an adequate aerodrome is considered to be Extended Range Operations (EROPS) or Extended Twin Operations (ETOPS). Approved ETOPS requires the calculation of PETs between adequate airfields.

Derivation of Formula



D	= Total Distance
X	= Distance to PET from A
D - X	= Distance from PET to B
H	= Ground speed HOME from PET
O	= Ground speed ON from the PET

By definition TIME HOME = TIME ON and TIME = $\dfrac{\text{DISTANCE}}{\text{GROUND SPEED}}$

$$\frac{X}{H} = \frac{D - X}{O}$$

$$XO = H(D - X)$$

$$XO = HD - HX$$

$$XO + XH = HD$$

$$X(O + H) = HD$$

$$X = \frac{DH}{O + H}$$

Transposition to the navigation computer:

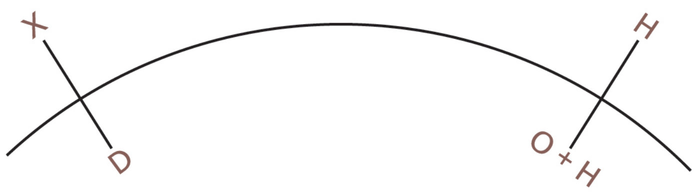


Figure 13.2 All-engine Point of Equal Time (critical point)

The Effect of Wind on the Position of the PET:

Let A to B total distance D = 500 NM and TAS = 300 kt.

STILL AIR **X**

$$= \frac{500 \quad \times}{+}$$

$$= \frac{500 \times 300}{300 + 300} = 250\ \text{NM}$$

= **HALFWAY**

60 kt HEADWIND **X**

$$= \frac{500 \quad \times}{+}$$

$$= \frac{500 \times 360}{240 + 360} = 300\ \text{NM}$$

= **Greater than HALFWAY**

60 kt TAILWIND **X**

$$= \frac{500 \quad \times}{+}$$

$$= \frac{500 \times 240}{360 + 240} = 200\ \text{NM}$$

= **Less than HALFWAY**

- **In still air the PET is HALFWAY**
- **If there is a wind then the PET moves INTO WIND**
- **The stronger the wind the greater the movement INTO WIND**
- **A gross error check. If you have a headwind component outbound the PET has to be more than halfway between departure and destination**

Single Sector All-engine PET

Fill in the ground speed rectangles at *Figure 13.3* and calculate the distance and time to the all-engine PET.

Wind Component A to the PET is +45 kt

Wind Component PET to B is -10 kt

The all-engine TAS	475 kt
Engine failure TAS	380 kt
The route distance	2050 NM

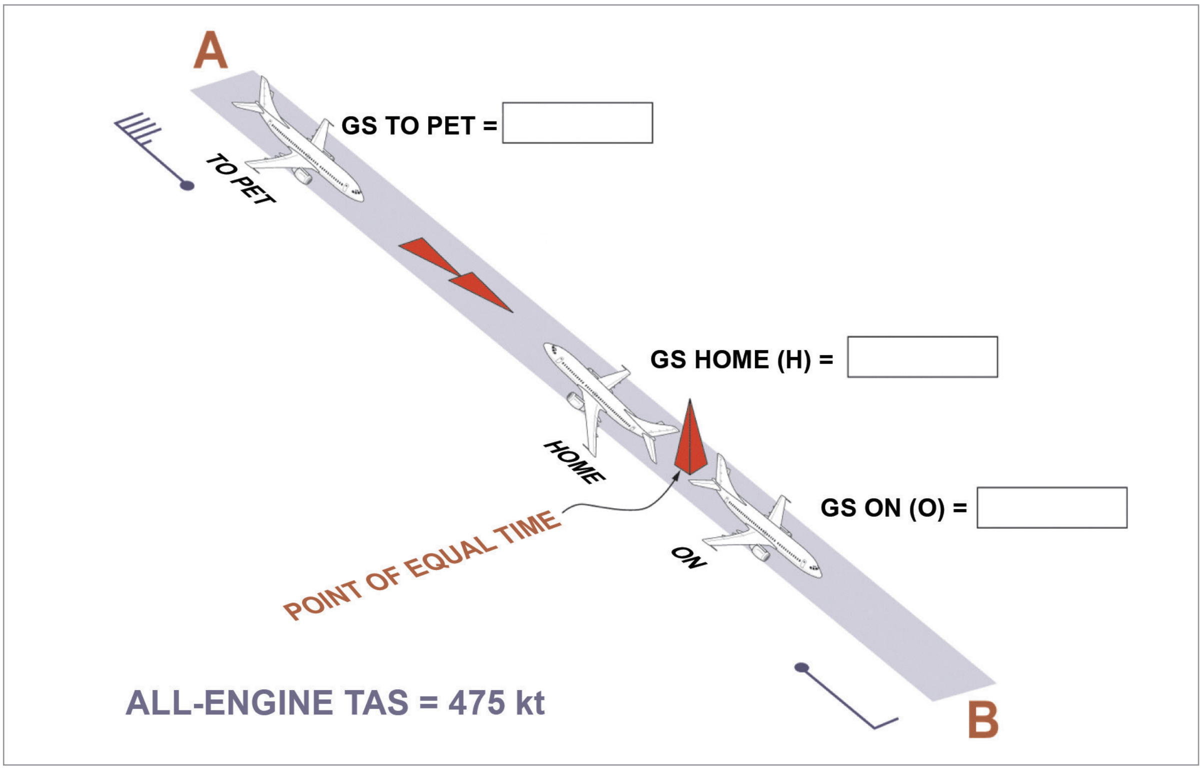


Figure 13.3 Example all-engine single leg PET

GS H	475 - 45 = 430
GS On	475 - 10 = 465
GS out to PET	475 + 45 = 520

$$X = \frac{2050 \times 430}{465 + 430} = 985 \text{ NM}$$

985 NM @ GS out 520 = 113.5 min

Engine Failure PET

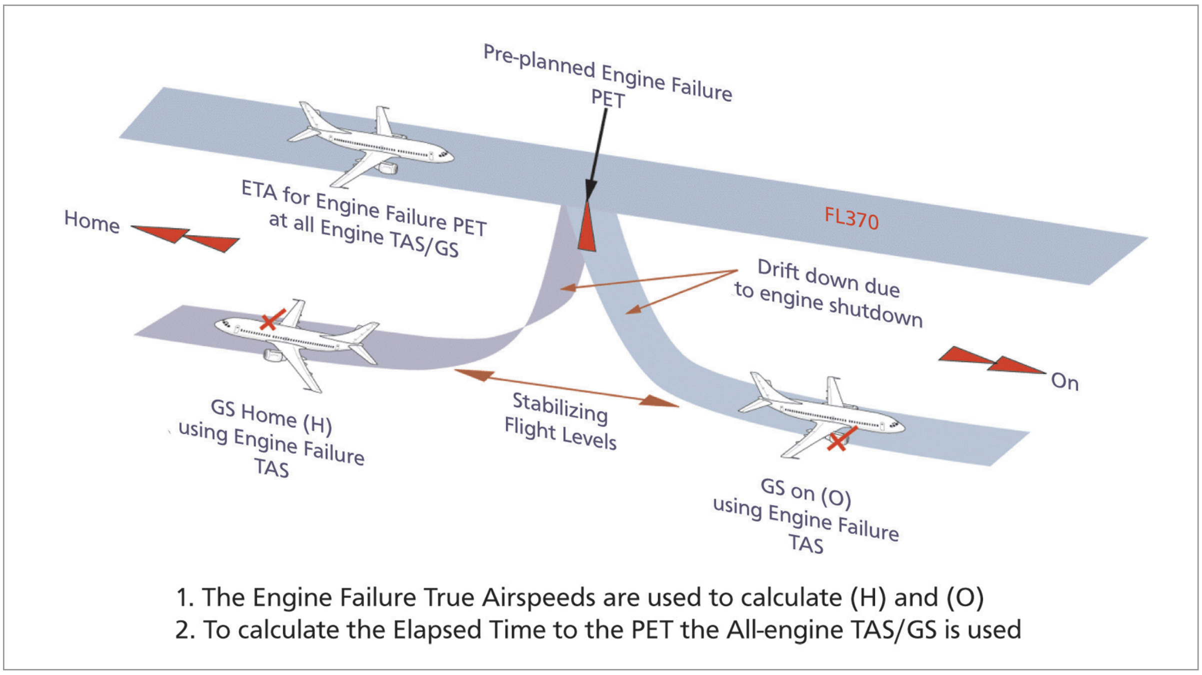


Figure 13.4 Engine failure Point of Equal Time

The loss of a power unit will necessitate invariably a "drift down" to a stabilizing pressure altitude where the aircraft will either continue ON, or return HOME, at the reduced engine failure TAS/GS, depending on whether the failure occurred before or after the ETA (computed at the all-engine TAS/GS) for the engine failure PET. If the engine failure happened at the PET then, in theory, the pilot could choose to fly to either airfield as the flight times are equal.

With reference to *Figure 13.5* fill in the ground speed rectangles and calculate the distance and time to the engine failure PET.

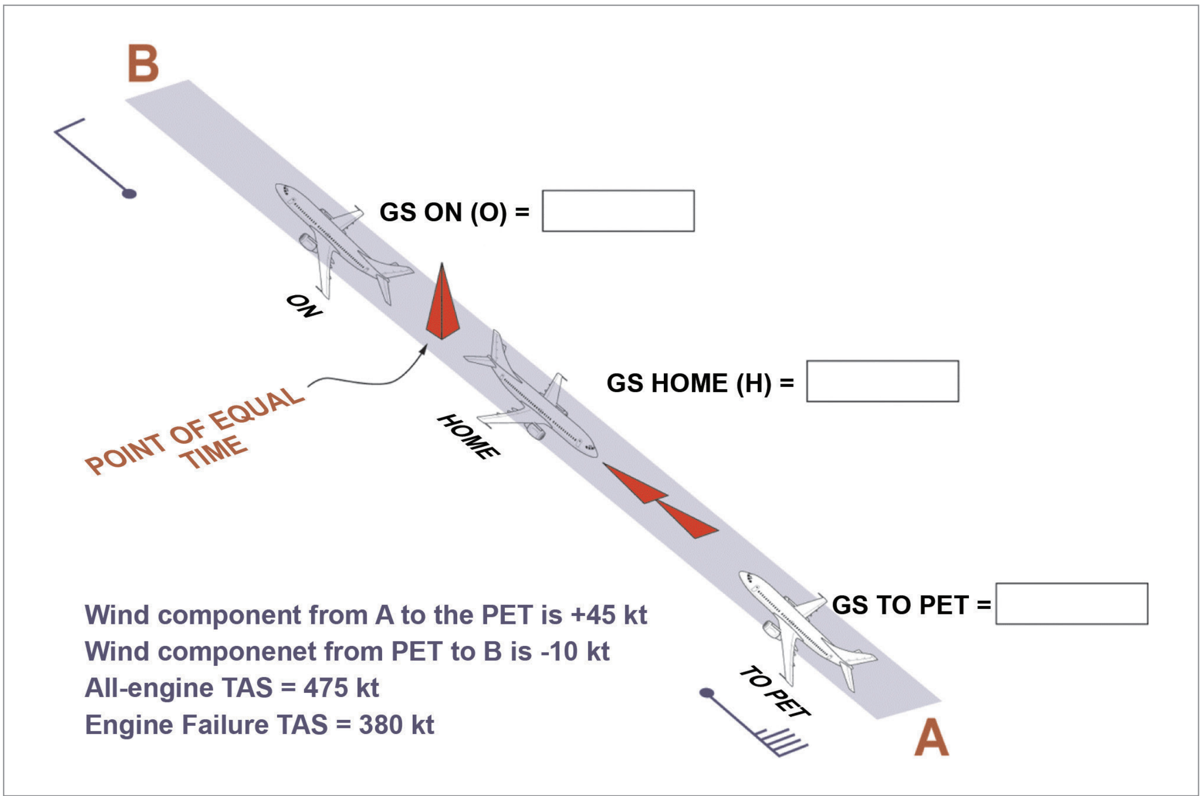


Figure 13.5 Example engine failure PET single leg

GS H 380 - 45 = 335

GS On 380 - 10 = 370

GS out to PET 475 + 45 = 520

$$X = \frac{2050 \times 335}{370 + 335} = 974 \text{ NM}$$

974 NM @ GS out 520 = 112.5 min

The difference in distance between an all-engine and engine failure PET can be seen to be very small, even though in these two examples there was a difference in all-engine and engine failure TAS of 95 kt. Thus an engine failure PET is normally constructed, which may then be used for serious occurrences other than power unit failure.

To calculate the distance X to **an engine failure PET use the engine failure TAS to calculate O and H** in the formula.

To calculate the distance X to an all-engine PET use the all-engine TAS to calculate O and H in the formula.

To calculate the time to fly **to an all-engine or an engine failure PET use the all-engine TAS to calculate the ground speed from the departure point to the PET**.

Questions - 1

1. **Given:**

Distance from A to B	**1200 NM**
GS On	**230 kt**
GS Home	**170 kt**

What is the distance and time to the PET from "A"?

a.	600 NM	2 h 37 min
b.	510 NM	2 h 13 min
c.	690 NM	3 h
d.	510 NM	3 h

2. **Given:**

Distance from A to B	**3200 NM**
GS On	**480 kt**
GS Home	**520 kt**

What is the distance and time to the PET from "A"?

a.	1664 NM	3 h 12 min
b.	1600 NM	3 h 20 min
c.	1664 NM	3 h 28 min
d.	1536 NM	3 h 12 min

3. **Given:**

TAS	**400 kt**
Distance from A to B	**2000 NM**

A 40 kt headwind is forecast from A to B

What is the distance and time to the PET from "A"?

a.	1100 NM	3 h 03 min
b.	1100 NM	2 h 30 min
c.	900 NM	2 h 30 min
d.	1000 NM	2 h 47 min

4. **Given:**

TAS	**165 kt**
W/V	**090°/35**
A to B	**1620 NM**
Course	**035°**

What is the distance and time to the PET from "A"?

a.	903 NM	6 h 04 min
b.	810 NM	5 h 42 min
c.	708 NM	5 h
d.	912 NM	6 h 26 min

5. **Given:**

TAS	**500 kt**
W/V	**330°/50**
A to B	**2600 NM**
Course	**090°**

What is the distance and time to the PET from "A"?

a. 1365 NM 2 h 36 min
b. 1235 NM 2 h 22 min
c. 1235 NM 2 h 36 min
d. 2012 NM 3 h 53 min

Questions 6, 7 and 8 are engine failure cases

6. **Given:**

GS On	**300 kt**
GS Out	**350 kt**
GS Home	**250 kt**
Distance from A to B	**1200 NM**

What is the distance and time to the PET from "A"?

a. 545 NM 1 h 34 min
b. 654 NM 1 h 52 min
c. 500 NM 1 h 40 min
d. 545 NM 1 h 49 min

7. **Given:**

2 Engine TAS	**450 kt**
1 Engine TAS	**350 kt**
Distance from A to B	**3000 NM with a 50 kt tailwind component.**

What is the distance and time to the engine failure PET?

a. 1285 NM 3 h 12 min
b. 1333 NM 2 h 40 min
c. 1714 NM 3 h 43 min
d. 1285 NM 2 h 34 min

8. **Given:**

2 Engine TAS	**480 kt**
1 Engine TAS	**400 kt**
W/V	**330°/80**
A to B	**3500 NM**
Course	**200°**

What is the distance and time to the engine failure PET from "A"?

a. 1515 NM 3 h 23 min
b. 1558 NM 2 h 56 min
c. 1515 NM 2 h 51 min
d. 1985 NM 3 h 44 min

Given the following data answer questions 9 &10

CAS	**190 kt cruising**
Pressure altitude	**9000 ft**
Temperature	**ISA -10°C**
W/V	**320/40 kt**
A to B is a distance	**350 NM**
Course	**350°**
Endurance	**3 hours**

9. What is the distance to the PET?

a. 220 NM
b. 311 NM
c. 146 NM
d. 204 NM

10. Given an actual time of departure (ATD) of 11:05, what is the ETA for the PET?

a. 12:49
b. 12:13
c. 11:55
d. 12:26

Answers - 1

1. 510 NM **2 h 13 min**

$$X = \frac{1200 \times 170}{230 + 170} = \mathbf{510\ NM} \text{ @ } 230 \text{ kt} = \mathbf{2\ h\ 13\ min}$$

2. 1664 NM **3 h 28 min**

$$X = \frac{3200 \times 520}{480 + 520} = \mathbf{1664\ NM} \text{ @ } 480 \text{ kt} = \mathbf{3\ h\ 28\ min}$$

3. 1100 NM **3 h 03 min**

$$X = \frac{2000 \times 440}{360 + 440} = \mathbf{1100\ NM} \text{ @ } 360 \text{ kt} = \mathbf{3\ h\ 03\ min}$$

4. 912 NM **6 h 26 min**

Use your Navigation Computer to get ground speed on and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

There are no short cuts!

$$X = \frac{1620 \times 183}{142 + 183} = \mathbf{912\ NM} \text{ @ } 142 \text{ kt} = \mathbf{6\ h\ 26\ min}$$

5. 1235 NM **2 h 22 min**

Use your Navigation Computer to get ground speed on and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

$$X = \frac{2600 \times 472}{522 + 472} = \mathbf{1235\ NM} \text{ @ } 522 \text{ kt} = \mathbf{2\ h\ 22\ min}$$

Engine Failure Case

6. 545 NM **1 h 34 min**

$$X = \frac{1200 \times 250}{300 + 250} = \mathbf{545\ NM} \text{ @ } 350 \text{ kt} = \mathbf{1\ h\ 34\ min}$$

7. 1285 NM **2 h 34 min**

$$X = \frac{3000 \times 300}{400 + 300} = \mathbf{1285\ NM} \text{ @ } 500 \text{ kt} = \mathbf{2\ h\ 34\ min}$$

8. What is the distance and time to the engine failure PET from "A"

1515 NM 2 h 51 min

Use your Navigation Computer to get ground speed on, out and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

There are no short cuts!

$$X = \frac{3500 \times 342}{448 + 342} = \mathbf{1515\ NM} \text{ @ } 530\text{ kt} = \mathbf{2\ h\ 51\ min}$$

Information for Qs 9 & 10

ISA at 9000 ft -3

ISA deviation -10

OAT -13°C

Navigation Computer for TAS 214 kt

Use your Navigation Computer to get ground speed on and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

Ground speed On & Out = 178 kt

Ground speed Home = 249 kt

9. 204 NM

$$X = \frac{350 \times 249}{178 + 249} = \mathbf{204\ NM}$$

10. 12:13

204 NM @ 178 kt = **1 h 08 min + 11:05 = 12:13**

Questions - 2

1. **Given:**
Track 355°T
W/V 340°/30 kt
TAS 140 kt
Total distance A to B 350 NM

What are the time and distance to the point of equal time between A and B?

a. 75 min 211 NM
b. 75 min 140 NM
c. 50 min 140 NM
d. 114 min 211 NM

2. **Given:**
Course A to B 088°(T)
Distance 1250 NM
Mean TAS 330 kt
W/V A to B 340°/60 kt

The time from A to the Point of Equal Time between A and B is:

a. 1 h 54 min
b. 1 h 44 min
c. 1 h 39 min
d 2 h 02 min

3. **Distance between airports = 340 NM**
True track = 320°
W/V = 160°/40
TAS = 110 kt

Distance to PET is:

a. 121 NM
b. 219 NM
c. 112 NM
d. 228 NM

4. **Flying from A to B, 270 NM**
True track 030°
W/V 120°/35
TAS 125 kt

What are the distance and time to the Point of Equal Time?

a. 141 NM 65 min
b. 141 NM 68 min
c. 135 NM 68 min
d. 150 NM 65 min

Answers - 2

1	2	3	4
d	b	c	c

Chapter

14

Point of Safe Return (PSR)

Introduction

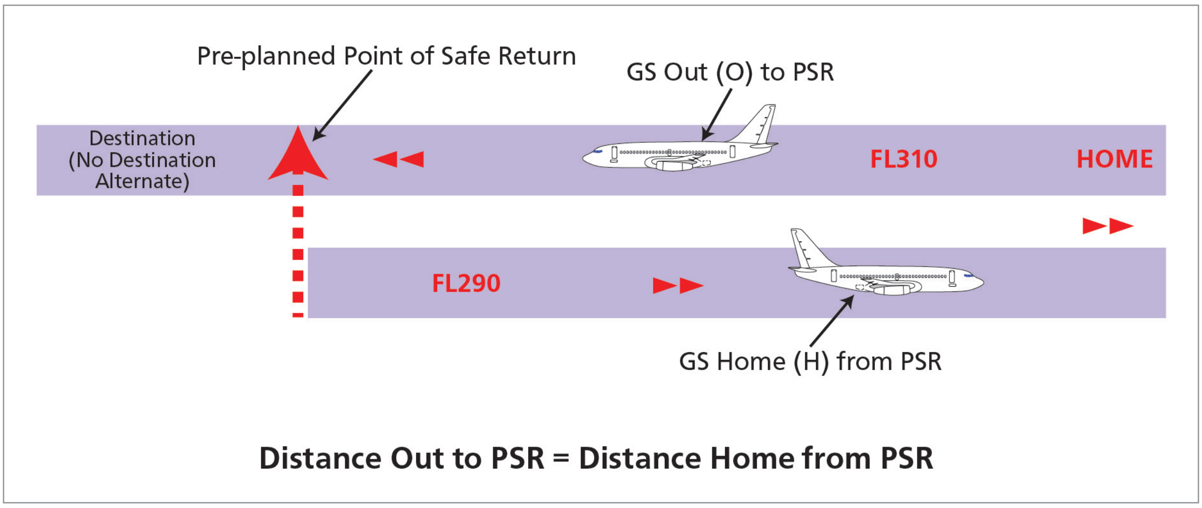


Figure 14.1 Point of safe return

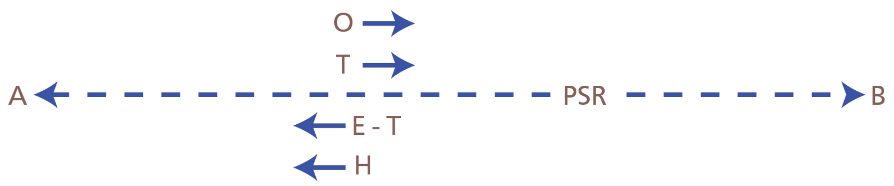
The **POINT OF SAFE RETURN (PSR)**, previously referred to as the **POINT OF NO RETURN (PNR)**, is the furthest point along a planned route to which an aircraft can fly and return to the departure airfield, or departure alternate, within the **SAFE ENDURANCE** of the aircraft. **SAFE ENDURANCE** is the length of time an aircraft can fly without consuming the mandatory reserves of fuel that are required overhead its departure airfield, or departure alternate, in the event of the aircraft returning from the PSR. This SAFE ENDURANCE, quoted as a period of time (or an amount of fuel) is used to calculate the PSR. It must not be confused with the **TOTAL ENDURANCE**, the time an aircraft can remain airborne, at the end of which the tanks are empty.

If the state of the weather, runway, let-down aids or political situation at a destination airfield is likely to deteriorate and the only recourse would be to return back to the departure airfield, or departure alternate, it is prudent to calculate a PSR. Normally, the calculation of a PSR would only be necessary for flights to an "**isolated destination and no adequate destination alternate exists**". Occasions on which a PSR may be required might include flights from mainland airfields to destinations such as Easter Island, Cocos Island, Tahiti, Ascension Island and the Azores.

In flight, at a reasonable time before the ETA for the PSR, the pilot checks that the destination airfield's weather, landing aids and runway state are acceptable for a period of usually one hour before to one hour after the destination ETA.

The **distance OUT** to the PSR equals the **distance HOME** from the PSR. The **time OUT** to the PSR and **time HOME** from the PSR will be the **same in zero wind**; if there is an overall wind component the **time OUT** and **time HOME** will be unequal. But, in each case, the two values total the Safe Endurance time.

Derivation of the Formula



E = THE SAFE ENDURANCE

T = TIME OUT TO the PSR

E - T = Time HOME FROM the PSR

O = Ground speed OUT to the PSR

H = Ground speed HOME FROM the PSR

DISTANCE = TIME × SPEED

By definition DISTANCE OUT TO PSR = DISTANCE HOME FROM PSR

$$
\begin{aligned}
T \times O &= (E - T)\,H \\
TO &= EH - TH \\
TO + TH &= EH \\
T(O + H) &= EH \\
T &= \frac{EH}{O + H}
\end{aligned}
$$

Figure 14.2 Derivation PSR formula

Transposing the Formula to the Navigation Computer

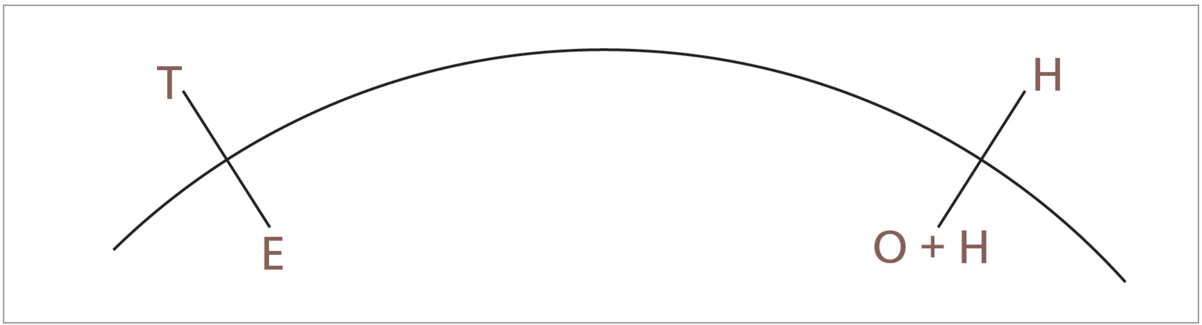


Figure 14.3 Transposing formula to the navigation computer

The Effect of Wind on the Location of the PSR

Let E = 10 h; TAS = 300 kt.

STILL AIR	T	=	$\frac{\times}{+}$	=	min	
	D	=		min @ kt		
		=		NM		(Answer 1500 NM)
50 kt HEADWIND OUT	T	=	$\frac{\times}{+}$	=	min	
	D	=		min @ kt		
		=		NM		(Answer 1458 NM)
50 kt TAILWIND OUT	T	=	$\frac{\times}{+}$	=	min	
	D	=		min @ kt		
		=		NM		(Answer 1458 NM)

- In still air the distance to the PSR is the greatest.
- Any wind component reduces the distance to the PSR.
- This distance is the same for a HEAD or TAIL wind of the same value.
- The greater the wind component the greater the reduction in the distance to the PSR.

Single Leg PSR

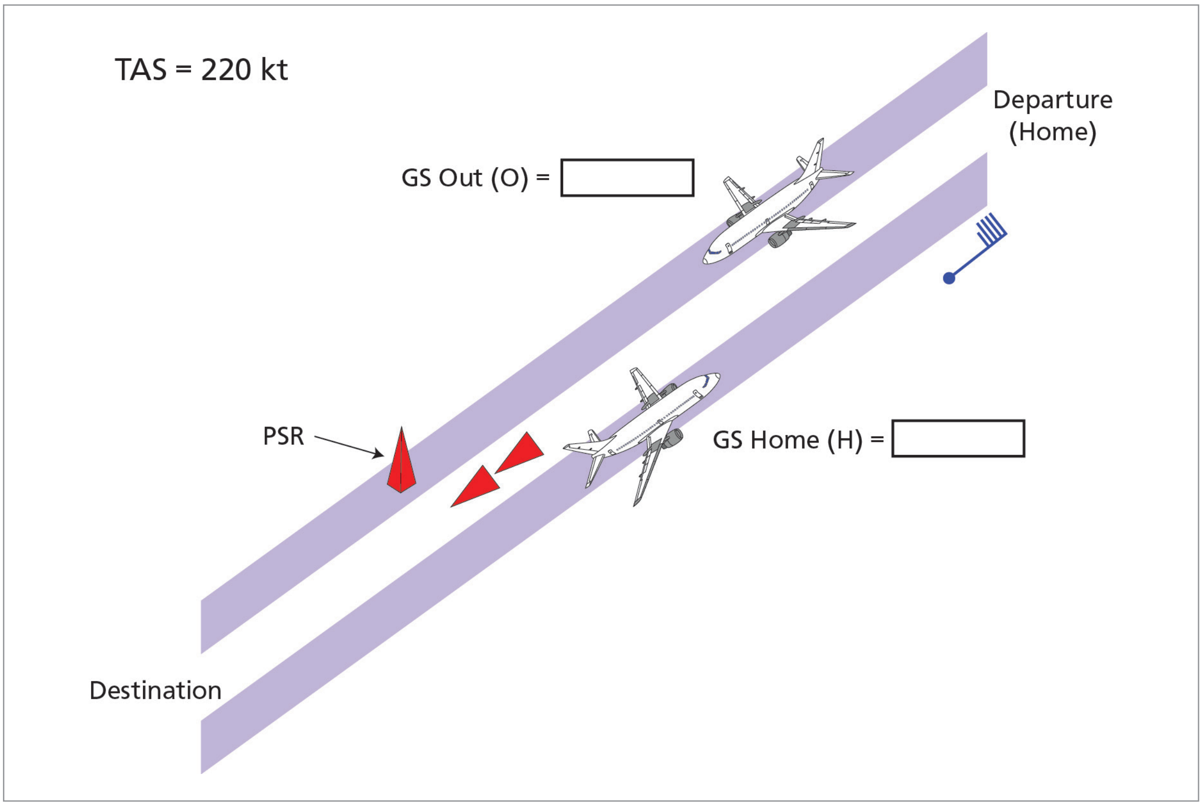


Figure 14.4 Example PSR

Study the *Figure 14.4* and, using the formula, calculate the time and distance to the PSR. The aircraft is flying towards its destination at a TAS of 220 kt with a wind component of +45 kt. Its Total Endurance is 7 h 40 min and the Safe Endurance is 6 h; use TAS 220 kt throughout.

Workings

$$\frac{6 \times 175}{265 + 175} = 2 \text{ h } 23 \text{ mins @ } 265 \text{ kt} = 632 \text{ NM}$$

(Answer: 2 h 23 min, 632 NM)

Questions - Single Leg PSR

1. **Given:**

Total endurance	**7 h 40 min**
Safe endurance	**6 h**
GS Out	**230 kt**
GS Home	**170 kt**

What is the time and distance to the PSR from "A"?

a.	2 h 33 min	587 NM
b.	3 h 15 min	750 NM
c.	3 h 27 min	794 NM
d.	2 h 33 min	434 NM

2. **Given:**

Total endurance	**5 h**
Reserves required	**1 h**
GS On	**250 kt**
GS Out	**280 kt**
GS Home	**320 kt**

What is the time and distance to the PSR from "A"?

a.	2 h 40 min	747 NM
b.	2 h 15 min	629 NM
c.	2 h 08 min	597 NM
d.	1 h 52 min	523 NM

3. **Given:**

Total endurance	**300 min**
Required reserves	**45 min**
TAS	**140 kt**
Course	**050°**
W/V	**270°/30**

What is the time and distance to the PSR from "A"?

a.	148 min	401 NM
b.	125 min	338 NM
c.	90 min	242 NM
d.	106 min	287 NM

4. **Given:**

TAS	**160 kt**
W/V	**100°/30**
A to B	**1620 NM**
Course	**030°**
Depart A at	**09:30 UTC**
Total endurance	**4 h**
Safe endurance	**3 h 20 min**

What are the distance, time and ETA to the PSR from "A"?

a.	94 min	231 NM	11:04
b.	106 min	261 NM	11:16
c.	128 min	315 NM	11:38
d.	106 min	296 NM	11:16

5. **Given:**

TAS	**500 kt**
W/V	**330°/50**
A to B	**4600 NM**
Course	**090°**
Total endurance	**12 h**
Safe endurance	**10 h**

What is the time and distance to the PSR from "A"?

a.	4 h 45 min	2480 NM
b.	2 h 22 min	1235 NM
c.	5 h 42 min	2974 NM
d.	4 h 45 min	2242 NM

Answers - Single Leg PSR

1. 2 h 33 min 587 NM

$$T = \frac{6 \times 170}{230 + 170}$$ = **2 h 33 min** @ 230 kt = **587 NM**

2 2 h 08 min 597 NM

$$T = \frac{4 \times 320}{280 + 320}$$ = **2 h 08 min** @ 280 kt = **597 NM**

3. 106 min 287 NM

Use your Navigation Computer to get ground speed out and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

There are no short cuts!

$$T = \frac{255 \times 116}{162 + 116}$$ = **106 mins** @ 162 kt = **287 NM**

4. 106 min 261 NM 11:16

Use your Navigation Computer to get ground speed out and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

$$T = \frac{200 \times 168}{148 + 168}$$ = **106 min** @ 148 kt = **261 NM** **ETA 11:16**

5. 4 h 45 min 2480 NM

Use your Navigation Computer to get ground speed out and home.

Remember to balance the drift for both outbound and the reciprocal home legs.

$$T = \frac{10 \times 472}{522 + 472}$$ = **4 hr 45 min** @ 522 kt = **2480 NM**

Derivation of the Formula for Variable Fuel Flows

In the preceding examples Safe Endurance was quoted in hours and minutes. If it is given as an amount of fuel then the following formula, which takes into account individual sector fuel flows altitudes, temperatures, wind components and engine configurations, may be used:

LET **d** = Distance to the PSR

F = Fuel available (less reserves) for calculation of the PSR

CO = The fuel consumption **OUT** to the PSR, **kg/NM**

CH = The fuel consumption **HOME** from the PSR, **kg/NM**

Consumption in kg/NM is usually obtained by: $\frac{\text{FUEL FLOW}}{\text{GROUND SPEED}}$

Or $\frac{\text{SECTOR FUEL}}{\text{SECTOR DISTANCE}}$

FUEL USED TO THE PSR + FUEL USED HOME FROM THE PSR = F

Therefore:

$$\mathbf{dCO + dCH = F}$$

$$\mathbf{d(CO + CH) = F}$$

$$\mathbf{d = \frac{F}{CO + CH}}$$

Example Variable Fuel Flows PSR - Single Sector

TAS 310 kt; wind component out to the PSR +30 kt. Total fuel available less reserves 39 500 kg; fuel flow out to PSR at FL270 is 6250 kg/h; fuel flow home from the PSR at FL310 is 5300 kg/h. Calculate the distance and time to the PSR.

$$\mathbf{CO = \frac{6250\ kg/h}{340\ kt} = 18.38\ kg/NM}$$

$$\mathbf{CH = \frac{5300\ kg/h}{280\ kt} = 18.93\ kg/NM}$$

$$\mathbf{D = \frac{39\,500\ kg}{18.38 + 18.93} = 1059\ NM}$$

Time to PSR = 1059 @ 340 kt = 3 h 7 min

Answer = 1059 NM 3 h 7 min

Questions - PSR with Fuel

6. **Given:**

GS Out	**400 kt**
Fuel flow out	**2800 kg/h**
GS Home	**450 kt**
Fuel flow home	**2500 kg/h**
Total endurance	**15 000 kg**
Reserves required	**3000 kg**

What is the distance and time to the PSR from "A"?

a. 1194 NM 3 hr
b. 872 NM 2 hr 11 min
c. 955 NM 2 hr 23 min
d. 1468 NM 3 hr 40 min

7. **Given:**

Total fuel available	**16 000 kg**
Landing reserves required	**1500 kg**
P to Q distance	**2050 NM**
fuel required	**11 500 kg**
Q to P distance	**2050 NM**
fuel required	**10 200 kg**

What is the distance to the PSR from "P"?

a. 1369 NM
b. 1514 NM
c. 426 NM
d. 1656 NM

8. **Given:**

TAS	**480 kt**
W/V	**330°/80**
A to B	**3500 NM**
Course	**200°**
Fuel flow out	**2850 kg/hr**
Fuel flow home	**2680 kg/hr**
Total fuel available	**12 000 kg**
Landing reserves required	**2000 kg**

What is the distance and time to the PSR from "A"?

a. 1558 NM 2 hr 57 min
b. 855 NM 2 hr
c. 1135 NM 2 hr 08 min
d. 855 NM 1 hr 37 min

Answers - PSR with Fuel

6. CO = 2800/400 = 7.00 kg/NGM
   CH = 2500/450 = 5.56 kg/NGM

   955 NM   2 h 23 min

$$D = \frac{12\,000}{7 + 5.56} = 955 \text{ NM @ } 400 \text{ kt} = 2 \text{ h } 23 \text{ min}$$

7. CO = 11500/2050 = 5.61 kg/NGM
   CH = 10200/2050 = 4.98 kg/NGM

   1369 NM

$$D = \frac{14\,500}{5.61 + 4.98} = 1369 \text{ NM}$$

8. CO = 2850/530 = 5.38 kg/NGM
   CH = 2680/425 = 6.31 kg/NGM

   855 NM   1 h 37 min

Use your Navigation Computer to get ground speed out and home.
Remember to balance the drift for both outbound and the reciprocal home legs.
There are no short cuts!

$$D = \frac{10\,000}{5.38 + 6.31} = 855 \text{ NM @ } 530 \text{ kt} = 1 \text{ h } 37 \text{ min}$$

Questions - All Types

1. **Given:**
15 000 kg total fuel
Reserve 1500 kg
TAS 440 kt
Wind component 45 head outbound
Average fuel flow 2150 kg/h

What is the distance to the point of safe return?

a. 1520 NM
b. 1368 NM
c. 1702 NM
d. 1250 NM

2. **Given:**
Fuel flow 2150 kg/h,
Total fuel in tanks 15 000 kg,
Fuel reserve required on arrival 3500 kg,
TAS outbound 420 kt, wind -30 kt,
TAS home bound 430 kt, wind +20 kt.

Find the time to point of safe return.

a. 2 h 06 min
b. 1 h 26 min
c. 3 h 33 min
d. 2 h 52 min

3. **Given:**
Safe endurance = 5 hours
True track = 315
W/V = 100/20
TAS = 115

What is distance to PSR?

a. 205 NM
b. 100 NM
c. 282 NM
d. 141 NM

4. **Given the following:**
Departure to destination is 500 NM
Safe endurance is 4 hours
Ground speed out is 150 kt
Ground speed home is 130 kt

What is the distance and time to the point of safe return from departure point?

a. 232 NM 107 min
b. 221 NM 89 min
c. 139 NM 60 min
d. 279 NM 111 min

Answers - All Types

1	2	3	4
b	d	c	d

Chapter

15

Revision Questions

Revision Questions

1. **A turbine-engined aircraft burns fuel at 200 gals per hour (gph) with a Fuel Density of 0.8. What is the fuel flow if Fuel Density is 0.75?**

   a. 213 gph
   b. 208 gph
   c. 200 gph
   d. 188 gph

2. **An aircraft flying at 7500 ft, is cleared to descend to be level at 1000 ft, 6 NM before reaching a beacon. If ground speed is 156 kt and Rate of Descent is 800 fpm, how many miles before the beacon should descent begin?**

   a. 15.0
   b. 30.2
   c. 27.1
   d. 11.1

3. **After flying for 16 minutes at 100 kt TAS with a 20 kt tailwind, you have to return to the airfield of departure.**
   You will arrive after:

   a. 10 min 40 sec
   b. 20 min
   c. 24 min
   d. 16 min

4. **An aircraft is in cruising flight at FL095, IAS 155 kt.**
   The pilot intends to descend at 500 ft/min to arrive overhead the MAN VOR at 2000 ft (QNH 1030 hPa).
   The TAS remains constant in the descent, wind is negligible, temperature standard.
   At which distance from MAN should the pilot commence the descent?

   a. 42 NM
   b. 40 NM
   c. 45 NM
   d. 48 NM

5. **At a fuel check you have 60 US gallons (US.gal) of usable fuel remaining.**
   Alternative fuel required is 12 US.gal. The flight time remaining is 1 hour 35 min.
   What is the highest consumption rate acceptable?

   a. 33.0 US.gal/h
   b. 37.9 US.gal/h
   c. 30.3 US.gal/h
   d. 21.3 US.gal/h

6. **ATC require a descent from FL270 to FL160 to be level 6 NM before a VOR.**
   If rate of descent is 800 feet per minute, mean ground speed is 256 kt, how far out from the VOR must descent be started?

   a 59 NM
   b. 65 NM
   c. 144 NM
   d. 150 NM

7. **Given:**
Track 355(T), wind velocity 340/30 kt, TAS 140 kt, total distance A to B 350 NM.
What are the time and distance to the point of equal time between A and B?

a. 75 min, 211 NM
b. 75 min, 140 NM
c. 50 min, 140 NM
d. 114 min, 211 NM

8. **The fuel burn-off is 200 kg/h with a relative fuel density of 0.8. If the relative fuel density is 0.75, the fuel burn will be:**

a 267 kg/h
b. 213 kg/h
c. 200 kg/h
d. 188 kg/h

9. **You are flying at FL330, M 0.84, OAT -48°C, headwind 52 kt. The time is 1338 UTC. ATC clear you to be at 030W (570 NM away) at 1500 UTC. To what Mach No. do you have to adhere?**

a 0.72
b. 0.76
c. 0.80
d. 0.84

10. **Where would you find information regarding Customs and Health facilities?**

a ATCC broadcasts
b. NOTAMs
c. NAV/RAD supplememnts
d. AIPs

11. **Where would you find information regarding Search and Rescue procedures?**

a ATCC broadcasts
b. NOTAMs
c. SIGMETs
d. AIPs

12. **An aircraft climbs from an airfield, elevation 1500 ft, QNH 1023 hPa, to FL75. What height does the aircraft have to climb?**
(Assume 1 hPa = 30 ft.)

a 6600 ft
b. 7800 ft
c. 6300 ft
d. 6000 ft

13. **Given by a met station elevation at 4000 ft where QNH is 1003 hPa. The minimum obstruction clearance altitude (MOCA) is 8500 ft. Assume 30 ft per hPa.**
What is the minimum pressure altitude?

a 1280 ft
b. 8500 ft
c. 8200 ft
d. 8800 ft

14. **Given:**
Magnetic track 215; mountain elevation 11 600 ft; local airfield gives QNH as 1035 hPa;
Required terrain clearance 1500 ft; temperature ISA - 15°C.

Which of the following is the minimum flight level considering the temperature?

a FL150
b. FL140
c. FL120
d. FL110

15. **Multi-engine a/c on IFR flight.**
Given:
trip fuel 65 US.gal;
contingency 5% trip;
alternate fuel including final reserve 17 US.gal; usable fuel at departure 93 US.gal. At a point halfway to destination, fuel consumed is 40 US.gal.

Assuming fuel consumption is unchanged, which of the following is correct?

a. At departure reserve fuel was 28 US.gal
b. At destination required reserves remain intact
c. Remaining fuel is insufficient to reach destination with reserves intact
d. Remaining fuel is insufficient to reach the destination

16. **Refer to ED-6. You are at position N4759 E01015. Which Flight Information Service should you contact?**

a. MEMMINGEN 117.20 MHz
b. MEMMINGEM 135.60 MHz
c. MUNCHEN 126.95 MHz
d. MUNCHEN 131.22 MHz

17. **Refer to Jeppesen Manual ED-6.**
An aeroplane is flying VFR and approaching position TANGO (N4837 E00916) at FL55 and on a magnetic track of 090.
The distance from TANGO is 20 NM.
The navigation aid and frequency at TANGO is:

a. VORTAC 112.50 kHz
b. DME 112.50 MHz
c. VOR 112.50 with no DME
d. VORTAC 112.50 MHz

18. **Refer to Jeppesen Manual ED-6.**
Flying from position ERBACH (N4821 E00955) to POLTRINGEN airport (N4833 E00857).
Find the magnetic course and distance.

a 108/60 NM
b. 252/41 NM
c. 287/41 NM
d. 287/60 NM

19. Refer to Jeppesen Manual ED-6.
Flying from position SIGMARINGEN (N4805 E00913) to BIBERACH airport (N4807 E00946).
Find the magnetic course and distance.

a 093/41 NM
b. 086/22 NM
c. 267/22 NM
d. 086/32 NM

20. Refer to Jeppesen Manual ED-6.
Flying VFR from PEITING (4748N 01055.5E) to IMMENSTADT (4733.5N 01013.0E) determine the magnetic course.

a 077
b. 243
c. 257
d. 063

21. Refer to Jeppesen Manual ED-6.
Flying VFR from VILLINGEN (N4758 E00831) to FREUDENSTADT (N4828 E00824), determine the distance.

a 54 NM
b. 29 km
c. 29 NM
d. 33 NM

22. Refer to Jeppesen Manual ED-6.
Give the frequency of the GRENCHEN VOR at N4711 E00725.

a 108.65 MHz
b. 326 kHz
c. channel 23
d. 120.1 MHz

23. Refer to Jeppesen Manual ED-6.
Give the frequency of ZURICH VOLMET.

a 127.2 MHz
b. 127.2 kHz
c. 128.525 MHz
d. 118.1 MHz

24. Refer to Jeppesen Manual ED-6.
The GRENCHEN LSZG aerodrome (N4711 E00725) has a tower frequency of 120.10 MHz. The "(V)" after the frequency indicates:

a available on request
b. only to be used during daylight
c. available for VFR flight only
d. VDF available

25. **Refer to Jeppesen Manual ED-6.**
The magnetic track from VILLINGEN (N4803.5 E00827.0) to FREUDENSTADT (N4828.0 E00824.0) is:

a 176
b. 004
c. 185
d. 356

26. **Refer to Jeppesen Manual ED-6.**
What is the frequency for Stuttgart ATIS?

a 126.12 MHz
b. 128.95 MHz
c. 118.60 MHz
d. 115.45 MHz

27. **Refer to Jeppesen Manual ED-6.**
What is the navaid at 4830N 00734E?

a VORTAC/NDB
b. NDB
c. TACAN
d. VOR/DME

28. **Refer to Jeppesen Manual ED-6.**
What navigation or communications facilities are at N4855 E00920?

a NDB
b. TACAN
c. VOR/DME
d. VORTAC

29. **Refer to Jeppesen Manual ED-6.**
What navigation or communications facilities are at N4822.9 E00838.7?

a NDB
b. VOR
c. VOR/DME
d. VORTAC

30. **The quantity of fuel which is calculated to be necessary for a jet aeroplane to fly IFR from departure to destination aerodrome is 5325 kg.**
Fuel consumption in holding mode is 6000 kg/h. Alternate fuel is 4380 kg.
Contingency should be 5% of trip fuel.

What is the minimum required quantity of fuel which should be on board at take-off?

a 13 220 kg
b. 14 500 kg
c. 12 970 kg
d. 13 370 kg

31. **Turbojet a/c, flying to an isolated airfield, with no destination alternative. On top of taxi, trip and contingency fuel, what fuel is required?**

a. Greater of 45 min + 15% of trip or 2 hours
b. 30 min holding @ 450 m AMSL
c. 30 min holding @ 450 m AAL
d. 2 hours at normal cruise consumption

32. **CAP 697 SEP1 Fig 2.5.**
For a flight departing from MSL at 3663 lb, cruising at FL80 @2300 rpm, 20°C lean of peak EGT, in 40 kt headwind, calculate endurance.

a 4.75 h
b. 5.3 h
c. 6.1 h
d. 6.55 h

33. **Minimum planned take-off fuel is 160 kg (30% total reserve is included). Assume the ground speed on this trip is constant.**
When half the distance has been flow, the remaining fuel is 70 kg.

Is it necessary to divert to a nearby alternate?

a. Diversion to a nearby alternate is necessary, because the remaining fuel is not sufficient
b. Diversion to a nearby alternate is not necessary, because the reserve fuel has not been used completely
c. Diversion to a nearby alternate is necessary, because it is allowed to calculate the fuel without the reserve
d. Diversion to a nearby alternate is necessary, unless the captain decides to continue on his own responsibility

34. **Refer to CAP 697 MRJT Fig 4.4**
Given:
DOM - 35 000 kg
Expected Load - 12 000 kg
Contingency, approach and hold fuel - 2500 kg
Departure aerodrome elevation - 500 ft
Alternate aerodrome elevation - 30 ft

Find (i) Final Reserve Fuel (Jet aircraft) and (ii) the relevant elevation

a. 2360 Alternate elevation
b. 1180 Destination elevation
c. 1180 Alternate elevation
d. 2360 Destination elevation

35. **Refer to CAP 697 SEP1, Fig 2.1.**
Aerodrome elevation 2500 ft, OAT +10°C.
Initial weight 3500 lb.
Climb to FL140, OAT -5°C.

What are the climb time, fuel, NAM?

a. 22 min, 6.5 US.gal, 46 NAM
b. 24 min, 7.5 US.gal, 50 NAM
c. 2 min, 1.0 US.gal, 4 NAM
d. 26 min, 8.5 US.gal, 54 NAM

36. **Refer to CAP 697 SEP1, Fig 2.1.**
Given:
FL75, OAT +5°C,
during climb, average headwind component 20 kt,
take-off from MSL with initial mass of 3650 lb.

Find time and fuel to climb.

a. 11 min, 3.6 US.gal
b. 7 min, 2.6 US.gal
c. 9 min, 2.7 US.gal
d. 9 min, 3.3 US.gal

37. **Refer to CAP 697 SEP1, Fig 2.2.3.**
Given:
FL75, OAT +10°C,
Lean mixture, 2300 rpm.

Find fuel flow (GPH) gallons per hour and TAS.

a. 11.6 GPH 160 kt
b. 68.5 GPH 160 kt
c. 71.1 GPH 143 kt
d. 11.6 GPH 143 kt

38. **Refer to CAP 697 SEP1 Fig 2.4**
Given:
Aeroplane mass at start up 3663 lb
fuel load (density 6 lb/gal) 74 gal
Take-off altitude sea level
Headwind 40 kt
Cruise altitude 8000 ft
Power setting full throttle 2300 rpm
20°C lean of peak

Calculate the range.

a 633 NM
b. 844 NM
c. 730 NM
d. 547.5 NM

39. **Refer to CAP 697, SEP1, Fig 2.5.**
Given: FL75;
Lean mixture; Full throttle/2300 rpm;
Take-off fuel 444 lb;
Take-off from MSL.

Find endurance in hours.

a. 5 h 12 min
b. 5 h 20 min
c. 4 h 42 min
d. 5 h 23 min

40. **The still air distance in the climb is 189 nautical air miles and time 30 minutes. What ground distance would be covered in a 30 kt headwind?**

a 189 NM
b. 203 NM
c. 174 NM
d. 193 NM

41. **Turbojet a/c;**
taxi fuel 600 kg; fuel flow cruise 10 000 kg/h;
fuel flow hold 8000 kg/h; alternate fuel 10 200 kg;
flight time 6 hours; visibility at destination 2000 m.

What is the minimum ramp fuel?

a 80 500 kg
b. 79 200 kg
c. 77 800 kg
d. 76 100 kg

42. **What is Decision Point Procedure?**
It is a procedure to reduce the amount of fuel carried on a flight by:

a. reducing contingency fuel from 10% to 5% of trip fuel
b. reducing contingency fuel to only that required from Decision Point to Destination
c. reducing trip fuel to only that required from Decision Aerodrome to Destination
d. reducing trip distance

43. **What is the purpose of Decision Point Procedure?**

a. Carry minimum fuel to increase Traffic Load
b. Increase safety of the flight
c. Reduce landing mass to avoid stressing the aircraft
d. To assist in decision making at refuelling

44. When calculating the fuel required to carry out a given flight, one must take into account:

1. the wind
2. foreseeable airborne delays
3. other weather forecasts
4. any foreseeable conditions which may delay landing

The combination which provides the correct statement is:

a 1,3
b. 2,4
c. 1,2,3,4
d. 1,2,3

45. Refer to CAP 697 MEP1 Fig 3.2.
A flight is to be made in a multi-engine piston aeroplane.
Given:
Cruising level 11 000 ft
OAT in the cruise -15°C
Usable fuel 123 US gallons
The power is set to economy cruise.

Find the range in NM with 45 min reserve fuel at 45% power.

a 752 NM
b. 852 NM
c. 610 NM
d. 602 NM

46. CAP 697 MRJT1 Fig 4.5.2 & 4.5.3.2
For a flight from B to C at FL310. M 0.74, ISA - 12°C,
957 NGM, 40 kt tailwind;
weight 50 100 kg.

How much fuel is required to fly to C?

a. 4570 kg
b. 4600 kg
c. 4630 kg
d. 4170 kg

47. CAP 697 MRJT1 Fig 4.7.2.
ETOPS - a/c can not travel more than 120 minutes from a suitable (sic, should read "Adequate") airfield. Assume LRC and diversion weight of 40 000 kg.

What is the still air diversion distance?

a 735
b. 794
c. 810
d. 875

48. **Ref CAP 697 MRJT1 Fig 4.2 & 4.5.3.2**
Estimated take-off mass 57 000 kg. Trip distance 150 NM. Temperature ISA-10°C. Cruise at M 0.74.

What is the short distance cruise altitude and TAS?

a. 25 000 ft & 445 kt
b. 33 000 ft & 420 kt
c. 25 000 ft & 435 kt
d. 33 000 ft & 430 kt

49. **Ref CAP 697 MRJT1, Fig 4.5.3.1. Aircraft mass at top of climb 61 500 kg. Distance 385 NM. FL350, OAT -54.3°C. Tailwind of 40 kt.**

Using Long Range Cruise, how much fuel is required?

a. 2200 kg
b. 2100 kg
c. 2300 kg
d. 2000 kg

50. **Refer CAP 697 MRJT Fig 4.3.5**
Tailwind component 10 kt
Temp ISA -10°C Break release 63 000 kg
Trip fuel overall 20 000 kg

What is the maximum possible trip distance?

a 3640
b. 3740
c. 3500
d. 3250

51. **Refer CAP 697 MRJT Fig 4.4**
Given:
Mean gross mass 47 000 kg
The fuel required for a 45 min holding at racetrack pattern at 5000 ft is:

a 1090
b. 1690
c. 1635
d. 1125

52. **Refer to CAP 697 Fig 4.1**
Given:
Cruise weight 53 000 kg; LRC/ M 0.74; cruise at FL310. What is the fuel penalty?

a 0%
b. 1%
c. 4%
d. 10%

53. **Refer to CAP 697 Fig 4.5.1.**
Given:
aerodrome at MSL; cruise at FL280; ISA-10°C; Brake release mass 57 500 kg. What is the climb fuel required?

a 1100 kg
b. 1150 kg
c. 1138 kg
d. 2200 kg

54. **Refer to CAP 697 Fig 4.5.1.**
Given:
Track 340(T); W/V 280/40 kt; aerodrome elevation 387 ft; ISA -10°C; Brake release mass 52 000 kg; cruise at FL280.
What are the climb fuel and time?

a. 15 min, 1100 kg.
b. 12 min, 1100 kg.
c. 10 min, 1000 kg.
d. 11 min, 1000 kg.

55. **Refer to CAP 697 MRJT Fig 4.3.1.**
Trip distance 1900 NM, fuel on board 15 000 kg, landing weight 50 000 kg. What is the minimum pressure altitude for this flight?

a. 17 000 ft
b. 10 000 ft
c. FL370
d. FL250

56. **Refer to CAP 697 MRJT1 Fig 4.2 and 4.5.3.2.**
Given:
Brake release weight 45 000 kg, trip distance 120 NM, temperature ISA-10°C, cruise at M 0.74.
Find short distance cruise altitude and TAS.

a. FL370 / 424 kt
b. FL250 / 435 kt
c. FL370 / 414 kt
d. FL250 / 445 kt

57. **Refer to CAP 697, MRJT1 Fig 4.1.**
Find the OPTIMUM ALTITUDE for the twin-jet aeroplane.
Given: Cruise mass = 54 000 kg,
Long Range Cruise or 0.74 Mach.

a. 35 300 ft
b. 34 600 ft
c. maximum operating altitude
d. 33 800 ft

58. Refer to CAP 697 MRJT1, Fig 4.2.
Find the SHORT DISTANCE CRUISE ALTITUDE for the twin-jet aeroplane.
Given: Brake release mass = 45 000 kt, Temperature = ISA + 20°C,
Trip distance = 50 Nautical Air Miles (NAM).

a. 11 000 ft
b. 12 500 ft
c. 10 000 ft
d. 7500 ft

59. Refer to CAP 697 MRJT1 Fig 4.3.1.
Given: Tailwind component 45 kt
Temperature ISA -10°C Cruise altitiude 29 000 ft Landing mass 55 000 kg

For a flight of 2800 nautical ground miles, the (i) trip fuel and (ii) trip time respectively are:

a. (i) 16 000 kg (ii) 6 h 25 min
b. (i) 18 000 kg (ii) 5 h 50 min
c. (i) 20 000 kg (ii) 6 h 40 min
d. (i) 17 100 kg (ii) 6 h 07 min

60. Refer to CAP 697, MRJT1 Fig 4.3.1c.
For a flight of 2400 nautical ground miles the following apply:
Temperature ISA -10°C Cruise altitude 29 000 ft Landing mass 45 000 kg
Trip fuel available 16 000 kg

What is the maximum headwind component which may be accepted?

a 35 kt
b. 15 kt
c. 0
d. 70 kt

61. Refer to CAP 697 MRJT1 Fig 4.3.3a
Given:
Cruise M 0.78, FL280, 50 000 kg, 200 NM, wind component 30 kt head. Find the fuel required.

a 1700 kg
b. 1740 kg
c. 1620 kg
d. 1970 kg

62. Refer to CAP 697 MRJT1, Fig 4.3.6.
In order to find ALTERNATE FUEL and TIME TO ALTERNATE, the AEROPLANE OPERATING MANUAL shall be entered with:

a. distance in NM, wind component, zero fuel mass
b. distance in NM, wind component, dry operating mass plus holding fuel
c. distance in NM, wind component, landing mass at alternate
d. distance in NM (NAM), wind component, landing mass at alternate

63. **Refer to CAP 697, MRJT1, Fig 4.5.1. Given:**
Brake release mass = 58 000 kg, Temperature = ISA + 15°C.

The fuel required to climb from an airfield at elevation 4000 ft to FL300 is:

a 1350 kg
b. 1400 kg
c. 1450 kg
d. 1250 kg

64. **Refer to CAP 697 MRJT1 Fig 4.5.2 & 4.5.3.1.**
Given:
Long range cruise at FL340
Distance C-D 3200 NM Temperature deviation from ISA +12°C
Tailwind component 50 kt
Gross mass at C 55 000 kg

The fuel required C-D is:

a. 17 500 kg
b. 14 300 kg
c. 17 700 kg
d. 14 500 kg

65. **Refer to CAP 697 MRJT1, Fig 4.5.2 and 4.5.3.4.**
Given:
Distance C - D 540 NM
Low Level Cruise 300 KIAS at FL210,
Temperature Deviation from ISA = +20°C Headwind component = 50 kt
Gross mass at C = 60 000 kg

The fuel required from C to D is:

a. 4250 kg
b. 4620 kg
c. 3680 kg
d. 3350 kg

66. **Refer to CAP 697 MRJT1, Fig 4.5.3.1.**
Given :
flight time from top of climb to the en route point in FL280 is 48 min. Cruise procedure is long range cruise (LRC), Temperature is ISA - 5°C.
Take-off mass = 56 000 kg,
Climb fuel = 1100 kg.

Find distance in NAM for this leg and fuel consumption.

a. 437 NAM, 2106 kg
b. 350 NAM, 2000 kg
c. 345 NAM, 1994 kg
d. 345 NAM, 2006 kg

67. Refer to CAP 697, MRJT1, Fig 4.1.
Given:
Brake release weight 55 500 kg; LRC/M 0.74. Find optimum altitude.

a. 33 800 ft
b. 34 500 ft
c. 35 300 ft
d. maximum operating altitude

68. Refer to CAP 697 MRJT1, Fig 4.3.1.
Given:
estimated zero fuel mass 50 t; estimated landing mass at destination 52 t ; final reserve fuel 2 t; alternate fuel 1 t; flight to destination, distance 720 NM, true course 030, W/V 340/30; cruise: LRC, at FL330 outside air temperature -30°C.
Find estimated trip fuel and time.

a. 4800 kg / 01 h 45 min
b. 4400 kg / 02 h 05 min
c. 4750 kg / 02 h 00 min
d. 4600 kg / 02 h 05 min

69. Refer to CAP 697 MRJT1 Fig 4.3.1c.
Within the limits of the data given, a mean temperature increase of 30°C will affect the trip time by approximately:

a -5%
b. +5%
c. +8%
d. -7%

70. Refer to CAP 697 MRJT1 Fig 4.3.2a.
Planning a flight from Paris (Charles de Gaulle) to London (Heathrow) for a twin-jet aeroplane. Power setting: M 0.74; FL280; Landing mass 50 000 kg; Distance to use 200 NM; W/V from Paris to London is 280/40, Mean track 340(T).
Find the estimated trip fuel.

a 1550 kg
b. 1740 kg
c. 1900 kg
d. 1450 kg

71. Refer to CAP 697 MRJT1 Fig 4.3.3c
Given:
Twin-jet aeroplane, ground distance to destination 1600 NM, headwind component 50 kt, FL330, cruise 0.78 Mach, ISA Deviation +20°C and landing mass 55 000 kg.
Find fuel required and trip time with simplified flight planning.

a. 12 250 kg, 04 h 00 min
b. 11 400 kg, 04 h 12 min
c. 11 600 kg, 04 h 15 min
d. 12 000 kg, 03 h 51 min

72. **Refer to CAP 697 MRJT1 Fig 4.3.5.**
Given:
Headwind 50 kt; Temperature ISA+10°C; Brake release mass 65 000 kg; Trip fuel 18 000 kg. What is the maximum possible trip distance?

a 3480 NGM
b. 2540 NGM
c. 3100 NGM
d. 2740 NGM

73. **Refer to CAP 697 MRJT1 Fig 4.3.6.**
Given: Distance to alternate 400 NM Landing mass at alternate 50 000 kg
Headwind component 25 kt

The alternate fuel required is:

a 2550 kg
b. 2800 kg
c. 2900 kg
d. 2650 kg

74. **Refer to CAP 697 MRJT1, Fig 4.3.6.**
Given:
DOM 35 500 kg, estimated load 14 500 kg, final reserve fuel 1200 kg, distance to alternate 95 NM, average true track 219, headwind component 10 kt.

Find fuel and time to alternate.

a. 800 kg / 24 min
b. 1100 kg / 44 min
c. 1100 kg / 25 min
d. 800 kg / 40 min

75. **Refer to CAP 697 MRJT1 Fig 4.4.**
Given:
Mean gross mass 47 000 kg
The fuel required for 50 minutes holding in a racetrack pattern at 5000 ft is:

a. 2180 kg
b. 1850 kg
c. 1817 kg
d. 1125 kg

76. **Refer to CAP 697 MRJT1, Fig 4.4.**
The final reserve fuel taken from the HOLDING PLANNING table for the twin-jet aeroplane is based on the following parameters:

a. pressure altitude, aeroplane mass and flaps up with minimum drag airspeed
b. pressure altitude, aeroplane mass and flaps down with maximum range speed
c. pressure altitude, aeroplane mass and flaps up with maximum range speed
d. pressure altitude, aeroplane mass and flaps down with minimum drag airspeed

77. **Refer to CAP 697 MRJT1, fig 4.5.1.**
Given:
Brake release mass 57 500 kg, temperature ISA - 10°C, headwind component 16 kt initial FL280,

Find: still air distance (NAM) and ground distance for the climb.

a. 67 NAM / 71 NM
b. 59 NAM / 62 NM
c. 62 NAM / 59 NM
d. 71 NAM / 67 NM

78. **Refer to CAP 697 MRJT1, fig 4.5.1.**
Planning an IFR flight from Paris (Charles de Gaulle) to London (Heathrow) for the twin-jet aeroplane.
Given:
Estimated take-off mass 52 000 kg, Airport elevation 387 ft, FL280,
W/V 280/40 kt, ISA deviation -10°C, average true course 340.

Find the time to top of climb.

a 3 min
b. 11 min
c. 12 min
d. 15 min

79. **Refer to CAP 697 MRJT1 fig 4.5.3.1.**
Given:
FL330; COAT -63°C; Weight 50 500 kg What is TAS?

a 411 kt
b. 433 kt
c. 421 kt
d. 423 kt

80. **Refer to CAP 697 MRJT1 fig 4.5.3.1.**
Given:
Long Range Cruise at FL350
OAT -45°C
Gross mass at the beginning of the leg 40 000 kg
Gross mass at the end of the leg 39 000 kg

Find: True airspeed (TAS) and cruise distance (NAM) for a twin-jet aeroplane

a. TAS 433 kt, 227 NAM
b. TAS 423 kt, 227 NAM
c. TAS 433 kt, 1163 NAM
d. TAS 423 kt, 936 NAM

81. **Refer to CAP 697 MRJT1 fig 4.5.3.1.**
LRC FL330 Temp -63°C Mass 54 100 kg time 29 min
Find the fuel consumed.

a 1207 kg
b. 1191 kg
c. 1092 kg
d. 1107 kg

82. **Refer to CAP 697 MRJT1 fig 4.5.4.**
A descent is planned at M 0.74/250 KIAS from 35 000 ft to 5000 ft.

How much fuel will be consumed during this descent?

a 278 kg
b. 290 kg
c. 150 kg
d. 140 kg

83. **Refer to CAP 697 MRJT1 fig 4.5.4a and Jeppesen Manual LONDON Heathrow 10-2 STAR**
Aircraft mass 49 700 kg, FL280.

Plan a descent to Heathrow elevation. What is the descent time?

a 8 min
b. 10 min
c. 17 min
d. 19 min

84. **Refer to CAP 697 MRJT1 simplified flight planning.**

Planning a flight from Paris (CDG) to London Heathrow for a twin-jet aeroplane. The wind from London to Manchester is 250/30 kt; mean track 350; distance 160 NM.
Assume the landing mass at alternate is about 50 000 kg.

Find the alternate fuel and time.

a. 1200 kg, 20 min
b. 1300 kg, 28 min
c. 1600 kg, 36 min
d. 1450 kg, 32 min

85. **Reference computer flight plans. Are they able to account for bad weather in calculating fuel required?**

a. can automatically allow extra consumption for anti-icing use
b. can automatically divert route around forecast thunderstorms
c. no
d. can automatically allow for poorly maintained engines

86. **Which statements are correct about computer flight plans?**

1) **They can file the flight plan for you.**
2) **In the event of an in-flight re-routing computer automatically generates a new flight plan.**

a 1 only
b. 2 only
c. Neither
d. Both

87. **A flight is planned from L to M, distance 850 NM. Wind component out is 35 kt (TWC), TAS 450 kt. Mean fuel flow out is 2500 kg/h, mean fuel flow inbound is 1900 kg/h and the fuel available is 6000 kg.**

The time and distance to PSR is :

a. 1 h 30 min, 660 NM
b. 1 h 30 min, 616 NM
c. 1 h 16 min, 606 NM
d. 1 h 16 min, 616 NM

88. **Find the distance to the POINT OF SAFE RETURN (PSR).**
Given:
Maximum useable fuel = 15 000 kg, minimum reserve fuel = 3500 kg,
Outbound: TAS 425 kt, headwind component = 30 kt, fuel flow = 2150 kg/h.
Return: TAS 430 kt, tailwind component = 20 kt, fuel flow = 2150 kg/h.

a 1491 NM
b. 1125 NM
c. 1143 NM
d. 1463 NM

89. **Given:**
15 000 kg total fuel, reserve 1500 kg, TAS 440 kt,
wind component 45 kt head outbound, average fuel flow 2150 kg/h.

What is the distance to the point of safe return?

a 1520 NM
b. 1368 NM
c. 1702 NM
d. 1250 NM

90. **Given:**
fuel flow 2150 kg/h,
total fuel in tanks 15 000 kg,
fuel reserve required on arrival 3500 kg, TAS outbound 420 kt, wind -30 kt,
TAS home bound 430 kt, wind +20 kt.

Find the time to point of safe return.

a. 2 h 06 min
b. 1 h 26 min
c. 3 h 33 min
d. 2 h 52 min

91. **Given:**
Safe endurance = 5 hours
True track = 315
W/V = 100/20
TAS = 115

What is distance to PSR?

a 205 NM
b. 100 NM
c. 282 NM
d. 141 NM

92. **Distance between airports = 340 NM**
True track = 320
W/V = 160/40
TAS = 110

Distance to PET is:

a 121 NM
b. 219 NM
c. 112 NM
d. 228 NM

93. **Flying from A to B, 270 NM, true track 030, wind velocity 120/35, TAS 125 kt.**

What are the distance and time to the point of equal time?

a. 141 NM, 65 min
b. 141 NM, 68 min
c. 135 NM, 68 min
d. 150 NM, 65 min

94. **Given:**
Course A to B 088(T) Distance 1250 NM Mean TAS 330 kt
Mean W/V A to B 340/60 kt

The time from A to the point of equal time between A and B is:

a. 1 hour 54 minutes
b. 1 hour 44 minutes
c. 1 hour 39 minutes
d. 2 hours 02 minutes

95. **Given:**
distance A to B = 2050 NM. Mean ground speed "on" = 440 kt
Mean ground speed "back" = 540 kt

The distance to the point of equal time (PET) between A and B is:

a 1153 NM
b. 1025 NM
c. 920 NM
d. 1130 NM

96. If CAS is 190 kt, altitude 9000 ft, temperature ISA -10°C True course 350, W/V 320/40, distance from departure to destination is 350 NM and endurance 3 hours, actual time of departure is 1105 UTC.

The PET is reached at:

a 1233 UTC
b. 1221 UTC
c. 1214 UTC
d. 1203 UTC

97. If CAS is 190 kt, altitude 9000 ft, temperature ISA - 10°C true course 350, W/V 320/40 distance from departure is 350 NM, endurance 3 hours.

The distance to PET is:

a 203 NM
b. 170 NM
c. 211 NM
d. 330 NM

98. An appropriate flight level for IFR flight in accordance with semi-circular height rules on a course of 180 degrees magnetic is:

a FL105
b. FL90
c. FL95
d. FL100

99. For an IFR flight using ICAO semi-circular cruising levels on a magnetic track of 200, which is a suitable level?

a FL290
b. FL300
c. FL310
d. FL320

100. Refer to Annex A and Jeppesen E(HI)4 SID Paris (Charles de Gaulle) 20-3. Planning an IFR flight from Paris to London (Heathrow) for the MRJT. Departure SID ABB 8A. Assume variation 3°W. Determine the magnetic course, ground speed and wind correction angle from TOC to ABB 116.6:

a. MC 349, GS 416 kt, WCA -5
b. MC 169, GS 416 kt, WCA +5
c. MC 349, GS 416 kt, WCA +5
d. MC 169, GS 450 kt, WCA +4

101. Refer to Jeppesen E(LO)1. What is the NBD serving Belfast City airport?

a. BEL 117.2 MHz
b. OY 332 kHz
c. HB 420 kHz
d. BEL 117.2 kHz

102. **Refer to Jeppesen E(LO)6.**
Airways routing between CHEB (OKG - N5003.3 E01224.4) to RODING (RDG - N4902.4 E01231.6).
Which is the lowest usable Flight Level?

a FL40
b. FL70
c. FL80
d. FL50

103. **Refer to Jeppesen Manual AMSTERDAM SCHIPOL 11-6. ILS DME RWY 22.**
Complete the blanks for the missed approach:
"Turn .... on track ...... climbing to ..... (.....)"

a. left, 005, 2000' 2012'
b. left, 266, 2000' 2102'
c. right, 240, 2000' 2011'
d. left, 160, 2000' 2014'

104. **Refer to Jeppesen Manual, any SID chart for London Heathrow.**
Which of the following is the correct Minimum Safe Altitude (MSA) for the airport?

a. East sector 2300 ft within 50 NM
b. West sector 2300 ft within 25 NM
c. East sector 2100 ft within 50 NM
d. West sector 2100 ft within 25 NM

105. **Refer to Jeppesen Manual chart E(HI) 4 FOR EXAMS.**
An aeroplane has to fly from about 10 NM south east of Salzburg (N4800 E01254) to Klagenfurt (N4636 E01434).
Which statement is correct?

a. The minimum obstacle clearance altitude (MOCA) on this route is 10 800 ft AMSL
b. The minimum en route altitude (MEA) is 13 400 ft
c. The minimum sector altitude (MSA) is 13 400 ft
d. The minimum grid safe altitude is 13 400 AMSL

106. **Refer to Jeppesen Manual chart E(HI)4 FOR EXAMS.**
An appropriate flight level for flight on airway UG1 from ERLANGEN ERL 114.9 (4939N 01109E) to FRANKFURT FFM 114.2 (5003N 00838E) is:

a FL300
b. FL290
c. FL310
d. FL320

107. **Refer to Jeppesen Manual chart E(HI)4 FOR EXAMS.**
The magnetic course and distance from ST PREX SPR 113.9 (N4628 E00627) to FRIBOURG FRI 115.1 (N4647 E00714) on airway UG60.

a. 048 / 46 NM
b. 061 / 37 NM
c. 061 / 28 NM
d. 041 / 78 NM

108. Refer to Jeppesen Manual chart E(HI)4 FOR EXAMS.
The radio aid at STAD (N5145 E00415) is:

a. an NDB , frequency 386 kHz
b. a VOR frequency 386 MHz
c. a VOR/DME on channel 386
d. a TACAN on channel 386

109. Refer to Jeppesen Manual chart E(HI)4 FOR EXAMS.
The radio aid at ZURICH (N4735.6 E00849.1) is:

a. an NDB , frequency 115.0 kHz
b. a VOR , frequency 115.0 MHz
c. a VOR/DME, frequency 115.0 MHz
d. a TACAN on channel 11

110. Refer to Jeppesen Manual chart E(HI)5 FOR EXAMS.
An appropriate FL for flight along airway UG5 from MENDE-NASBINALS MEN 115.3 (N4436 E00310) to GAILLAC GAI 115.8 (N4357 E00150) is:

a FL280
b. FL290
c. FL300
d. FL310

111. Refer to Jeppesen Manual chart E(HI)5.
The magnetic course and distance from LIMOGES LMG 114.5 (N4549 E00102) to CLERMONT FERRAND CMF 117.5 (N4547 E00311) on airway UG22 are:

a. 046 / 70 NM
b. 067 / 122 NM
c. 113 / 142 NM
d. 094 / 90 NM

112. Refer to Jeppesen Manual chart E(LO)1.
The magnetic course / distance from WALLASEY WAL 114.1 (N5324 W00308) to LIFFY (N5329 W00530) on airway B1 are:

a. 279 / 114 NM
b. 279 / 85 NM
c. 311 / 114 NM
d. 311 / 85 NM

113. Refer to Jeppesen Manual chart E(LO)5.
The airway intersection at RONNEBY (N5618 E01516) is marked by:

a. a fan marker call sign LP
b. a TACAN call sign RON
c. an NDB call sign N
d. an NDB call sign LF

114. Refer to Jeppesen Manual chart E(LO)5.
The magnetic course/ distance from EELDE EEL 112.4 (N5310 E00640) to WELGO (N5418 E00725) on airway A7 are:

a. 024 / 023 / 73 NM
b. 024 / 023 / 47 NM
c. 024 / 023 / 67 NM
d. 037 / 038 / 50 NM

115. Refer to Jeppesen Manual E(HI)3.
Are the VOR and TACAN navaids at OSNABRUCH (N5212 E00817) co-located?

a Yes
b. VOR/DME only
c. VOR/NDB only
d. No

116. Refer to Jeppesen Manual E(HI)4 for exams.
An aeroplane has to fly from Abbeville (5008.1N 00151.3E) to Biggin (5119.8 00000.2E).
At Biggin you can find 141. This is:

a. the average true course of the great circle from Biggin to Abbeville
b. the magnetic course to fly inbound to Biggin
c. the magnetic great circle course from Biggin to Abbeville
d. the radial, referenced to true north, of Biggin to fly inbound

117. Refer to Jeppesen Manual E(HI)4 for exams.
Flying from ABBEVILLE (N5008.1 E00151.3) by UA20 to BIGGIN (N5119.8 E00002.2).
What is the first suitable IFR FL above FL295?

a 300
b. 310
c. 320
d. 330

118. Refer to Jeppesen Manual E(HI)4 for exams.
For a flight from Paris Charles de Gaulle to London Heathrow, what is the average true course?

a 320
b. 300
c. 120
d. 140

119. Refer to Jeppesen Manual E(HI)4 for exams.
Of the following, the preferred airways routing from FRANKFURT FFM 114.2 (5003N 00838E) to KOKSY (5106N 00239E) above FL245, on a Wednesday is:

a. UR10 NTM UB6 BUB ATS
b. UG108 SPI UG1
c. UB69 DINKI UB6 BUB ATS
d. UG1

120. **Refer to Jeppesen Manual E(HI)4 for exams.**
The magnetic course/ distance from DINKESBUHL DKB 117.8 (4909N 01014E) to ERLANGEN ERL 114.9 (4939N 01109E) on airway UR11 are:

a. 052/ 97 NM
b. 050/ 47 NM
c. 133/ 85 NM
d. 230/ 97 NM

121. **Refer to Jeppesen Manual E(HI)4 for exams.**
The magnetic course and distance from SALZBURG SBG 113.8 (N4800 E01254) to STAUB (N4844 E01238) on airway UB5 is:

a. 346/ 43 NM
b. 166/ 64 NM
c. 346/ 64 NM
d. 346/ 45 NM

122. **Refer to Jeppesen Manual E(HI)4 for exams.**
What is the best route from CLACTON CLN (N5150.9 E00109.0) to MIDHURST MID (N5103.2 W00037.4)?

a UR12
b. TRIPO UR1 LAM UR1
c. UR123
d. UB29 LAM UR1

123. **Refer to Jeppesen Manual E(HI)4 for exams.**
What is the lowest continuous MEA from WALLASEY (N5323.5 W00308.0) to MIDHURST (N5103.2 W00037.4) on UA34?

a FL245
b. FL290
c. 5300 ft
d. 16 800 ft

124. **Refer to Jeppesen Manual E(HI)5 for exams.**
Given Leg MOULINS (N4642 E00338.0)/ DIJON (N4716.3 E00505.9).
Find route designator and distance.

a. UG12, 69 NM
b. D, 44 NM
c. UG21, 26 NM
d. Direct route, 69 NM

125. **Refer to Jeppesen Manual E(HI)5 for exams.**
On a flight from AMBOISE (N4725.7 E00103.9) to AGEN (N4353.3 E00052.4) What is the best airway route above FL200?

a. UB19 POI UB195
b. UH40 FOUCO UH20 PERIG UA34
c. UA34
d. UB19 CGC UA25

126. Refer to Jeppesen Manual E(HI)5 for Exams.
The minimum en route altitude available on airway UR160 from NICE NIZ 112.4 (4346N 00715E) to BASTIA BTA 116.2 (4232N 00929E) is:

a FL250
b. FL260
c. FL210
d. FL200

127. Refer to Jeppesen Manual E(HI)5 for exams.
What radio navaids are shown at CHIOGGIA (4504N E01216)?

a. VOR/DME freq 114.1, NDB freq 408
b. VOR freq 114.1, TACAN freq 408
c. VOR freq 114.1, TACAN channel 408
d. VOR/DME 114.1, DME freq 408

128. Refer to Jeppesen Manual E(LO)1.
From SHANNON (N5243.3 W00853.1) by W13 to KORAK. What is meant by "5000" by the route centre line?

a. MORA 5000 ft
b. MAA 5000 ft
c. MOCA 5000 ft
d. MEA 5000 ft

129. Refer to Jeppesen Manual E(LO)1.
The minimum en route altitude that can be maintained continuously on airway G1 from STUMBLE 113.1 (5200N 00502W) to BRECON 117.45 (5143N 00316W) is:

a FL80
b. FL110
c. 4100 ft AMSL
d. 2900 ft AMSL

130. Refer to Jeppesen Manual E(LO)1.
What navaids are shown at TOPCLIFFE (N5412.2 W00122.4)?

a. TACAN only, channel 84, TOP
b. TACAN and VOR, channel 84, 113.7, TOP
c. NDB 92 kHz, AB
d. VOR, 113.7 MHz, TOP

131. Refer to Jeppesen Manual E(LO)1.
What radio navigation aid is at SHANNON (5243N 00853W)?

a. VOR SHA 113.3 MHz only
b. VOR DME SHA 113.3 MHz
c. NDB frequency 353 kHz
d. TACAN frequency 113.3 kHz

132. Refer to Jeppesen Manual E(LO)2.
What is the lowest MEA that can be flown continuously between Jersey (N4913.3 W00202.7) and LIZAD (N4935.4 W00420.3)?

a FL140
b. 1000 ft
c. FL60
d. 2800 ft

133. Refer to Jeppesen Manual E(LO)5.
Fly by G9 from SUBI (N5222.8 E01435.3) to CZEMPIN (N5207.9 E01643.7).
What is a suitable FL?

a FL50
b. FL60
c. FL70
d. FL80

134. Refer to Jeppesen Manual E(LO)5
OSNABRUCH VOR and TACAN (5212N 00817E).
What can be said about the VOR and TACAN?

a. They are frequency paired
b. They are not frequency paired
c. They are frequency paired and have the same ident
d. They are not frequency paired and have different idents

135. Refer to Jeppesen Manual E(LO)5. See DENKO (N5249 E01550)
What does "440 DRE" mean?

a. 440 kHz plus ident
b. 440 kHz plus ident only when BFO switched on
c. 440 kHz plus ident only when BFO switched off
d. 440 MHz plus ADF only when BFO off

136. Refer to Jeppesen Manual E(LO)5.
What is the lowest MEA that can be flown continuously between RONNE (N5504.0 E01445.7) and DOXON (N5526.9 E01810.0)?

a FL100
b. 1000 ft
c. FL60
d. 2500 ft

137. Refer to Jeppesen Manual instrument approach chart:
LONDON HEATHROW ILS DME Rwy 09R (11-1).
The Minimum Descent Altitude (MDA) for an ILS approach, glide slope out, is:

a 405 ft
b. 480 ft
c. 275 ft
d. 200 ft

138. Refer to Jeppesen Manual instrument approach chart ZURICH ILS Rwy 16 (11-2). The lowest published authorized RVR for an ILS approach, glide slope out, all other aids serviceable, aeroplane category A, is:

a 800 m
b. 600 m
c. 720 m
d. 1500 m

139. Refer to Jeppesen Manual LONDON HEATHROW ILS DME Rwy 09L (11-2). The decision altitude for an ILS straight in landing is:

a 480 ft
b. 280 ft
c. 200 ft
d. 400 ft

140. Refer to Jeppesen Manual, London page 10-2D, Ockham STARs. At Ockham what are the lowest holding level and maximum speed?

a. 7000 ft, IAS 250 kt
b. 7000 ft, IAS 220 kt
c. FL140, IAS 220 kt
d. FL140, IAS 250 kt

141. Refer to Jeppesen Manual MADRID BARAJAS 10-2B STAR. Approaching the airfield from the South using UR10. What is the Initial Approach Fix for ILS RWY 33 ?

a VTB VOR
b. CJN VOR
c. CENTA
d. MOTIL

142. Refer to Jeppesen Manual MADRID, BARAJAS page 11-1. ILS DME Rwy 33. What is the minimum altitude for glide slope interception?

a 3500 ft
b. 4000 ft
c. 2067 ft
d. 1567 ft

143. Refer to Jeppesen Manual MUNICH ILS Rwy 26R (11-4). The ILS frequency and identifier are:

a 108.7 IMNW
b. 108.7 IMSW
c. 108.3 IMNW
d. 108.3 IMSW

144. Refer to Jeppesen Manual MUNICH NDB DME Rwy 26L approach (16-3) The frequency and identifier of the NDB for the published approaches are:

a 112.3 MUN
b. 108.6 DMS
c. 338 MNW
d. 400 MSW

145. **Refer to Jeppesen Manual Munich SID (10-3D).**
Which is the correct departure via KEMPTEN from runway 26L?

a KEMPTEN THREE ECHO
b. KEMPTEN FIVE SIERRA
c. KEMPTEN THREE QUEBEC
d. KEMPTEN THREE NOVEMBER

146. **Refer to Jeppesen Manual Munich STAR plates.**
With an easterly surface wind, approaching from the west, to Munich via the TANGO VOR. Which is the best STAR and its associated IAF (Initial Approach Fix)?

a. Kempten 2T / BETOS
b. NDG 1T / ROKIL
c. RODING 1R / MOOSBURG
d. AALEN 1T / ROKIL

147. **Refer to Jeppesen Manual Paris Charles-de-Gaulle, (21-7), ILS rwy 10.**
What is the ILS course?

a 088
b. 100
c. 118
d. 268

148. **Refer to Jeppesen Manual SID chart for AMSTERDAM ARNEM (10-3B).**
The route distance from take-off runway 27 to ARNEM is:

a 67 NM
b. 35 NM
c. 59 NM
d. 52 NM

149. **Refer to Jeppesen Manual SID chart for AMSTERDAM SCHIPOL (10-3).**
Which statement is correct for ANDIK departures from runway 19L?

a. Maximum IAS 250 kt turning left at SPL 3.1 DME
b. Cross ANDIK below FL60
c. Contact SCHIPOL DEPARTURE 119.05 passing 2000 ft and report altitude
d. The distance to ANDIK is 25 NM

150. **Refer to Jeppesen Manual, SID charts for Paris Charles-de-Gaulle.**
What is the distance to Abbeville on SID ABB 8 A?

a 72 NM
b. 74 NM
c. 72.5 NM
d. 74.5 NM

**151. Refer to Jeppesen Manual STAR 10-2 and instrument approach chart 11-4 ILS/DME Rwy 27R for London Heathrow.
Planning an IFR flight from Paris to London (Heathrow).
Name the identifier and frequency of the initial approach fix (IAF) of the BIG2A arrival route.**

a. EPM 316 kHz
b. BIG 115.1 kHz
c. BIG 115.1 MHz
d. OCK 115.3 MHz

**152. Refer to Jeppesen Manual STAR charts PARIS (Charles-de-Gaulle) (20-2).
The route distance from CHIEVRES (CIV) to BOURSONNE (BSN) is:**

a 73 NM
b. 83 NM
c. 88 NM
d. 96 NM

153. Refer to Jeppesen SPM, Paris, France plate 21-8 (ILS Rwy 10). What is the localizer course?

a 278
b. 088
c. 108.7
d. 178

**154. Refer to the Zurich 10 - 2 STAR plate.
On the BLM 2Z STAR, what is the routing to EKRON?**

a. From Denel Int, proceed to Sopim Int, intercept BLM 111 radial to Golke Int, intercept TRA 247 radial inbound (HOC 067 radial) to Ekro
b. Leave HOC VORDME on 067 radial (TRA 067 radial inbound) to Ekron
c. Leave WIL VORDME on 018 radial to Ekron
d. Leave BLM VORDME on 111 radial toGolke Int, intercept TRA 247 radial inbound (HOC 067 radial) to Ekron

155. Unless otherwise stated on charts for standard instrument departures the routes shown are given with:

a magnetic headings
b. true course
c. magnetic course
d. true headings

**156. Refer to Jeppesen Manual 5AT(HI).
Flying from 80N 170E to 75N 011E. Initial track is 177 grid.
What is the initial true track?**

a 177
b. 357
c. 347
d. 167

157. **Refer to Jeppesen Manual chart 5AT(HI).**
The initial true course from A (65N 006E) to C (62N 020W) is:

a 272
b. 269
c. 256
d. 246

158. **Refer to Jeppesen Manual chart 5AT(HI).**
What is the initial grid track from Stornoway (N5812.4 W00611.0) to Keflavik (N6400 W02240)?

a 320
b. 140
c. 313
d. 133

159. **Refer to Jeppesen Manual chart 5AT(HI).**
Route PTS P from VIGRA (N6233.2 E00602.2) to ADOBI (N6830.0 E00300.0).
What is the grid track?

a 353
b. 344
c. 173
d. 349

160. **Refer to Jeppesen Manual chart NAP.**
The initial magnetic course from A (64N 006E) to C (62N 020W) is:

a 275
b. 267
c. 271
d. 262

161. **Refer to Jeppesen Manual North Atlantic Plotting chart.**
Flying from A (N58 E004) to B (N62W020).
What is the great circle distance?

a 775 NM
b. 755 NM
c. 740 NM
d. 720 NM

162. **A "current flight plan" is:**

a. flight plan in the course of which radio communication should be practised between aeroplane and ATC
b filed flight plan
c. flight plan with the correct time of departure
d. filed flight plan with amendments and clearances included

163. A repetitive flight plan (RPL) is filed for a scheduled flight: Paris-Orly to Angouleme, Paris-Orly as alternate.
Following heavy snow falls, Angouleme airport will be closed at the expected time of arrival.The airline decides before departure to plan a re-routing of that flight to Limoges.

a. It is not possible to plan another destination and that flight has to be simply cancelled that day (scheduled flight and not chartered)
b. The airline's Operations department has to transmit a change to the RPL to the ATC office, at least half an hour before the planned time of departure
c. The pilot in command must advise ATC of his intention to divert to Limoges at least 15 minutes before the planned time of arrival
d. The RPL must be cancelled for that day and an individual flight plan must be filed

164. An aircraft in the cruise has a calibrated airspeed of 150 kt, a true airspeed of 180 kt and an average ground speed of 210 kt.
The speed box of the flight plan must be filled as follows:

a K0210
b. N0150
c. N0180
d. K0180

165. For a flight plan filed before flight, the indicated time of departure is:

a. the time overhead the first reporting point after take-off
b. the time at which the flight plan is filed
c. the estimated off-block time
d. the time of take-off

166. For a radio equipped aircraft, the identifier in the ATS flight plan item 7 must always:

a. be the RTF call sign to be used
b. include the aircraft registration
c. include the operating agency designator
d. include an indication of the aircraft type

167. For which flights are flight plans required?

i) IFR flights.
ii) IFR and VFR flights.
iii) Flights crossing national boundaries.
iv) Flights over water.
v) Public transport flights.

a. ii, iii and iv
b. i, iii and v
c. i and iii
d. ii, iii, i and v

168. Given:
Maximum certificated take-off mass 137 000 kg
Actual take-off mass 135 000 kg

For item 9 of the ATS flight plan the wake turbulence category is:

a. medium plus “M+”
b. heavy/medium “H/M”
c. medium “M”
d. heavy “H”

169. Given the following flight plan information:

Trip fuel	**136 kg**		
Flight time	**2.75 h**	**Reserve fuel**	**30% of trip**
Fuel in tanks	**Minimum**	**Taxi fuel**	**3 kg**

State how “endurance” should be completed on the ICAO flight plan:

a 0338
b. 0334
c. 0245
d. 0249

170. How many hours in advance of departure time should a flight plan be filed in the case of flights into areas subject to air traffic flow management (ATFM)?

a 3.00 h
b. 0.30 h
c. 1.00 h
d. 0.10 h

171. If a pilot lands at an aerodrome other than the destination aerodrome specified in the ICAO flight plan, she must ensure that the ATS unit at the destination is informed within a specified time of her planned ETA at destination.
The time is:

a 45 min
b. 30 min
c. 15 min
d. 10 min

172. If equipment listed in item 19 is not carried:

a. circle boxes of equipment not carried
b. tick the boxes of equipment carried
c. cross out the boxes for equipment not carried
d. list equipment carried in box 18 (other information)

173. If the destination airport has no ICAO indicator, in box 16 of your ATS flight plan, you write:

a ////
b. AAAA
c. XXXX
d. ZZZZ

174. In an ATS flight plan an aircraft will be classified as "L" if its MTOM is:

a. 27 000 kg
b. 10 000 kg
c. 57 000 kg
d. 7000 kg

175. In an ATS flight plan item 15 where either a route for which standard departure (SID) and a standard arrival (STAR) are provided:

a. SID should be entered but not STAR
b. both should be entered
c. STAR should be entered but not SID
d. neither SID nor STAR should be entered

176. In flight, it is possible to:

i) file an IFR flight plan.
ii) modify an active flight plan.
iii) cancel a VFR flight plan.
iv) close a VFR flight plan.
(rules of the air annex 2 3.3.5)

a. i and iii
b. i , ii, iii and iv
c. ii, iii and iv
d. i and iv

177. In order to comply with PANS-RAC, during an IFR flight, deviations from flight plan particulars should be reported to ATC.
Concerning TAS and time, the minimum deviations which must be reported are:

a. TAS 3% and time 3 minutes
b. TAS 5% and time 3 minutes
c. TAS 5 kt and time 5 minutes
d. TAS 10 kt and time 2 minutes

178. In the ATS flight plan item 15, for a flight along a designated route, where the departure aerodrome is not on or connected to that route:

a. it is not necessary to indicate the point of joining that route as it will be obvious to the ATS unit
b. it is necessary only to give the first reporting point on that route
c. the letters "DCT" should be entered, followed by the point of joining the ATS route
d. the words "as cleared" should be entered

179. In the ATS flight plan item 15, it is necessary to enter any point at which a change of cruising speed takes place.
For this purpose a "change of speed" is defined as:

a. 10% TAS or 0.05 Mach or more
b. 20 kt or 0.05 Mach or more
c. 5% TAS or 0.01 Mach or more
d. 20 km per hour or 0.1 Mach or more

180. **In the event that SELCAL is prescribed by an appropriate authority, in which section of the ATS flight plan will the SELCAL code be entered?**

a Equipment
b. Route
c. Aircraft identification
d. Other information

181. **Item 7 of the flight plan in accordance with PANS-RAC (DOC 4444) should always include, for an aircraft equipped with a radio:**

a aircraft initialization
b. aircraft type
c. aircraft call sign
d. aircraft operator

182. **Prior to an IFR flight, when filling in the ICAO flight plan, the time information which should be entered in box 16 "total elapsed time" is the time elapsed from:**

a. take-off until reaching the IAF (initial approach fix) of the destination aerodrome
b. taxi-out prior to take-off until the IAF
c. take-off until landing
d. taxi-out prior to take-off until completion of taxiing after landing

183. **Reference ICAO flight plan.**
What is the maximum estimated elapsed time or distance between points on track mentioned in item15 of the flight plan, for flights outside designated ATS routes?

a. 30 min / 200 NM
b. 60 min / 370 NM
c. 90 min / 370 km
d. 120 min / 370 NM

184. **Reference item 19 of the ICAO flight plan, endurance is:**

a. maximum flight time plus 45 minutes holding fuel
b. maximum flight time plus 30 minutes holding fuel
c. fuel endurance of the aircraft
d. total usable fuel required for the flight

185. **Reference the ICAO flight plan, in item 15 (speed) this speed refers to:**

a indicated airspeed
b. equivalent airspeed
c. initial cruising true airspeed
d. calculated ground speed

186. **Standard equipment in item 10 is considered to be:**

a. VHF, RTF, ADF, VOR, ILS
b. HF, RTF, VOR, DME
c. VHF, VOR, ADF
d. VHF, RTF, ILS, VOR

187. The navigation plan reads:

Trip fuel	**100 kg.**
Flight time	**1 h 35 min.**
Taxi fuel	**3 kg.**
Block fuel	**181 kg.**

How should "endurance" be shown on the flight plan?

a 0204
b. 0240
c. 0249
d. 0252

188. The planned departure time from the parking area is 1815 UTC. The estimated take-off time is 1825 UTC.
The IFR flight plan must be filed with ATC at the latest at:

a 1725 UTC
b. 1715 UTC
c. 1745 UTC
d. 1755 UTC

189. "Total Elapsed Time" for an IFR flight, when filling in the ICAO flight plan at box 16, is the time elapsed from:

a take-off until landing
b. take-off until reaching the IAF (Initial Approach Fix) of the destination aerodrome
c. taxi-out prior to take-off until taxiing after landing
d. taxiing until the IAF (Initial Approach Fix) of the destination aerodrome

190. What is Total Elapsed Time on a VFR flight plan?

a. From take-off to overhead destination
b. From take-off to overhead destination + 15 min
c. From take-off to landing
d. From taxi to arrival on the gate

191. When filling in a flight plan, wake turbulence category is a function of:

a. max certificated landing mass
b. max certificated take-off mass
c. estimated landing mass
d. estimated take-off mass

192. When filling in item 9 of the flight plan and there is no aircraft designator listed, what should the entry be?

a None
b. ZZZZ followed by an entry at item 18
c. XXXX followed by an entry at item 18
d. A descriptive abbreviation of the aircraft type

193. **When submitting a flight plan before flight, departure time is:**

a. overhead the first reporting point
b. at which the aircraft leaves the parking area
c. of take-off
d. at which flight plan is filed

194. **You have a flight plan, IFR, from Amsterdam to London.
In the flight plan it is noted that you will deviate from the ATS route on passing the FIR boundary Amsterdam/London.
The airway clearance reads " Cleared to London via flight plan route".**

Which of these statements is correct?

a. The filed deviation is not accepted
b. The route according to the flight plan is accepted
c. It is not allowed to file such a flight plan
d. You will get a separate clearance for the deviation

195. **You have a mode A transponder (4 digits, 4096 codes) and mode C. Item 10 of the flight plan should show**

a C
b. A
c. P
d. S

196. **You have filed a flight plan for an uncontrolled flight and suffer a delay prior to departure. After how long a delay must you restate your EOBT?**

a 30 min
b. 40 min
c. 60 min
d. 90 min

197. **You make a diversion from the route given in the flight plan and land at an uncontrolled airfield.
Within what time after landing should you inform ATC?**

a 10 min
b. 20 min
c. 30 min
d. 45 min

198. **Refer to Jeppesen Manual - VFR Section Athinai Hellinikon 29-1
What is the variation?**

a. 3° east
b. 3° west
c. Not shown on chart
d. 6° east

199. **Refer to Jeppesen Manual - VFR Section De Kooy 19-1**
What is the minimum altitude over the quiet sector?

a. 32 800 ft
b. 1500 ft
c. 3500 ft
d. 6500 ft

200. **Refer to Jeppesen Manual - VFR Section De Kooy 19-1**
What is the frequency and QDM of the ILS for runway 22?

a. 109.70 MHz 216° (M)
b. 109.70 kHz 220° (M)
c. 119.10 MHz 216° (T)
d. 109.70 MHz 216° (T)

201. **Refer to Jeppesen Manual - VFR Section Esbjerg 19-2**
What are the dimensions of runway 08/26?

a. 2600 ft by 45 ft
b. 8530 ft by 45 ft
c. 8530 metres by 45 metres
d. 2600 metres by 45 metres

202. **Refer to Jeppesen Manual - VFR Section Sabadell 19-1**
What is the frequency of the Barcelona ATIS?

a. 119.10 MHz
b. 120.80 MHz
c. 118.65 MHz
d. 738 kHz

203. **Refer to Jeppesen Manual - VFR Section Aberdeen 10-IV**
What frequency is the Aberdeen ATSU on?

a. 114.30 MHz
b. 126.25 MHz
c. 119.87 MHz
d. 135.17 MHz

204. **Refer to Jeppesen Manual - VFR Section Aberdeen 10-IV**
What is the max ground elevation within the CTR?

a. 1733 ft
b. 1733 m
c. 2105 ft
d. 1245 ft

205. **Refer to Jeppesen Manual - VFR Section Aberdeen 19-1**
What frequency/frequencies could you receive ATIS when on the ground?

a. 114.30 MHz only
b. 121.85 MHz only
c. 114.30 MHz or 121.85 MHZ
d. 121.70 MHz

206. **Refer to Jeppesen Manual - VFR Section Aberdeen**
What is the maximum wing span of an aircraft using the eastern apron and taxiway?

a. 20 ft
b. 20 m
c. 23 m
d. 10 m

207. **Refer to Jeppesen Manual - VFR Section Athinai 29-1**
What are the call sign and frequency for start-up?

a. ATIS 123.40 MHz
b. Approach 119.10 MHz
c. Ground 121.70 MHz
d. Tower 118.10 MHz

Annex A

OPERATIONAL FLIGHT PLAN	FLT NR	ACFT REG	ACFT TYPE	FROM-TO	RWY			W/V
				LFPG - EGLL	T			QNH
SKED TD	Remarks:FOR TRAINING AND EXAMINATION PURPOSES ONLY			AVG WC:________	MAX LM			MALTOM (Met)
SKED TA					TRIP FUE L			COR
SKED BLOCK TM				AVG FF:________	MALTOM			MALTOM
FLT PLAN TIME				TOC:________	EST ZFM			
					EST ALTOF			(MAX ZFM)

PLN TO	G + L -	CMB ADDN *	TIME ACC	POSITION	TC GC	W/V	WCA	T CMB ISA	FL	CRZ PROC	TAS	GS	DIST INT	DIST ACC	NAM FLT	TAS ^80
				LFPG												
				TOC	340	280/40	X	ISA-10 °C	280	0.74	X	X	50	50		
				ABB 116.5		280/40		ISA-10 °C	280	0.74	430					
				TOD		280/40		ISA-10 °C	280	0.74						
			00:41	EGLL	320	280/40	X	ISA-10 °C	280	0.74	X	X				

SEG	TOM	CALC NAM	ACC FUEL
	acc+CA* X		
1	M		
1	INT FUEL	X	
1	M		
1	STEP CL		
2	M		
2	INT FUEL	assumed 80	
2	M		
2	STEP CL		
3	M		
3	INT FUEL		
3	M		
3	STEP CL		
4	M		
4	INT FUEL		
4	M		
4	STEP CL		
5	M		
5	INT FUEL		
5	M		
5	STEP CL		
LAST	M		
LAST	INT FUEL		
LAST	M		
LAST	ADD DES X		
LAST	LM49,700KG		
RECL	M		
RECL	INT FUEL		
RECL	M		
RECL	ADD DES		
RECL	LM		

ALTN	FL	AVG TC	W/V	TAS	GS	DIST	TIME	FUEL
EGCC		330	250/30					

TRIP FUEL	assumed 1750kg		
CONT FUEL			
ALTN FUEL			
FINAL RES	1300kg	00:30	
PLNTOF			
EXTRA FUEL			
TKOF FUEL			
TAXI FUEL			
BLOCK FUEL			

BASED ON TAFS: DATE: TKOF ALTN

FO____________ PIC____________

APPENDIX C TO FP FEEDBACK

Answers to Revision Questions

1	2	3	4	5	6	7	8	9	10	11	12
a	c	c	d	c	b	d	c	c	d	d	c

13	14	15	16	17	18	19	20	21	22	23	24
d	b	c	c	d	c	b	b	c	a	a	d

25	26	27	28	29	30	31	32	33	34	35	36
d	a	d	c	b	c	d	b	a	c	a	d

37	38	39	40	41	42	43	44	45	46	47	48
a	a	a	c	c	b	a	c	a	a	a	c

49	50	51	52	53	54	55	56	57	58	59	60
a	b	c	c	c	d	a	b	b	c	d	a

61	62	63	64	65	66	67	68	69	70	71	72
b	c	d	d	a	c	b	a	a	b	a	d

73	74	75	76	77	78	79	80	81	82	83	84
b	c	c	a	c	b	c	a	c	c	d	d

85	86	87	88	89	90	91	92	93	94	95	96
c	a	d	b	b	d	c	c	c	b	d	c

97	98	99	100	101	102	103	104	105	106	107	108
a	d	c	a	c	c	d	d	d	c	b	a

109	110	111	112	113	114	115	116	117	118	119	120
b	b	d	b	c	a	d	c	b	a	a	b

121	122	123	124	125	126	127	128	129	130	131	132
d	d	b	d	c	a	a	d	b	a	b	a

133	134	135	136	137	138	139	140	141	142	143	144
c	d	b	a	b	c	b	b	a	b	a	d

145	146	147	148	149	150	151	152	153	154	155	156
b	d	a	a	c	d	c	d	b	d	c	c

157	158	159	160	161	162	163	164	165	166	167	168
b	a	b	a	b	d	d	c	c	a	c	d

169	170	171	172	173	174	175	176	177	178	179	180
b	a	b	c	d	d	b	b	b	c	c	d

181	182	183	184	185	186	187	188	189	190	191	192
c	a	a	c	c	a	c	b	b	a	b	b

193	194	195	196	197	198	199	200	201	202	203	204
b	b	a	c	c	a	b	a	d	c	d	a

205	206	207
c	b	c

Specimen Examination Paper

All questions worth one mark unless stated.

1. Information on Search and Rescue (SAR) procedures may be obtained:

a. from NOTAMs
b. from the latest AIC
c. from the Aeronautical Information Publication
d. by RT communication with the FIR within which the aircraft is operating

2. Refer to ED-6.
The track and distance between Friedrichschafen (EDNY) and Stuttgart (EDDS) are:

a.	350°(M)	62.5 km
b.	345°(M)	65 NM
c.	349°(M)	62.5 NM
d.	351°(M)	116 km

3. Refer to ED-6.
The radio navigation aid at N4854.8 E00920.4 is:

a.	a VOR/DME	call sign LBU	frequency 109.20 kHz
b.	a Tacan	call sign LBU	channel number 109.20
c.	a VOR/TAC	call sign LBU	frequency 109.20 MHz
d.	a VOR/DME	call sign LBU	frequency 109.20 MHz

4. Refer to CAP 697 SEP Figure 2.1.
Given : Airfield elevation 6000 ft OAT 15°C Initial Weight 3525 lb
Cruise altitude 14 000 ft OAT -13°C Wind component 60 kt tail
The time, fuel and nautical ground miles to TOC are:

a.	16 min	5 gal	31 NGM
b.	15 min	6 gal	18 NGM
c.	17 min	7 gal	46 NGM
d.	16 min	5 gal	52 NGM

5. Refer to CAP 697 SEP Figure 2.2.
Given:
Pressure Altitude 10 000 ft OAT -15°C Power 23 inHg @ 2300rpm
The fuel flow and KIAS are:

a.	67.3 PPH	140 kt
b.	67.3 GPH	157 kt
c.	11.4 GPH	139 kt
d.	66.2 GPH	137 kt

6. **Refer to CAP 697 MEP Figure 3.4.**
An aircraft is flying at a High Speed Cruise at a pressure altitude of 12 000 ft, temperature ISA +15°C. The TAS is:

a. 189 kt
b. 186 kt
c. 183 kt
d. 182 kt

7. **Refer to CAP 697 MEP Figure 3.5**
The endurance "With 45 Min. Reserve at 45% Power" for an Economy Cruise at 13 000 ft is:

a. 4 h 25 min
b. 4 h 04 min
c. 4 h 57 min
d. 6 h 18 min

8. **The air distance and time to climb is 197 NAM and 33 min respectively. What is the required ground distance with a 40 kt headwind component?**

a. 222 NGM
b. 184 NGM
c. 157 NGM
d. 175 NGM

9. **An aircraft is airborne from an airfield, elevation 1560 ft AMSL, on a QNH of 986 mb/hPa.**
On its track of 269°(M) there is a mountain 12 090 ft AMSL. To clear this obstacle by a minimum of 2000 ft its correct ICAO VFR Flight level is: (1 mb/hPa = 30 ft).

a. FL145
b. FL155
c. FL160
d. FL165

10. **On a Jeppesen chart the figures "FL80 2700a" are displayed below an airway. What does the "FL80" indicate?**

a. The route MORA (a safety altitude)
b. Minimum en route altitude
c. Maximum authorized altitude
d. The base of the airway

11. **In the Jeppesen SID, STARs & IAP directions are given as:**

a. true course/track
b. magnetic course/track
c. true heading
d. magnetic heading

12. **Refer to CAP 697 SIMPLIFIED LRC (use Figures 4.5.3.1 & 4.3.1B)**
Given : Distance 997 NGM tailwind component 160 kt landing weight 45 000 kg
Cruise weight 56 000 kg FL370 ISA 0°C
The fuel required and trip time are:

a. 11 200 kg 4 h 09 min
b. 5300 kg 1 h 09 min
c. 4200 kg 1 h 51 min
d. 5000 kg 2 h 00 min

13. **Refer to CAP 697 MRJT Figure 4.4**
Given:
Aircraft mass 43 000 kg
Destination airfield elevation = 3500 ft Alternate airfield elevation = 10 ft
ISA conditions
What is the final reserve?

a. 2110 kg
b. 1025 kg
c. 1038 kg
d. 1055 kg

14. **Refer to CAP 697 MRJT Figure 4.5.4**
An aircraft with an estimated landing weight of 55 000 kg plans a descent from FL310 through turbulence; the mean wind component in the descent is 45 kt headwind.
The fuel and ground distance are:

a. 280 kg 82 NGM
b. 270 kg 107 NGM
c. 270 kg 79 NGM
d. 275 kg 117 NGM

15. **Refer to CAP 697 MRJT Fig 4.3.2b**
Given :
5000 kg fuel available Cruise at FL210 50 kt headwind
Landing weight 45 000 kg
How far could you fly?

a. 600 NGM
b. 750 NGM
c. 500 NGM
d. 670 NGM

16. **Refer to CAP 697 MRJT Figure 4.3.1b**
Given
Trip Distance 1000 NM Nil wind FL290
For a temperature increase of 30°C the approximate change in trip time is:

a. +10%
b. -5%
c. -10%
d. +7%

17. Refer to CAP 697 MRJT Figure 4.1
If an aircraft's cruise weight is 50 000 kg the Optimum Altitude for a 0.78 Mach flight is:

a. 35 500 ft pressure altitude
b. 36 200 ft pressure altitude
c. 35 500 ft altitude
d. FL360

18. Reference CAP 697 MRJT Figure 4.5.3.2
Given:
Brake Release Mass 62 800 kg Fuel to TOC 1400 kg
0.74 Mach Cruise at FL310 ISA -10°C Wind component 50 kt head
Mass at first reporting point after TOC 59 500 kg

The planned ground distance TOC to the first reporting point is:

a. 356 NM
b. 314 NM
c. 277 NM
d. 280 NM

19. Given:
Track 185°(T) Variation 9° east Heading 182°(M)
Which is the lowest suitable ICAO IFR cruising level?

a. FL280
b. FL310
c. FL290
d. FL270

20. Reference CAP 697 MRJT Figure 4.5.1
Given:
Climb to FL350 ISA+6°C MSL airfield Brake Release Weight 57 500 kg

The time, fuel, TAS and distance covered are:

a.	22 min	1625 kg	395 kt	114 NAM
b.	20 min	1625 kg	395 kt	117 NAM
c.	20 min	1630 kg	395 kt	100 NAM
d.	21 min	1675 kg	398 kt	133 NAM

21. Reference CAP 697 MRJT Figure 4.3.6
Give:
Time to alternate 54 min Landing weight 55 000 kg Wind component 50 kt tail

The alternate fuel and nautical ground mile distance are:

a.	2500 kg	320 NGM
b.	1500 kg	175 NGM
c.	2350 kg	355 NGM
d.	2200 kg	350 NGM

22. **Reference CAP 697 MRJT Figure 4.5.3.1**
Given:
Pressure altitude 33 000 ft LRC OAT -61°C Cruise time 29 min
Zero wind Initial gross weight 54 100 kg

The fuel required is:

a. 1093 kg
b. 1107 kg
c. 1100 kg
d. 1207 kg

23. **Refer CAP 697 MRJT Fig 4.3.1**
Given:
FL370 @ LRC ISA +20°C Distance 800 NGM
50 kt headwind Landing weight 50 000 kg

What is the trip fuel and flight time?

a. 5600 kg 2 h 15 min
b. 4500 kg 2 h 00 min
c. 4100 kg 1 h 48 min
d. 4400 kg 1 h 48 min

24. **A flight is due to operate between London and Glasgow on a Repetitive Flight Plan (RPL). Prior to departure Glasgow is closed due to heavy snow.**
The operator intends to operate this flight to Edinburgh instead.
The correct action regarding flight plans is:

a. this cannot be done, go back to airport hotel
b. operations should inform the London ATC Unit at least 10 minutes before departure
c. cancel the RPL and file a standard ICAO flight plan to Edinburgh
d. take-off for Glasgow and divert along route

25. **A normal commercial IFR flight has an estimated EOBT of 1540 UTC with the estimated take-off time as 1555 UTC.**
What is the latest time for filing the ICAO flight plan?

a. 1510 UTC
b. 1455 UTC
c. 1525 UTC
d. 1440 UTC

26. **A flight from BIRMINGHAM (EGBB) to DUBLIN (EIDW) has an EOBT of 09:30 UTC, actual airborne time of 09:50, expected trip time of 1 hour, estimated flying time to SHANNON FIR (EISN) boundary of 55 minutes.**
How should you complete item 18 of the ICAO flight plan regarding your estimate for the FIR boundary?

a. EET/EIDW1045
b EET/EISN1025
c. EET/EISN0055
d. EET/EISN0060

27. **Refer to Jeppesen MUNICH 10-2B**
When approaching Munich via TANGO with a westerly surface wind, the route and track miles to the IAF are expected to be:

a. AALEN - WLD - ROKIL – MBG 90 NM
b. AALEN - WLD - ROKIL 51 NM
c. AALEN - WLD - ROKIL – MBG 124 NM
d. WLD-ROKIL 10 NM

28. **Refer to Jeppesen E(LO)1**
The magnetic course and distance from LIFFY (N5329 W00530) and WAL (N5324 W00308) is:

a. 279°(M) 85 NM
b. 099°(M) 114 NM
c. 099°(M) 85 NM
d. 099°(M) 59 NM

29. **Refer to Jeppesen Polar High Altitude Chart 5AT(HI).**
What is the Grid track from Stornoway (N58 W006) to Kulusuk (N6530 W03710)?

a. 318°
b. 298°
c. 138°
d. 118°

30. **Given :**
A to B Distance 2050 NM Safe Endurance 6 hours
GS OUT = 480 kt GS ON = 450 kt GS HOME = 380 kt

Calculate the distance and time to the Point of Equal Time from A.

a. 1272 NM 2 h 39 min
b. 906 NM 1 h 53 min
c. 1111 NM 2 h 19 min
d. 939 NM 1 h 57 min

31. **Given: GS OUT = 178 GS HOME = 249**
Distance A to B = 450 NM Endurance 3 hours

What is the distance to the Point of Safe Return from A?

a. 204 NM
b. 311 NM
c. 415 NM
d. 262 NM

32. **You plan to fly from A to B at a TAS of 230 kt, a GS of 255 kt and an initial cruising pressure altitude of 15 000 ft.**
How should you complete item 15 of the ICAO Flight Plan?

a. K0230 F150
b. N0230 F150
c. N0255 S1500
d. N0230 FL150

33. Refer to Jeppesen E(LO)5.
What is the lowest continuous flight level you should maintain along B45 when flying from Czempin/CZE (N5207 E01643) to Chociwel/CHO (N5328 E01521)?

a. FL60
b. FL70
c. FL180
d. FL80

34. A current flight plan is:

a. the filed flight plan with amendments and clearances included
b. the filed flight plan without any changes
c. flight plan with correct time of departure
d. one that is stored via repetitive flight plan procedures

35. Refer CAP 697 MRJT Figure 4.3.6
Flight from Paris to London with Manchester being the alternate.
Given:
London - Manchester 160 NM Mean track 350°(T) W/V 250/30°(T)
Estimated landing mass at alternate 50 000 kg

What is the fuel and time to the alternate?

a.	1200 kg	20 min
b.	1600 kg	36 min
c.	1450 kg	32 min
d.	1300 kg	28 min

36. Refer CAP 697 MRJT Fig 4.7.2
Given:
ETOPS approval for 120 minutes Weight at diversion 50 000 kg
Long Range Cruise

Your diversion airfield should be within:

a. 742 NM
b. 379 NM
c. 768 NM
d. 1101 NM

37. Refer to Jeppesen AMSTERDAM Schiphol SID 10-3
Which of the following statements is true regarding an ANDIK departure from RWY 19L?

a. Contact Schipol Departure on 119.05 MHz when passing 2000 ft and report altitude
b. The distance to ANDIK is 25 NM
c. Cross ANDIK below FL60
d. Maximum IAS 250 kt till turning left at SPL 3.1DME

38. **You are cruising at FL250 and need to be at FL50 10 NM before a VOR/DME. Your rate of descent is 1250 ft/min and your GS in the descent 250 kt.**

How far before the VOR/DME should you start your descent?

a. 66.7 NM
b. 83.3 NM
c. 98.5 NM
d. 76.7 NM

39. **You are required to uplift 40 US gallons of AVGAS with SG of 0.72. How many litres and kilograms is this?**

a. 109 l 151 kg
b. 182 l 131 kg
c. 182 l 289 kg
d. 151 l 109 kg

40. **Refer CAP 697 MRJT Figure 4.3.2c**
Given:
Mach 0.74 cruise Trip fuel available 17 000 kg FL280
Estimated landing mass 52 000 kg Trip distance 2500 NGM

What is the maximum wind component?

a. Zero
b. 25 kt head
c. 25 kt tail
d. 60 kt head

41. **Refer to Jeppesen E(LO)1**
What type of radio navigation aid is located at Perth (N5626 W00322)?

a. VOR on 110.4 MHz and NDB on 394 kHz
b. TACAN on 110.4 kHz
c. VOR on 110.4 MHz
d. VOR/DME on 110.4 MHz

42. **Given:**
DOM 33 510 kg Traffic load 7600 kg Taxi fuel 250 kg
Trip Fuel 2500 kg Contingency fuel 125 kg Final reserve fuel 983 kg
Alternate fuel 1100 kg

What is the estimated landing mass at the destination?

a. 43 318 kg
b. 45 818 kg
c. 42 218 kg
d. 43 193 kg

43. **When completing an IFR flight plan the "Total Elapsed Time" in item 16 is from:**

a. take-off to overhead the destination airport
b. from first taxiing under own power until the IAF for destination airport
c. take-off to the IAF for the destination airport
d. take-off until landing at the destination airport

44. **An aircraft has been planned to fly via a significant point based upon the TIR VORDME, QDM120 at range of 95 NM.**
The correct entry for the ICAO flight plan is:

a. TIR300095
b. TIR120095
c. TIR30095
d. 300095TIR

45. **Reference E(HI)4 (CAA FOR EXAMS)**
GIBSO (N5045.1 W00230.3)
Aircraft intending to use UR-14 will be expected to cross GIBSO at or above:

a. FL200
b. FL250
c. FL280
d. FL310

46. **Reference E(HI)5 CAA for examinations**
From Mende-Nasimbals (N4436.4 E00309.7) to Gaillac (N4357.3 E00149.5) via UG5.

Which of these levels is the lowest available?

a. 290
b. 310
c. 330
d. 350

47. **Reference E(HI)4 (CAA FOR EXAMS)**
What is the total distance and mean true course between Abbeville (N5008.1 E00151.3) and Biggin (N5119.8 E00002.2) on UA20?

a. 100 NM 321°(T)
b. 162 NM 313°(T)
c. 162 NM 316°(T)
d. 100 NM 316°(T)

48. **An aircraft is carrying Maritime Survival Equipment.**
The correct entry at item 19 is:

a. cross out indicators P, D and J; tick M
b. circle indicator M
c. tick indicator M
d. cross out indicators P, D and J

49. **Refer to Training Manual, Amsterdam page 10-9X.**
What is the minimum radio altitude for a Cat 2 ILS DME approach to runway 01L?

a. 88 ft
b. 100 ft
c. 300 m
d. 103 ft

50. **At a fuel Relative Density of 0.80 an aircraft turbine engine burns 220 litres per hour. If Relative Density is 0.75 what is the fuel burn?**

a. 235 L/h
b. 206 L/h
c. 220 L/h
d. 176 L/h

Answers to Specimen Examination Paper

1	2	3	4	5	6	7	8	9	10	11	12
c	c	d	d	a	b	a	d	d	b	b	c

13	14	15	16	17	18	19	20	21	22	23	24
d	c	a	b	a	c	d	b	c	a	a	c

25	26	27	28	29	30	31	32	33	34	35	36
d	c	a	c	a	d	b	b	d	a	c	a

37	38	39	40	41	42	43	44	45	46	47	48
a	d	d	b	c	a	c	a	b	a	d	d

49	50
b	a

Explanations to Specimen Examination Paper

1. c. from the Aeronautical Information Publication. FACT

2. c. 349°(M) 62.5 NM

3. d. a VOR/DME call sign LBU frequency 109.20 MHz
(radio aids panel)

4. d.

16 min	5 gal	52 NGM	
14000	23	7.5	48
6000	7	2.5	12
16 min	5 gal	36 NAM + $(\frac{16}{60} \times 60)$ = 52 NGM	

5. a. 67.3 PPH 140 kt
ISA Temp -5°C, so ISA Dev = -10°C ⇨ Interpolate!

ISA	-20°C	11.4	68.4 PPH	143 KIAS
ISA		11.0	66.2 PPH	137 KIAS
ISA -10		11.2	67.3 PPH	140 KIAS

6. b. 186 kt
ISA at 12 000 = -9°C
Convert ISA +15 into actual temperature of +6°C then enter graph

7. a. 4 h 25 min
Use left-hand side of graph for 65% power

8. d. 175 NGM

$\frac{16}{60} \times 40 = 22 \quad 197 - 22 = 175$

9. d. FL165
Min Ht req'd = 12 090 AMSL (QNH) + 2000 ft = 14 090 ft min Alt
1013 - 986 = 27 hPa × 30 = 810 ft +14 090 = 14 900 ft min P Alt
VFR = Even + 500
Min FL = FL165

10. b. Minimum En Route Altitude
Jeppesen - introduction p57

11. b. Magnetic Course/Track
All tracks are magnetic unless marked "T" or "G"

12. c. 4200 kg 1 h 51 min
tailwind component 160 kt

TAS = 427

Use 725 NAM with no wind correction

$$\frac{427}{587} = \frac{725\text{ NAM}}{997\text{ NGM}}$$

13. d. 1055 kg
Remember use 1500 ft above alternate
Use 1500 ft from 4.4
Fuel flow is 2110 kg/h @ 43 000 kg
Remember 30 minutes for FR

14. c. 270 kg 107 NGM
Use table 4.5.4b NAM = 93

$$\frac{19}{60} \times 45 = 14 \qquad 93 - 14 = 79\text{ NGM}$$

15. a. 600 NGM
NB. Working backwards through the graph

16. b. -5%
ISA -10 = 2.55 h
ISA + 20 = 2.40

$$= \frac{0.15}{2.55} \times 100 = 5.88\%$$ less as TAS increases.

17. a. 35 500 ft pressure altitude

18. c. 277 NM
Mass at TOC = 61400
61 400 kg = 4989 NAM
59 500 kg = $\frac{4675\text{ NAM}}{314\text{ NAM}}$

$$\text{TAS} = 434 - 10 = \frac{424}{\text{GS} = 374} = \frac{314\text{ NAM}}{277\text{ NGM}}$$

19. d. FL270
185 – 9 = 176°(M) therefore ODDs

20. b. 20 min 1625 kg 395 kt 117 NAM

21. c. 2350 kg 355 NGM
backwards through the graph

22. a. 1100 kg
ISA -10 TAS 433 - 10 423 kt
29 min at 423 kt = 204 NAM/NGM
54 100 = 3929 – 204 = 3725
3725 NAM = 53 000
54 100 – 53 000 = 1100 kg
Correct fuel for ISA Dev = 1093 kg

23. a. 5600 kg 2 h 15 min

24. c. Cancel the RPL and file a standard ICAO Flight Plan to Edinburgh

25. d. 1440 UTC
Rule - IFR 1 hour before EOBT not take-off time

26. c. EET/EISN0055
Always enter elapsed times in hours & minutes not estimates

27. a. AALEN - WLD - ROKIL – MBG 90 NM runway 26 in use, MBG is IAF

28. c. 099°(M) 85 NM
42 + 17 + 26

29. a. 318°
Align protractor along the Grid parallels

30. d. 939 NM 1 h 57 min

$$\frac{2050 \times 380}{450 + 380} = 939 \text{ NM @ } 480 = 1\text{h } 57 \text{ min}$$

31. b. 311 NM

$$\frac{3 \text{ hrs} \times 249}{178 + 249} = 1.75 \text{ h @ } 178 = 311 \text{ NM}$$

32. b. N0230 F150
Jeppesen Air Traffic Control p436/7

33. d. FL80
Lowest continuous is FL70 off chart THEN remember even level track

34. a. The filed flight plan with amendments and clearances included FACT

35. c. 1450 kg 32 min
Mean track 350°(T) W/V 250/30°(T) Using CRP5 get a 5 kt tailwind to enter graphs

36. a. 742 NM

37. a. Contact Schipol Departure on 119.05 MHz when passing 2000 ft and report altitude

38. d. 76.7 NM

$$25\,000 - 5000 = \frac{20\,000}{1250} = 16 \text{ min @ } 250 \text{ kt} = 66.7 \text{ NM} + 10 = 76.7 \text{ NM}$$

39. d. 151 L 109 kg
Use CRP5 set 40 against US.gal then read off others
Or use your calculator as follows
40 US.gal × 3.78 = 151 litres × 0.72 = 109 kg

40. b. 25 kt head
Back from fuel, normal from distance

41. c. VOR on 110.4 MHz

42. a. 43 318 kg
Taxi fuel 250 kg not included
Trip Fuel 2500 kg and used by destination
What is the estimated landing mass at the **destination**?
NB. Assuming Contingency Fuel is not burnt

43. c. Take-off to the IAF for the destination airport
RULE

44. a. TIR300095
Jeppesen Air Traffic Control Section p438

45. b. FL250
See chart note 11

46. a. 290
Though an even level direction, look for the "<O" which indicates odd levels in that direction

47. d. 100 NM 316°(T)
321°(M) – 5°W

48. d. Cross out indicators P, D and J. Jeppesen Air Traffic Control Section p439

49. b. 100 ft
Radio Alt will be AGL i.e.: about (QFE) ht
Amsterdam is below MSL

50. a. 235 L/h
Use Navigation Computer 220 L @ SG 0.8 = 176 kg
176 kg @ SG 0.75 = 235 L

Chapter

16

Index