

Flight planning

VFR:

Westerly (180 – 359): Even + 500

Easterly (000 – 179): Odd + 500

* Remember to convert to **magnetic track** when determining westerly or easterly

Congested areas: 1000ft above highest obstacle within 600m radius

Elsewhere: 500ft (150m) above ground

IFR:

Westerly: Even

Easterly: Odd

FL Number only: Min en-route altitude (MEA)

Number “a”: Min off-route altitude (MORA) **Obstruction clearance: 10NM either side of route**

Number “T”: Min obstruction clearance altitude (MOCA)

MAA: Max authorized altitude (MAA)

ISA temperature correction:

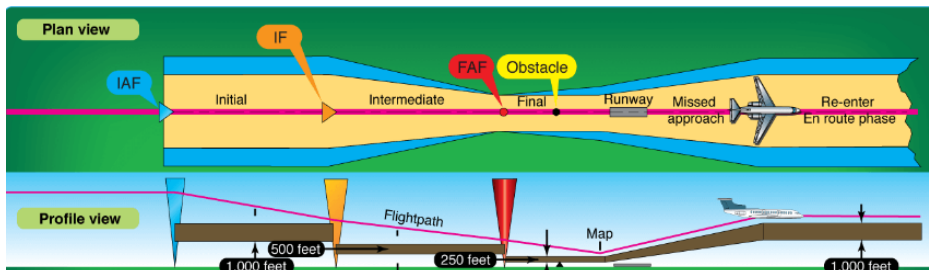
- ISA temp correction applied to **pressure altitude**
- Apply temp correction **ONLY** if it exceeds 20% MOC
- Apply temp correction for **MSA** always

Min sector altitude (**MSA**): 1000ft within 25NM

Mach = TAS/LSS (LSS = $38.95 \times \sqrt{273 - \text{OAT (K)}}$)

“Established”: Intermediate approach

SID/STAR: Routes are defined as **magnetic courses**



Charts:

In a grid sector, a number represents **MSA**

VHF distance = $1.25 \times \sqrt{\text{Altitude}}$

*If distance too short, use HF, lower HF frequency for night, higher HF frequency for day

Fuel planning:

USG x 6 = lb

USG x 3.7852 = litres

IMP gal x 4.55 = litres

Lb x 0.454 = kg

Kg x 2.205 = lb

Fuel in terms of **mass** (Kg or lb): **Not affected by SG**

Fuel burn in terms of **volume** (Gallons or litres): New fuel flow = (Old fuel flow x old SG) ÷ new SG

Range **without any extra fuel:**

Useable fuel: Block fuel – taxi – alternate – holding (45 min prop) – 5% contingency

Range = Useable fuel ÷ fuel consumption x GS

Regulation:

- Required to land **with reserve fuel**
- **SEP** has to land with **45 mins fuel reserve**
- Sum of trip fuel (Includes contingency 5%) = (Tank capacity – taxi) - 45 mins final reserve

Snow showers, causing runway contamination most likely to affect fuel log (Due to landing at alternate) compared to rain/fog/mist

For commercial flights:

Final reserve fuel (Reciprocating/piston engine): 45 minutes *(Vital)

Final reserve fuel (Turbojet):

- **30min HOLDING** fuel flow at **1500ft** above alternate aerodrome
- **30min HOLDING** fuel flow at **1500ft** above **destination** aerodrome when **no alternate required** (Therefore additional fuel + final reserve = 15 min additional + 30 min reserve fuel = 45 mins)
- For **emergency only** & it is **prohibited to plan** the usage of that fuel

Final reserve fuel for ISOLATED aerodromes:

- Fuel for **2 hours** at normal cruise consumption **including final reserve fuel**

Minimum additional fuel:

- **No destination alternate:** Additional **15 minutes** holding fuel (Therefore additional fuel + final reserve = 15 min additional + 30 min reserve fuel = **45 mins**)
- With destination alternate: No additional, alternate fuel given
- Additional fuel for using **PDP**:
 - (i) **Piston/reciprocating the greater of:**
 - **2 hours CRUISE FUEL FLOW OR 45 minutes fuel + 15% cruise time (Destination) whichever is less (TOC to TOD)**
 - OR
 - **45 minutes fuel (Alternate)**
 - (ii) **Jet the greater of:**
 - **30 minutes hold (Not less than final reserve fuel)**
 - **2 hours cruise consumption**
- **Planned final reserve fuel** can be subtracted from calculated **additional fuel**

Contingency fuel:

- For **unforeseen** circumstances between **departure & destination**
- Such as **ATC** requesting to **increase speed**
- **5% of trip fuel OR 5 minutes of holding fuel** whichever is **higher**
- **3% of planned trip fuel provided ERA is available**
- **Minimum = No contingency left**

Alternate fuel:

- **Includes missed approach at destination**
- **Excludes missed approach at alternate**

Useable fuel:

- **At destination:** Not less than the sum of **alternate fuel & final reserve fuel**
- With **no destination alternate** flies for **45 mins** at **holding speed** at **450m (1500ft)**

Trip fuel:

- **Take-off to landing**
- **Includes fuel for climb & descents**

Taxi fuel: At destination **NOT** considered

Landing mass at destination = ZFM + final reserve + alternate + contingency (Lowest fuel amount: Alternate + final reserve)

Landing mass at alternate = ZFM + final reserve + contingency

Diversions: Remaining fuel **same amount** as required fuel to reach aerodrome where safe landing made, **with final reserve fuel**

Integrated procedure:

- **Integrated range curves & tables:** Used to determine **fuel consumption** for a certain air distance considering **decreasing fuel flow with decreasing mass**
- **Range flight planning:** Distance from **take-off to ToC** has to **be known**
- **More precise** & considers **different fuel consumption** during different **flight sectors**

Specific fuel consumption:

Fuel tankering considerations:

- **Weather** at destination **below minima**
- **No suitable fuel** at planned **destination**

Predetermined point (PDP):

- Last possible **point of diversion** to ERA used as **predetermined point (PDP)**
- **Required: Contingency fuel** from **PDP to destination & additional fuel** according to regulations

Decision point procedure:

- Reduce **min required fuel** & therefore **increase traffic load**
- **In case of emergency** while flying to **isolated aerodrome**
- Reducing **contingency fuel** to only that required from **decision point to destination**
- Trip fuel from departure to destination: Contingency at least from **decision point "DP" to destination**
- **Trip fuel to destination** aerodrome is calculated **via decision point**
- Provides **option to select an aerodrome** as destination **alternate** at a distance from planned destination that **cannot be reached** after first flying to destination. **Increases max range** by **reduction of mandatory fuel reserves**
- Reduce **contingency fuel** by adding contingency **only from burn-off between DP & destination**

Calculations:

Determining extra fuel that can be added

1) Find the actual masses

- Actual ZFM = DOM + TL
- Actual TOM = Actual ZFM + take-off fuel
- Actual LM = Actual TOM – Trip fuel
- Actual ramp mass = Actual TOM + taxi fuel

2) Find the most limiting extra fuel (Lowest value):

- MTOM – ATOM
- MLM – ALM = Uncorrected extra fuel
To correct for fuel penalty: (Uncorrected extra fuel ÷ fuel penalty difference) x 1000
- Max ramp mass – actual ramp mass
- Tank capacity (Tank capacity – taxi fuel – take-off fuel)

If question states **ADDITIONAL LOAD** it is **TRAFFIC LOAD: MZFM - Actual ZFM**

If question states **FUEL LOAD** it is **EXTRA FUEL LOAD**

Max permitted take-off fuel = **Limiting TOF + trip fuel**

Trip fuel = Fuel consumption x distance

Total fuel = Contingency + additional/alternate + final reserve + trip

Minimum trip fuel at destination = Alternate + final reserve

Minimum trip fuel at alternate = Final reserve (**30 jets or 45 mins piston/reciprocating**)

PDP calculations:

- Sum of **trip fuel** from **departure to destination** + **contingency** from **decision point to destination**
 - Trip fuel = Distance to destination ÷ GS x fuel consumption
 - Contingency = (Distance decision point to destination ÷ GS x fuel consumption) x 5%
 - Sum of **trip fuel** from **departure to alternate/refuel** + **contingency** from **destination to alternate/refuel**
 - Trip fuel = Distance to alternate ÷ GS x fuel consumption
 - Contingency = (Distance DP to alternate ÷ GS x fuel consumption) x 5%
- Determine the bigger sum, (a) or (b) & all your answers are based on this sum
 - **Read carefully** they may ask for **trip, contingency, total fuel or additional fuel**

Questions for **additional fuel** disregard steps above:

- **TURBINE ENGINES:**
 - **2 hours cruise consumption**
 - **30 minutes for destination ALTERNATE**
- **RECIPROCATING ENGINES:**
 - **45 minutes** fuel consumption + fuel for **15% of the flight time at cruise** (15% of Cruise distance ÷ GS (TOC to TOD)) for **destination** or **2 hours cruise** whichever is less
 - **45 minutes only for destination ALTERNATE**

Planned final reserve fuel can be subtracted from calculated **additional fuel** (**Final reserve fuel is included in additional fuel**)

NOTAM briefing:

- NOTAM-N: New
- NOTAM-R: Replaced
- NOTAM-C: Cancelled
- Date & time given: YYMMDDTIME
- LO: Locater
- PN: Prior notice

- U/S: Unserviceable
- ACC is not part of airport
- ZRT - Zone restricted temporarily: From sunrise (SR) – 30 to sunset (SS) + 30
- Customs & health formalities found in AIP

NOSIG = No significant change

Point of equal time & point of safe return

Point of **safe return (PSR/PNR)**: Last point along the route from which an aircraft can legally **fly back** to its **departure aerodrome**, having **passed the PSR**, the aircraft is committed to **continue** to **destination or alternate**

Point of **equal time (PET/CP)**: Takes **same time** to fly **onward to destination** as it would to **return to departure**

PET always moves **into the wind** (E.g. if wind from N.E PET moves further N.E)

PSR/PNR always **moves closer to departure** if there is **wind regardless tail or head**

Calculations:

- Find **groundspeed home & outbound** using wind data
- Find **endurance**: **Safe endurance** = (Max fuel – min reserve fuel) ÷ fuel flow
- E = endurance, O = outbound GS, H = Homebound GS

(i) **PSR:**

Time to PSR = $(E \times H) \div (O + H)$

Distance of PSR from departure = **Time to PSR** x **O** = $EOH / (O + H)$

(ii) **PET:**

Distance of PET from departure = $(D \times H) \div (O + H)$

Time to PET = **Distance to PET** ÷ **O**

Descent overlooked as it **doesn't matter**

Endurance not relevant

Inversely proportional to (O + H)

OEI PET:

- **PNR**: Calculate **time** with **GS_{AE} outbound & GS_{SE} homebound**. Then to find **distance** use **GS_{AE} outbound**
- **OEI PET**: Calculate the **distance** using **GS_{SE} only**. Then to find **time** use **GS_{AE} outbound**

Some questions require effective TAS to calculate GS

(i) Find WCA:

$XWC = \sin(\text{wind angle}) \times \text{wind speed}$

$WCA = XWC \times 60 \div TAS$

Basically, you **NEED** to use the effective TAS if $WCA > 10^\circ$, if not disregard step (ii)

(ii) **Effective TAS** = **TAS** x **cos WCA**

(iii) **HWC** = **cos (wind angle)** x **wind speed**

(iv) **GS** = **Effective TAS** +/- **headwind/tailwind**

Remember to read question carefully!

- If question asks for **zero reserve** use **PSR**
- Remember to deduct fuel used to find **safe endurance left**
- Some questions ask for PET/PNR from **destination**
- Some questions ask for OEI at PNR:

So from departure to PNR use all engine TAS then back from PNR to departure uses OEI TAS

Flight plan:

(i) Item 7:

- **Identifier: RTF callsign to be used**

(ii) Item 8:

Flight type

- S: Scheduled
- N: Non scheduled
- G: General
- M: Military
- X: Others

(iii) Item 9:

- Wake turbulence CAT: Based on **MTOM** not **ATOM**

- "H" heavy is **highest** >136 000kg
- "L" < 7000kg
- **Number:** Number of aircraft flying in the **group**
- (iv) Item 10:
 - Standard equipment: **VHF RTF, ADF, VOR, ILS**
 - Surveillance
 - A: 4096
 - C: Mode A + altitude reporting
 - S: Mode S + PA & ident
 - Equipment:
 - X: MNPS
 - W: RVSM
- (v) Item 13: ETD = **Go off blocks**
- (vi) Item 15:
 - Route: Points of interval **not more than 30 minutes or 200NM**
 - Airspeed is **TAS, (E.g. 90 knots = N0090)**
 - FL: **F (E.g. FL85 = F085)**
 - VOR ident, magnetic bearing & distance in **km**
- (vii) Item 16:
 - Take-off to IAF
 - EET (Estimated elapsed time): Aircraft **take-off** to **overhead destination (It is duration of flight! Not time!)**
 - Aerodrome: **No ICAO identifier: ZZZZ**
- (viii) Item 18:
 - Other information: SELCAL code
 - Transporting health personnel in conflict: **STS/HOSP**
- (ix) Item 19
 - Endurance:
 - **Endurance of aircraft, total useable fuel on board**
 - Fuel flow in flight: Trip fuel ÷ flight time
 - Endurance in minutes (E.g. 240 mins = 240)
 - Persons on board: Passengers unknown = **TBN** (To be notified)
 - UHF emergency **243.0MHz**

Computer flight plan:

- Advantage: Can use computer to file, can **calculate alternate fuel for missed approach climb cruise descent approach**
- Disadvantage: **Less up to date, no rerouting, unable to account for bad weather**

Repetitive flight plan (**RPLs**):

- **IFR** flights regularly on same day of consecutive weeks on **10 occasions**
- In case of any **adverse weather/closure** of destination, **RPL** cancelled & flight plan filed

Others:

Flight plan amended or cancelled, new flight plan submitted:

- Delay of **>30 mins EOBT controlled:**
- Delay of **>60 mins EOBT un-controlled**

IFR –VFR: **On commanders request ONLY**

Flights in **IFR & across borders** require flight plan notification

In case of **AFTM** flight plan should be filed at least **3 hours in advance** of the **EOBT**

"Current flight plan": Includes amendments & clearances

You can't close a flight plan in flight

Pilot informs ATC in case **TAS varies by 5%, Mach 0.01 & time by 2 minutes**

Diverting to uncontrolled: Inform ATC in **30 minutes**

Delayed: **Amended or cancelled** within **30 minutes**

Airborne: **10 mins before entering CTR**

Flight plan submitted: **1 hour before leaving parking**

Controlled flight: 60 mins before departure

Flight planning & flight re-planning

1 in 60: Track error = Distance off track x 60 ÷ distance

NAM = NGM x TAS ÷ GS

Fuel calculation:

- New NAM – old NAM x fuel consumption (kg/NAM)
- (Block – taxi) ÷ (Trip + contingency) ÷ time = fuel consumption

**If wind changed from headwind to tailwind don't waste time calculating additional fuel, as tailwinds results in less fuel burn*

Fuel remaining = [(Block – taxi) ÷ ((100% + contingency %) ÷ 100) ÷ endurance x flight time left] + contingency

Centre pump failure, fuel consumed at wings first, fuel transferred from centre tank to wings:

- Rate of transfer x time = Transferred fuel
- Remaining fuel available = (Transferred fuel + fuel in wings) – (fuel consumption x time of failure)
- Endurance left = Remaining fuel ÷ fuel consumption

(Cruising alt + pressure correction – level off altitude) ÷ ROD = Time to descend

Distance = GS x time to descend

True track = True heading + INS drift

True heading = True heading – INS drift