INTRODUCTION

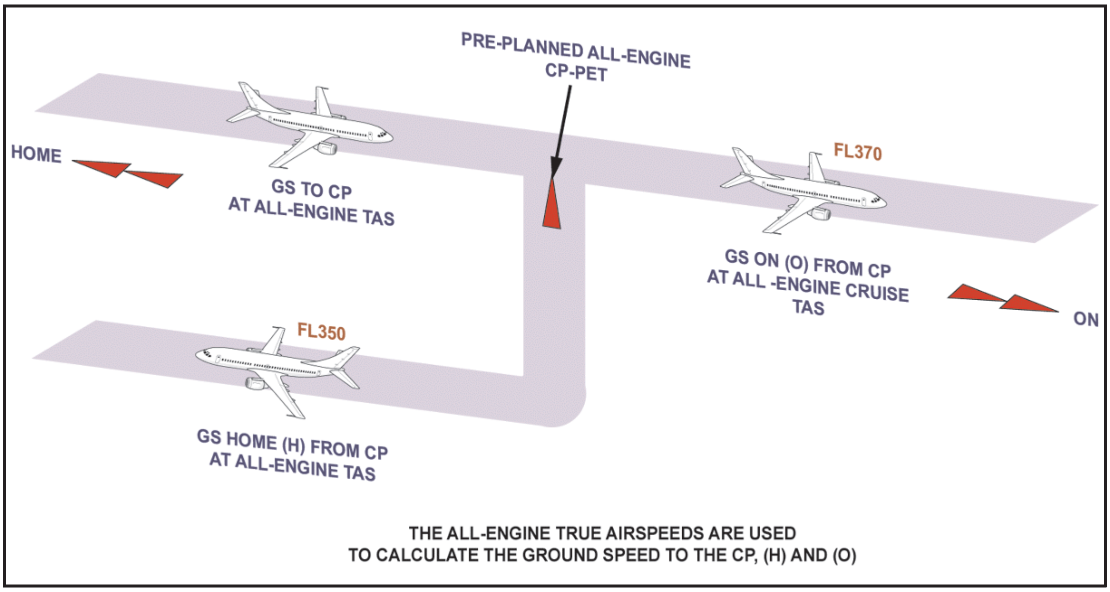


Figure 9.1: All-engine critical point (Point of Equal Time).

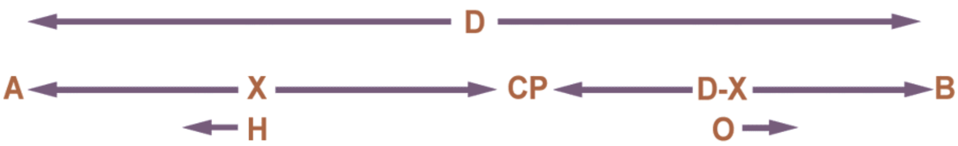
The Point of Equal Time(PET) or sometimes is referred to as Critical Point(CP), is that track position, in relation to two suitable airfields, from which it is **the same time** for an aircraft to fly to either. These two airfields could be the departure and destination airfields, or any two airfields 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 in-operative cruise speed. Any operation planned beyond this distance from an adequate aerodrome is considered to be Extended Range Twin Operations (ETOPS: see CAP 513). Approved ETOPS requires the calculation of PETs between adequate airfields.

DERIVATION OF FORMULA



D = Total Distance

X = Distance to CP from A

D - X = Distance from CP to B

H = Groundspeed HOME from CP

O = Groundspeed ON from the CP

By definition TIME HOME = TIME ON and TIME = $\dfrac{\text{DISTANCE}}{\text{GROUNDSPEED}}$

$$\frac{X}{H} = \frac{D - X}{O}$$

$$XO = H(D - X)$$

$$XO = HD - HX$$

$$XO + XH = HD$$

$$X(O + H) = HD$$

$$X = \frac{DH}{O + H}$$

Figure 9.2: Derivation of CP formula/transposing formula for navigation computer.

THE EFFECT OF WIND ON THE POSITION OF THE PET:

Let A to B total distance D = 500nm and TAS = 300kt.

STILL AIR **X**

$$= \frac{500 \quad \times}{+}$$

$$= \frac{500 \times 300}{300 + 300} = 250\ nm$$

= **HALFWAY**

60kt HEADWIND **X**

$$= \frac{500 \quad \times}{+}$$

$$= \frac{500 \times 360}{240 + 360} = 300\ nm$$

= **Greater than HALFWAY**

60kt TAILWIND **X**

$$= \frac{500 \quad \times}{+}$$

$$= \frac{500 \times 240}{360 + 240} = 200\ nm$$

= **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**

SINGLE SECTOR ALL-ENGINE PET

Fill in the groundspeed rectangles at Figure 10.3 and calculate the distance and time to the All-engine PET.

The all-engine TAS	475 kts
Engine failure TAS	380 kts
The route distance	2,050 nm

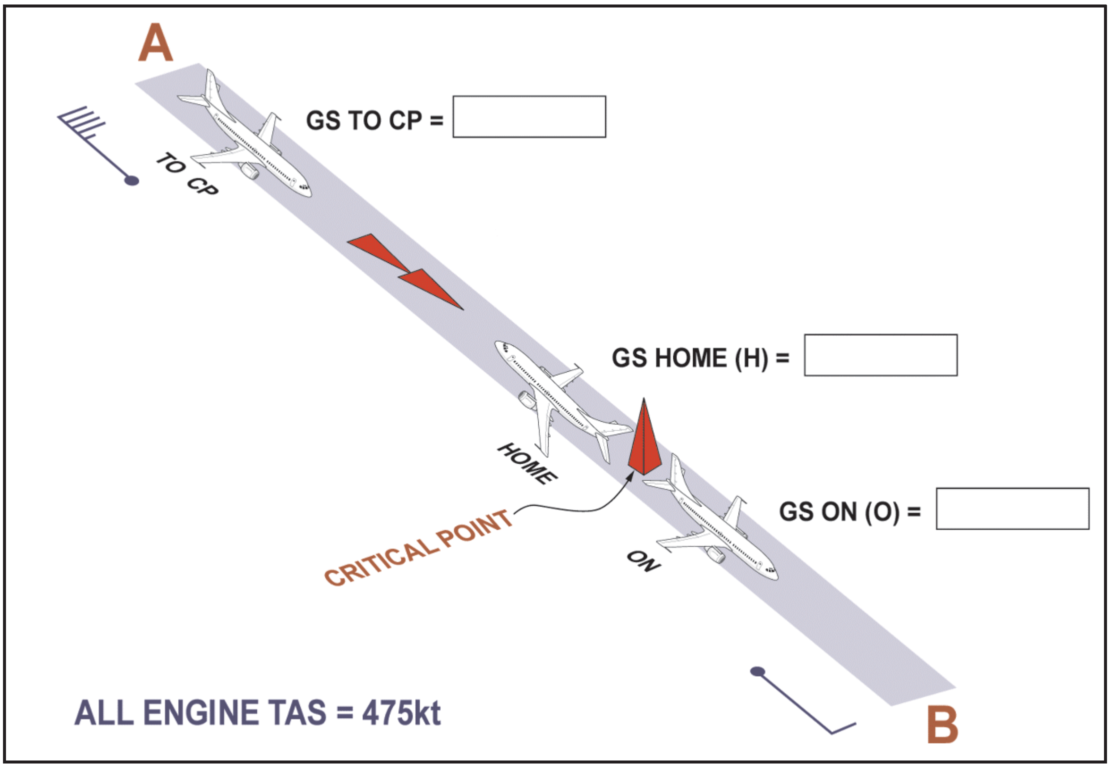


Figure 9.3: Example all engine single leg PET.

G/S H	475 - 45 = 430
G/S On	475 - 10 = 465
G/S out to PET	475 + 45 = 520

$$X = \frac{2050 \times 430}{465 + 430} = 985 \text{ nm}$$

985 nm @ G/S out 520 = 113.5 min

ENGINE FAILURE PET

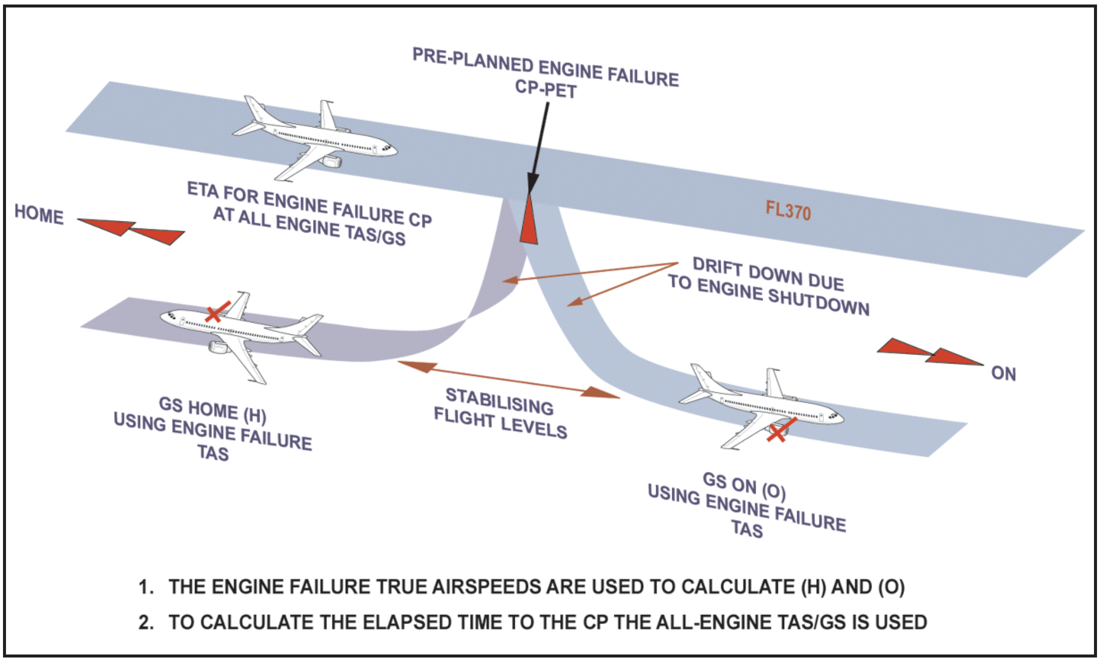


Figure 9.4: Engine failure critical point.

The loss of a power unit will necessitate invariably a “drift down” to a stabilising 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 9.5* fill in the groundspeed rectangles and calculate the distance and time to the Engine-failure PET.

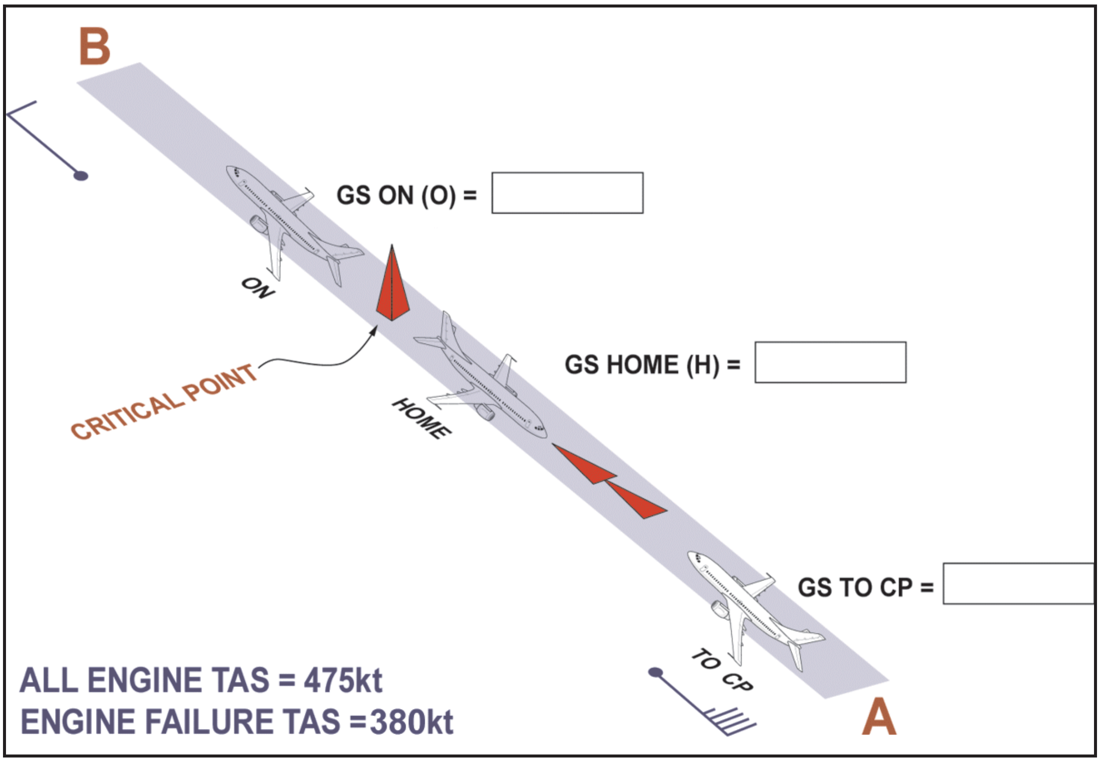


Figure 9.5: Example engine failure PET single leg.

G/S H	380 - 45 = 335
G/S On	380 - 10 = 370
G/S out to PET	475 + 45 = 520

$$X = \frac{2050 \times 335}{370 + 335} = 974 \text{ nm}$$

974 nm @ G/S out 520 = 112.5 min

The difference in distance to 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 95kt. 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 groundspeed 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 hr 37 min
b.	510 nm	2 hr 13 min
c.	690 nm	3 hr
d.	510 nm	3 hr

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 hr 12 min
b.	1600 nm	3 hr 20 min
c.	1664 nm	3 hr 28 min
d.	1536 nm	3 hr 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 hr 03 min
b.	1100 nm	2 hr 30 min
c.	900 nm	2 hr 30 min
d.	1000 nm	2 hr 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 hr 04 min
b.	810 nm	5 hr 42 min
c.	708 nm	5 hr
d.	912 nm	6 hr 26 min