DOCUMENT
GSM-AUS-CPL.032

DOCUMENT TITLE

AUS OPERATIONS, FLIGHT PLANNING AND PERFORMANCE

CHAPTER 2
AVGAS ECHO MKIV

Version 1.0
January 2013

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AVGAS

THE WEIGHT OF AVGAS

The ECHO Mk IV manual states on page 3, item 1.3 that the fuel specific gravity is 0.71.

1.3 Two main and two auxiliary fuel tanks are fitted, the location and capacity of which are :

	Usable fuel (US gal)	Unusable fuel (US gal)	Total fuel (US gal)
MAIN TANKS:			
Left	50	2	52
Right	50	2	52
AUXILIARY TANKS:			
Left	40	3	43
Right	40	3	43
TOTAL (US gal)	180	10	190

The grade of fuel to be used is 100/130 aviation gasoline with **SPECIFIC GRAVITY 0.71.** The weight of unusable fuel is included in the basic empty weight

Specific Gravity 0.71 means that 1 litre of this AVGAS weighs 710 g (grams), which is 0.71 kg (kilograms).

All fuel for the Echo is measured in US Gallons. Study the following conversion factors :

1 Imperial (Imp) gal = 1.201 US gal

1 Imperial (Imp) gal = 4.546 litres

1 US gallon = 3.785 litres.

Example 1

What is the weight of 1 US gallon of fuel?

Apply the specific gravity of .71

1 US gallon = 3.785 x .71

= 2.687 kg.

Answer : One US gallon weighs **2.687 kg**

Example 2

What is the weight in kg of 80 US Gal?

80 x 2.687 = 214.96kg

Answer : 214.96kg

Note: To convert kg of fuel back into US Gal requires the opposite procedure

Example 3

How many US Gal would 410 kg of fuel represent?

410 / 2.687 = 152.59

Answer : 152.59 Gallons.

FUEL DEFINITIONS AND TERMINOLOGY

Start and Taxi Fuel: The fuel used from start up to brakes release at the beginning of the take off roll.

Manoeuvring Fuel : Fuel used after landing.

FOB : Fuel on Board at take off.

FBO : Fuel Burnoff

Flight Fuel (FF) : The fuel used for take off, climb, cruise, descent and landing.

Fixed Reserve Fuel : A safety reserve, only available for use in unplanned situations such as the unexpected closure of the destination airport. It is enough for 45 minutes flight at the cruise consumption.

Variable Reserve Fuel : Fuel to allow for unpredictable factors such as errors in the forecast wind velocity. It is typically 15% of flight fuel.

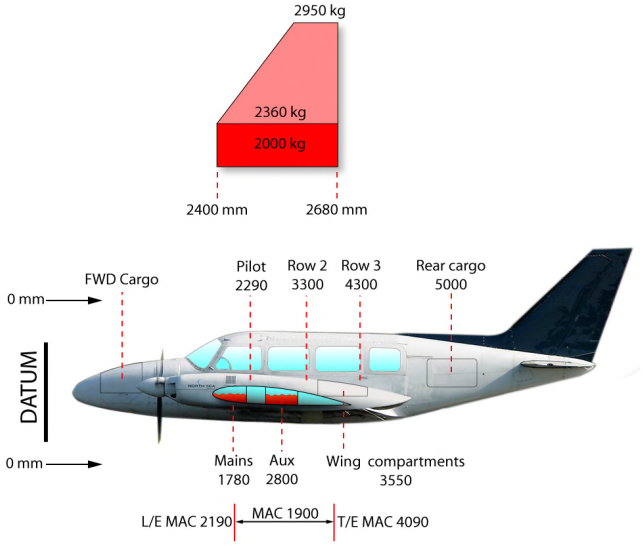
Alternate Fuel : The FBO between the destination and alternate if required.

Holding Fuel : 30 to 60 minutes fuel at the minimum consumption.

ECHO - THE EFFECT OF FBO (FUEL BURN OFF)

INTRODUCTION

How the position of the C of G is affected in flight by fuel burn off depends on the aircraft type. (Location, size and shape of the fuel tanks). The C of G will not move with Fuel Burn Off (FBO) in an aircraft which has the tanks installed at the C of G position at Zero Fuel Weight. If the tanks of the aircraft are installed behind or forward of this position, the C of G will move in flight as the fuel is used. This is the case with most aircraft.



In the Echo Mk IV the main tanks are installed in the FWD section of the wing, at the position 1780mm behind the datum. We can expect that the C of G moves AFT in flight when fuel is burned off. The auxiliary tanks are 2800mm behind the datum and the C of G moves forward when fuel is burnt from these tanks.

When checking that the aircraft is within its weight and balance limits, we must make sure that the following aircraft structural and performance limits are not exceeded.

- Maximum Zero Fuel Weight (MZFW).
- Maximum Take-Off Weight (MTOW).
- Maximum Landing Weight (MLW).

In addition to flight fuel, fixed reserves of 45 minutes at the cruise consumption and a variable reserve of 15% of flight fuel also need to be carried. Although reserves may not be used as planned flight fuel, the C of G must be checked for all situations including Zero Fuel Weight.

Apart from structural weight limitations you must ensure that the C of G is within the performance limits at :

- Take-off Weight.
- Landing Weight.
- Zero Fuel Weight

WEIGHT DEFINITIONS

Removable Equipment Removable equipment is all equipment which is carried on some or all operations but is not included in the Empty Weight of the aircraft.

Empty Weight The empty weight is the weight of the aircraft including all fixed equipment, unusable fuel, undrainable oil, and, if applicable, hydraulic fluid.

Basic Empty Weight The basic empty weight is the empty weight + the engine oil.

Operating Weight The operating weight is the basic empty weight of an aircraft + the removable equipment which remains on board for a certain type of operations. In some heavy aircraft the crew is part of the operating weight. The Flight Manual (Handbook) will tell you.

Ramp Weight The ramp weight is the weight of the aircraft on the ramp (apron).

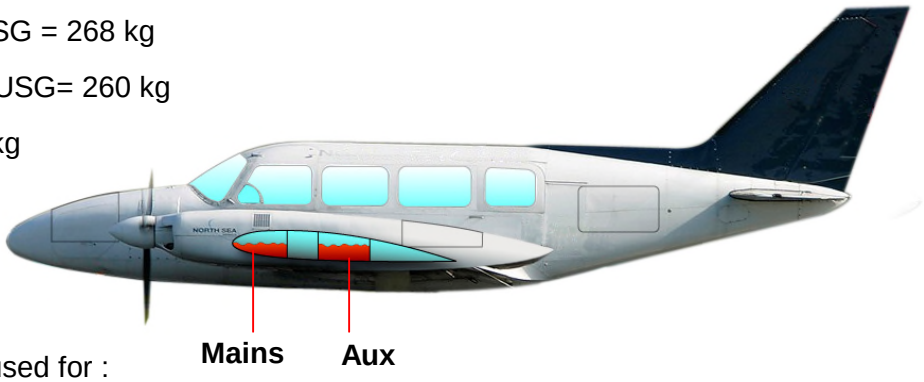
Maximum Ramp Weight The maximum ramp weight is the maximum take-off weight + the fuel required to taxi and line up.

ECHO MK IV FUEL MANAGEMENT

1 US Gallon weighs 2.68 kg (AVGAS).

Fuel Load with full tanks :

- Mains at start 100 USG = 268 kg
- Mains at take off 97 USG= 260 kg
- Aux. 80 USG = 215 kg



Main fuel tanks must be used for :

- Taxi
- Take off to top of climb
- Top of descent to landing

Note: MAINS are forward of C of G range.

- Fuel in mains keeps C of G forward.
- The C of G moves aft when using fuel from the mains. Burning fuel from the mains may be a problem if C of G is near the rear limit.
- Because fuel in the mains moves the C of G forward, fuel can be used as ballast to keep the C of G forward. This fuel must not be used in flight.

AUXILIARY FUEL TANKS

- Use from top of climb to top of descent or until empty.
- Fuel in auxiliary keeps C of G rearward (aft).
- The C of G moves FORWARD when using fuel from the auxiliaries.
- Burning fuel from the auxiliaries may be a problem if C of G is near the forward limit.

Note: AUXILIARIES are rearward of C of G range.

FUEL AS BALLAST

- To maximise payload, use only fuel as ballast.
- To maximise useable fuel, use solid ballast first then minimum ballast fuel.