Bell Helicopter
A Textron Company

Nov 30, 2010

INFORMATION LETTER 214-10-12

TO: **All Bell Helicopter 214B/B-1 Owners/Operators**

SUBJECT: **DERIVED EMPTY WEIGHT CLARIFICATIONS**

Helicopter weight calculations are necessary to derive the Certified Empty Weight if weighed in a non-standard condition.

Bell Helicopter specifies for the Models 214B/B-1 helicopters, a Certified Empty Weight will include all unusable fluids. Specific examples are given in each Flight Manual (FM) showing how to take the Certified Empty Weight and determine the most forward and most aft CG conditions to ensure that safe flight is possible. The Maintenance Manual states that an aircraft should be weighed in this condition (all unusable fluids on board); however clarification is required regarding procedures if this condition does not exist.

There is confusion over the terminology of “Unusable Fuel”. Unusable fuel is normally the sum of trapped and drainable fuel. This is the definition used for the sample weighing example in the 214B Maintenance Manual. For clarification purposes the terms trapped and drainable will be used herein. Drainable fuel is the fuel that remains in the tank after all usable fuel is pumped out. This fuel may be removed from the aircraft through the fuel tank sump valves. Trapped fuel is the fuel in the lines and pumps that can not be removed via the fuel tank sumps.

There are three possible fuel conditions that may exist when weighing an aircraft.

1. The aircraft contains all trapped and drainable fuel as specified
2. The aircraft contains trapped fuel but no drainable fuel
3. The aircraft contains no fuel either drainable or trapped

When these situations exist, the following should be applied to determine the Certified Empty Weight.

Condition 1: <u>All trapped & drainable fuel is on board</u> when weighed. This condition exists when the aircraft has been fully serviced and then defueled without draining fuel from the fuel tank sumps prior to weighing.

- In this case there are no specific adjustments for drainable or trapped fuel that need to be made to the as weighed condition.

Condition 2: <u>Trapped but no drainable fuel is onboard</u> when weighed. This condition exists when the aircraft has been fully serviced and then defueled but fuel tank sump drains have been opened and as much fuel as possible is drained from aircraft prior to weighing.

- In this case drainable fuel must be added to the as weighed condition in order to derive the Certified Empty Weight. The specific adjustment may be found in Table 1 below. For the 214B/B-1 the following adjustment to the as weighed condition should be made.

    - Drainable Fuel: +24.7 lbs at F.S. 116.8 for +2,885 in-lbs

Condition 3: <u>No trapped or drainable fuel is onboard</u> when weighed. This condition might exist when the aircraft tanks are removed and/or replaced and all fuel lines were drained during the operation. In this case the aircraft would not have been fueled and engine(s) run prior to the aircraft weighing. This is the dry condition depicted in Figure 8-7 of the 214B Maintenance Manual.

- In this case both drainable and trapped fuel must be added to the as weighed condition in order to derive the Certified Empty Weight. The specific adjustment may be found in Table 1 below. For the 214B/B-1 the following adjustment to the as weighed condition should be made.

    - Drainable Fuel: +24.7 lbs at F.S. 116.8 for +2,885 in-lbs
    - Trapped Fuel: +21.4 lbs at F.S. 166.8 for +3,569 in-lbs

- 214B Maintenance Manual Figure 8-7 has been revised to show the trapped and drainable fuel as separate line entries in Example Condition 3.

	FUEL								
		Usable		Unusable					
Model	@ lb/gal	Usable (lbs)	F.S. (in)	Drainable (lbs)	F.S. (in)	Moment (in-lb)	Trapped (lbs)	F.S. (in)	Moment (in-lb)
214B/B-1	JP-5 6.8	1,387	153.3	24.7	116.8	2,885	21.4	166.8	3,569

Table 1 214B/B-1 Fuel Quantity – Usable/Drainable/Trapped

BELL HELICOPTER TEXTRON
ACTUAL WEIGHT RECORD
MODEL 214B

DATE WEIGHED ___SAMPLE_____ SERIAL NUMBER _280XX_____
SCALE READINGS SKID CONFIGURATION

	SCALE	TARE	NET
FORWARD JACKPOINT, F.S. 61.70 B.L. -30.0	495	98	397
FORWARD JACKPOINT, F.S. 61.70 B.L. +30.0	2696	97	2599
AFT JACKPOINT, F.S.211.64 B.L. +/-14.70	4538	198	4340
TOTAL	7729	393	7336

* IN LATERAL CALCULATIONS
- IS LEFT
+ IS RIGHT

LONGITUDINAL C.G., AS WEIGHED

$$C.G = \frac{61.70(2996) + 211.64\ (4340)}{\text{TOTAL WEIGHT}} = \frac{1103371}{5353} = 150.40 \text{ IN.}$$

LATERAL C.G., AS WEIGHED*

$$C.G.= \frac{-30.0\ (397) + 30.0\ (2599) - 14.70\ (4340)}{\text{TOTAL WEIGHT}} = \frac{+2262}{7336} = +0.31 \text{ IN.}$$

		LONGITUDINAL			LATERAL *	
WEIGHT EMPTY DERIVATION	WEIGHT	ARM	MOMENT		ARM	MOMENT
AS WEIGHED	7336.0	150.40	1103371		+0.31	+ 2262
ADD: TRAPPED FUEL, JP-5	21.4	166.8	+3569		0	0
DRAINABLE FUEL, JP-5	24.7	116.8	+2885		0	0
UNDRAINABLE OIL, ENGINE	9.2	195.0	+1794		0	0
TRANSMISSION & GEARBOX OIL	45.9	197.0	+9043		0	0
HYDRAULIC FLUID	16.8	131.5	+2209		-1.0	-17
PASSENGER SEATS	+126.2	+103.1	+13017		0	0
BALLAST (SEE PAGE 2)	+97.5	-4.7	-458			-50
WEIGHT EMPTY, SKID CONFIG.	+7677.7	147.89	1135430		+0.3	+2195

EXAMPLE CONDITION 3 (Sheet 1 of 2)

BELL HELICOPTER TEXTRON
ACTUAL WEIGHT RECORD
MODEL 214B

DATE WEIGHED ____SAMPLE_____ SERIAL NUMBER __280XX_____

MOST FORWARD C.G.

WEIGHT EMPTY	7677.7	147.9	1135430		+0.3	+2195
+ PILOT AND COPILOT	340.0	46.7	15878		0	0
+PASSENGERS (5), CTR SEAT, FACING AFT	850.0	88.0	74800		0	0
+PASSENGERS (5), BACK SEAT, FACING FWD	850.0	117.0	99450		0	0
+ OIL, ENGINE, USABLE	15.5	195.0	3023		0	0
+ FUEL, MOST FORWARD, JP-5	469.0	127.6	60313		0	0
	10202.2	136.1	1388894		+0.2	+2195

MOST AFT C.G.

WEIGHT EMPTY	7677.7	147.9	1135430		+0.3	+2195
+ PILOT	170	46.7	7939		+22.0	+3740
+ OIL, ENGINE, USABLE	15.5	195.0	3023		0	0
+ FUEL, JP-5	1387.0	153.8	213321		0	0
	9250.2	147.0	1359713		+0.6	+5935

OPTIONAL EQUIPMENT INSTALLED

PART NUMBER	ITEM	WEIGHT	LONGITUDINAL ARM	LATERAL ARM
205-706-052-013	Bumper, Cargo suspension	6.8	139.2	0
212-706-101-001	Seat, Copilot	36.8	54.0	-22.0
212-706-105-005	Passenger Step	20.3	107.4	0
214-706-002-003	Cargo Suspension Assy	57.8	138.6	0
214-706-010	Passenger Seat Installation	126.2	103.1	0
214-706-011-003	VHF Radio Kit, King KTR-905	8.4	26.9	+0.5
214-706-016-001	Mirror, Convex, Cargo Loading	3.1	7.6	+10.0
~~214-706-006-001~~	~~Copilot Instruments~~	~~27.6~~	~~24.2~~	~~-14.1~~
~~214-706-008-001~~	~~Copilot Controls~~	~~22.5~~	~~33.9~~	~~-22.5~~
214-030-131-003	Ballast Plate (6)	90.0	-4.7	0
214-030-131-001	Ballast Plate (1)	7.5	-4.7	-6.7

EXAMPLE CONDITION 3 (Sheet 2 of 2)