

Fox Todd

From: Fox Todd
Sent: Thursday, September 12, 2019 2:39 PM
To: Spanier, Neal (FAA)
Cc: Kakas, Paige E (FAA); Craig, Bob W (FAA); Fox Todd
Subject: RE: CEN19LA263 - Weight and Balance Calculations

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Inspector Spanier,

Thank you for confirming that my weight-and-balance calculations (based on pilot-supplied data provided during his FAA interview at the FSDO) are indeed correct.

Also, for absolute clarity, according to the Type Certificate Data Sheet and the airplane's original weight-and-balance record, the unusable fuel used for the empty aircraft weight is located at +46 inches... and both the Type Certificate Data Sheet and Airplane Owner's Manual indicate that the useable fuel is located at +48 inches. So, apparently, there is a 2 inch difference between the center of gravity location of the airplane's unusable fuel and the useable fuel in the fuel tanks.

I will include this email with our NTSB docket materials associated with the accident investigation.

Sincerely,
Andrew Todd Fox
NTSB, Air Safety Investigator

From: Spanier, Neal (FAA) [REDACTED]
Sent: Thursday, September 12, 2019 2:18 PM
To: Fox Todd [REDACTED]
Cc: Kakas, Paige E (FAA) [REDACTED]; Craig, Bob W (FAA) [REDACTED]
Subject: RE: CEN19LA263 - Weight and Balance Calculations

Todd,

Yes, your calculations based on the pilot supplied data is consistent with the calculations I have made.

Neal Spanier
Aviation Safety
Principal Operations Inspector
Cincinnati Flight Standards
[REDACTED]



From: Fox Todd [REDACTED]
Sent: Thursday, September 12, 2019 2:52 PM
To: Spanier, Neal (FAA) [REDACTED]
Cc: Fox Todd [REDACTED]; Kakas, Paige E (FAA) [REDACTED]; Craig, Bob W (FAA) [REDACTED]
Subject: CEN19LA263 - Weight and Balance Calculations
Importance: High

Inspector Spanier,

According to FAA Type Certificate Data Sheet No. 3A12 rev 85, the certificated empty weight and center of gravity location for the accident airplane (s/n 36628) must include unusable fuel of 30 lbs at +46 inches and undrainable oil totaling zero lbs at -20 inches. Engine oil is not included with the certificated empty weight.

The original "licensed" empty weight of 1,313 lbs from the accident airplane documentation included the 30 lbs of fuel at +46 inches and, as appropriate, did not include any engine oil.

Based on the aforementioned information, the amount of engine oil that the pilot reported (6 quarts = 11.25 lbs) has to be considered for any weight-and-balance calculation. This is also consistent with the example weight-and-balance worksheet included in the Cessna 172 Owner's Manual.

Therefore, based on the pilot-supplied weights and locations of the occupants, engine oil, fuel, and baggage... I calculated the following weight-and-balance values for the accident flight:

FAA Interview (Pilot Supplied Data)	WEIGHT	CG	MOMENT	MOMENT/1000
Empty Weight	1324.64	37.23	49316.3472	49.32
6 Quarts of Oil	11.25	-20.00	-225.00	-0.23
Front Seat Occupants (385 lbs)	385.00	36.00	13860.00	13.86
Rear Seat Occupant (245 lbs)	245.00	70.00	17150.00	17.15
Rear Seat Bags (30 lbs)	30.00	70.00	2100.00	2.10
Fuel (35 gallons * 6 lbs/gallon = 210 lbs)	210.00	48.00	10080.00	10.08
Totals	2205.89	41.83	92281.3472	92.28

Please advise if my calculations are consistent with your data calculations.

Sincerely,
Andrew Todd Fox
NTSB, Air Safety Investigator

C.F. Airtronics, Inc. 2460 Greentree Road Lebanon, Ohio 45036 FAA Repair Station # [REDACTED]		Date 05/28/2015	
		W. O. No.: 8238	
		Tech.: Peter York	
		Aircraft Reg. No.: N8928B	
Aircraft Data			
Aircraft Owner: Steve Bucholtz [REDACTED] New Carlisle, Ohio 45344		Make: Cessna	
		Model: 172	
		Aircraft Serial No.: 17236628	
NEW AIRCRAFT WEIGHT AND BALANCE DATA			
New Empty Weight: 1324.64 Lbs.			
New C.G.: 37.23 in. aft of datum			
New Moment: 49322.46 in/lbs.			
New Useful Load: 875.36 Lbs.			
Item:	Weight	Arm	Moment
Old Aircraft Weight and Balance	1323.86	37.25	49313
Removed:			
KT-78 transponder	3.00	15.00	45.00
KX-145 nav/com	3.10	14.00	43.40
KI-205 CDI	.70	15.00	10.50
	-----	-----	-----
Installed :			
TT-22 Mode S Transponder	.77	12.00	9.24
TC-20 Transponder control unit	.11	17.00	1.87
KX-155 nav/com	4.75	14.00	66.50
KI-208 CDI	1.20	15.00	18.00
PM-1000 II ICS	.75	17.00	12.75
-----END-----			
Totals:	1324.64	37.23	49322.46

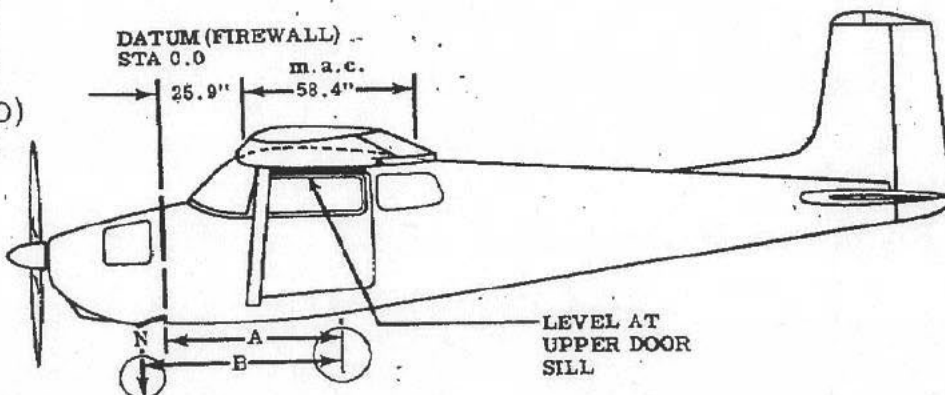
CESSNA AIRCRAFT COMPANY

WICHITA, KANSAS

MODEL 172 (1958)

Weight & Balance Data

DATE 1-29-58
SERIAL NO. 36628
"N" NO. 8928B (STD)



AIRCRAFT EMPTY WEIGHT			
POSITION	SCALE READING	TARE	NET WEIGHT
LEFT WHEEL			
RIGHT WHEEL			
NOSE WHEEL			
TOTAL NET EMPTY WEIGHT			

$$\text{ARM} = (\quad) - (\quad) \times (\quad) = (\quad) \text{ INCHES}$$

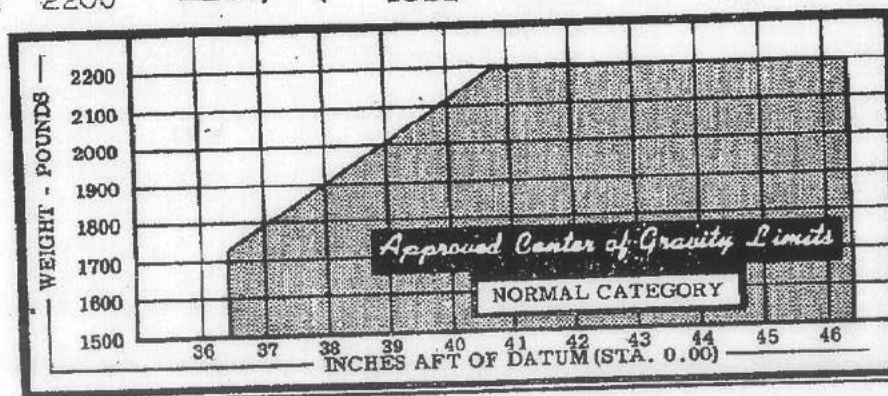
COMPUTED

$$\text{ARM} = (A) - \frac{(N) \times (B)}{W} = \text{ARM OF EMPTY WT. C.G. (INCHES AFT OF DATUM)}$$

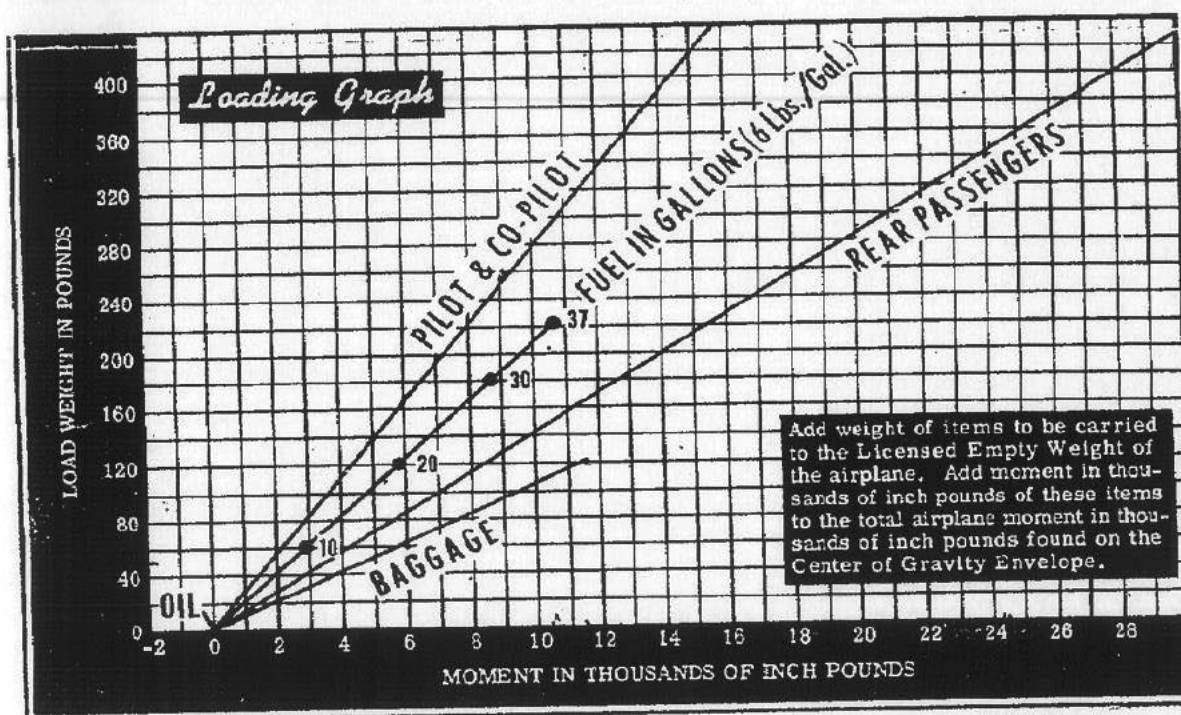
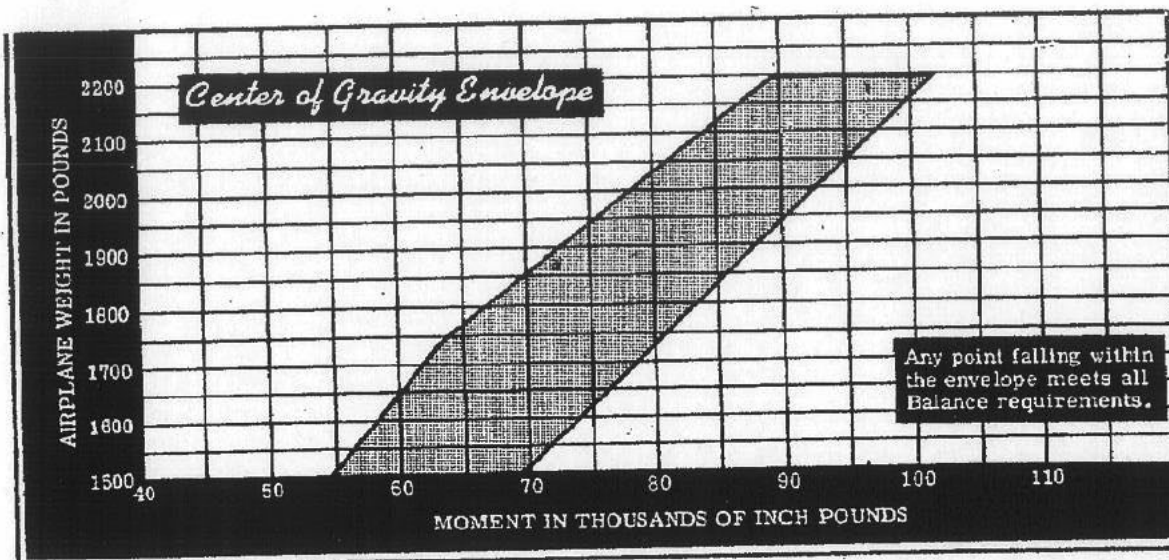
ITEMS	WEIGHT	ARM	MOMENT
AIRCRAFT EMPTY WT.	1283	51.0	65657
UNUSEABLE FUEL	30.0	46	1380
TOTALS	LICENSED EMPTY WT. 1313 LBS	EMPTY C. G. 37.9 INCHES	TOTAL MOMENT 49766.5 INCH LBS

$$(\text{GROSS WT.}) - (\text{LICENSED EMPTY WT.}) = \text{USEFUL LOAD}$$

$$(2200 \text{ LBS.}) - (1313 \text{ LBS.}) = (887 \text{ LBS.})$$



IT IS THE RESPONSIBILITY OF THE AIRPLANE OWNER AND THE PILOT TO INSURE THAT THE AIRPLANE IS LOADED PROPERLY. THE EMPTY WEIGHT C.G. AND USEFUL LOAD ARE NOTED ABOVE FOR THIS AIRPLANE AS DELIVERED FROM THE FACTORY. IF THE AIR-PLANE IS LOADED IN ACCORDANCE WITH THE INFORMATION CONTAINED HEREIN, THE AIRPLANE WILL BE IN COMPLIANCE WITH THE FEDERAL AVIATION REGULATIONS FOR THIS INFORMATION.



EXAMPLE: Empty weight of 1313 lb., moment of 49.75 in. lb.

	WT.	ARM IN INCHES	MOMENT IN THOUSANDS OF IN. LBS.
EMPTY WEIGHT (LICENSED)	(1313.)	()	(49.8)
OIL (8 qts)	15.0	-20	-0.3
PILOT & FRONT SEAT PASSENGER	(340.)	(36)	(12.2)
REAR SEAT PASSENGERS	(340.)	(70)	(23.8)
FUEL (IN EXCESS OF UNUSABLE)	(104.)	(48)	(5.0)
BAGGAGE (ALLOWABLE 120 lbs.)	(120.)	(95)	(11.4)
TOTAL WT.	(2232.)		(99.2)

Locate this point (2232 ; 99.2) on the center of gravity envelope graph, and, since the point falls within the envelope, the above loading meets all balance requirements.