

Airplane Weight and Balance

The Inherent Dangers of Weight and Balance Procedural Complacency

— What You Don't Know Can Get You and Your Passengers Killed!

Presented to: FAA Safety Seminar Attendees

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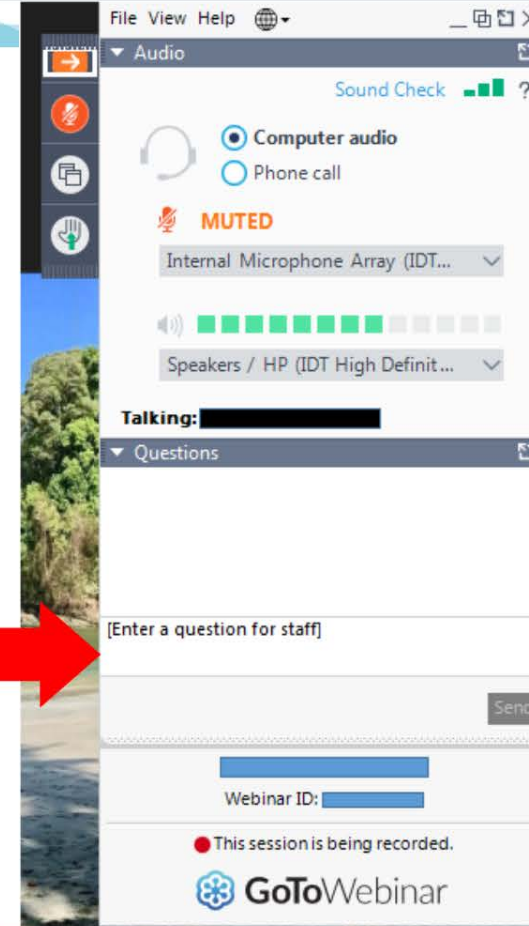
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- **Control panel**
 - Ask a question
- **Questions will be answered at the end**



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- You can download this presentation at the link below.
 - http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_2018.pptx
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Presentation Agenda

- Weight & Balance Accident Trends
- Weight & Balance Accident Scenarios
- Applicable FARs
- Weight & Balance Concepts
- Weight & Balance Terms
- Weight & Balance Computations
- Calculating Weight & Balance Using iPad and ForeFlight
- Weight Impact on V-Speeds
- A Few Weight & Balance Scenarios
- How to Query the NTSB Database
- Flight Service Transition from DUATS to Leidos



**NTSB Statistics
on
Weight & Balance Accidents
in the
United States
from 2000 to 2017**



NTSB Weight & Balance Accident Trends U.S. 2000 – 2017

U. S. Weight & Balance Accident Severity				
Year	Fatal	Non-Fatal	Total	% Fatal
2000	11	5	16	68.8%
2001	5	3	8	62.5%
2002	5	2	7	71.4%
2003	1	0	1	100.0%
2004	1	4	5	20.0%
2005	2	6	8	25.0%
2006	6	3	9	66.7%
2007	6	5	11	54.5%
2008	4	2	6	66.7%
2009	8	5	13	61.5%
2010	6	2	8	75.0%
2011	1	3	4	25.0%
2012	6	1	7	85.7%
2013	4	4	8	50.0%
2014	6	2	8	75.0%
2015	5	5	10	50.0%
2016	4	2	6	66.7%
2017	4	1	5	80.0%
Total	85	55	140	60.7%

- 60.7% of these accidents involved fatalities.



NTSB Weight & Balance Accident Trends U.S. 2000 – 2017

- On average there is a 44.1% chance that someone onboard will die if you have an accident where weight & balance is a causal factor

U. S. Weight & Balance Injuries								
Year	Fatal	Serious	Minor	Total	Uninjured	People Involved	% Fatal - Injuries	% Fatal - People
2000	29	11	2	42	11	53	69.0%	54.7%
2001	13	14	13	40	5	45	32.5%	28.9%
2002	12	4	1	17	3	20	70.6%	60.0%
2003	2	0	0	2	0	2	100.0%	100.0%
2004	2	0	4	6	4	10	33.3%	20.0%
2005	5	2	6	13	9	22	38.5%	22.7%
2006	13	6	5	24	6	30	54.2%	43.3%
2007	15	8	3	26	22	48	57.7%	31.3%
2008	14	2	0	16	4	20	87.5%	70.0%
2009	22	8	4	34	4	38	64.7%	57.9%
2010	13	8	2	23	5	28	56.5%	46.4%
2011	5	5	5	15	0	15	33.3%	33.3%
2012	14	3	1	18	0	18	77.8%	77.8%
2013	5	7	0	12	14	26	41.7%	19.2%
2014	10	2	2	14	1	15	71.4%	66.7%
2015	21	8	4	33	13	46	63.6%	45.7%
2016	12	1	0	13	25	38	92.3%	31.6%
2017	7	0	3	10	1	11	70.0%	63.6%
Total	214	89	55	358	127	485	59.8%	44.1%

NTSB Weight & Balance Accident Trends DE/NJ/PA 2000 – 2017

- Our area has done better than the national average but there have still been fatalities and serious injuries.

Area Weight & Balance Accident Severity				
State	Fatal	Non-Fatal	Total	% Fatal
DE	0	0	0	N/A
NJ	2	2	4	50.0%
PA	2	4	6	33.3%
Total	4	6	10	40.0%

Area Weight & Balance Injuries								
State	Fatal	Serious	Minor	Total	Uninjured	People Involved	% Fatal - Injuries	% Fatal - People
DE	0	0	0	0	0	0	N/A	N/A
NJ	6	3	1	10	2	12	60.0%	50.0%
PA	3	3	2	8	11	19	37.5%	15.8%
Total	9	6	3	18	13	31	50.0%	29.0%

NTSB Weight & Balance Accident Trends

U.S. – 2000 – 2017

- TOW = Take-Off Weight
- Most of these accidents had an AFT CG that was AFT of the CG limit
- N4955A – 5 people (3 children ages 11, 12, 13)
- N59532 – boy (age 4) not belted in, died of head trauma

NTSB Weight & Balance Accident Scenarios														
Accident #	Event Date	Location	Injury Severity	N-Number	Make / Model	Fatal Injuries	Serious Injuries	Minor Injuries	POH TOW	Actual TOW	POH AFT CG	NTSB AFT CG	Lbs Over TOW	NTSB Found AFT CG Exceeded
ANC11FA037	5/27/2011	Chugiak, AK	Fatal	N4955A	CESSNA 180	5	0	0	2550.0	2793.0	45.8	42.18	243.0	No
ERA10LA120	1/15/2010	Picayune, MS	Fatal	N107SS	STEELE SAMUEL D RV-4	2	0	0	1500.0	1756.0	Unknown	Unknown	256.0	Yes by 0.27"
ANC10FA048	6/1/2010	Anchorage, AK	Fatal	N59352	CESSNA U206F	1	4	0	3600.0	4258.2	Unknown	Unknown	658.2	Yes by 3.95-8.82"
ERA09MA157	2/8/2009	Quebradillas, PR	Fatal	N118ME	CESSNA U206H	6	0	0	3600.0	3943.0	Unknown	Unknown	343.0	Yes-no data
ERA11FA293	5/11/2011	Tarentum, PA	Non-Fatal	N17825	BEECH F33A	0	2	2	3400.0	3830.5	86.7	87.63	430.5	Yes by 0.93"
ERA10LA082	11/29/2009	Memphis, TN	Fatal	N9243C	PIPER PA-32RT-300	1	3	0	Unknown	Unknown	99.26	102.52	143.0	Yes by 3.26"

Cessna 180 N4955A – NTSB Report ANC11FA037

- The accident occurred 5/27/2011
 - Pilot's logbook noted about 4 hours in the accident airplane
 - Pilot had not flown since 6/12/2010
 - Pilot did not meet the FAA's recent experience requirement for the required number of takeoff and landings to carry passengers.
- Airplane's estimated gross weight at the time of the accident was about 243 pounds over its approved maximum takeoff weight.
- Witness accounts reported
 - Airplane swerving off the runway during the takeoff roll
 - Nose-high attitude and rapid roll prior to impact
- Pilot likely lost control during the takeoff roll
 - Pilot applied excessive nose-up pitch to become airborne.
 - Once airborne, pilot failed to attain sufficient airspeed to avoid an aerodynamic stall
 - Airplane descended out of control to the ground.

Cessna 180 N4955A – NTSB Report ANC11FA037

- Estimated Weight and Balance
 - Due to the extensive fire damage, an exact weight and balance calculation could not be made.
 - Pilot's weight was taken from his most current FAA medical examination.
 - Weight of the front seat passenger was taken from her reported weight on her Alaska driver's license.
 - Weights for the rear seat passengers (girls: ages 11 and 13, and boy: age 12) were estimated using the Centers for Disease Control (CDC) growth charts showing average weight by age and gender.



Cessna 180 N4955A – NTSB Report ANC11FA037

- Items of cargo that were identifiable are listed as follows:
 - Chainsaw
 - Pistol
 - Multiple bags of food and grocery items
 - Personal clothing and bags
 - Pots
 - Kitchen utensils
 - Rope
 - Bundle of electrical wire
- Pilot's son said that the airplane's fuel tanks were completely filled prior to the accident flight from the pilot's personal fuel storage tank.

Cessna 180 N4955A – NTSB Report ANC11FA037

- Estimated weights
 - Basic Empty Weight (from March 5, 1991) – 1631 pounds
 - Pilot and Front seat Passenger – 417 pounds
 - Rear Seat Passengers – 293 pounds
 - Cargo – 100 pounds
 - Fuel (55 gallons) – 330 pounds
 - Oil (12 quarts) – 22 pounds
- The gross weight of the airplane at the time of the accident was estimated to be 2,793 pounds, or 243 pounds over the approved maximum takeoff gross weight for the airplane.
- The estimated center of gravity at the time of the accident was positive 42.18 inches.
- The center of gravity range at 2,550 pounds (maximum gross weight) is positive 39.5 inches to positive 45.8 inches

Are There Any FARs That Cover Weight & Balance?



14 CFR 91.103 – Preflight Action

- Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. ***This information must include {but is not limited to}*** —
 - a) For a flight under IFR or a flight not in the vicinity of an airport, **weather reports and forecasts**, fuel requirements, **alternatives available if the planned flight cannot be completed**, and any known traffic delays of which the pilot in command has been advised by ATC;
 - b) For any flight, **runway lengths at airports of intended use**, and the following takeoff and landing distance information:
 - 1) For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and
 - 2) For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, **aircraft gross weight**, and wind and temperature.

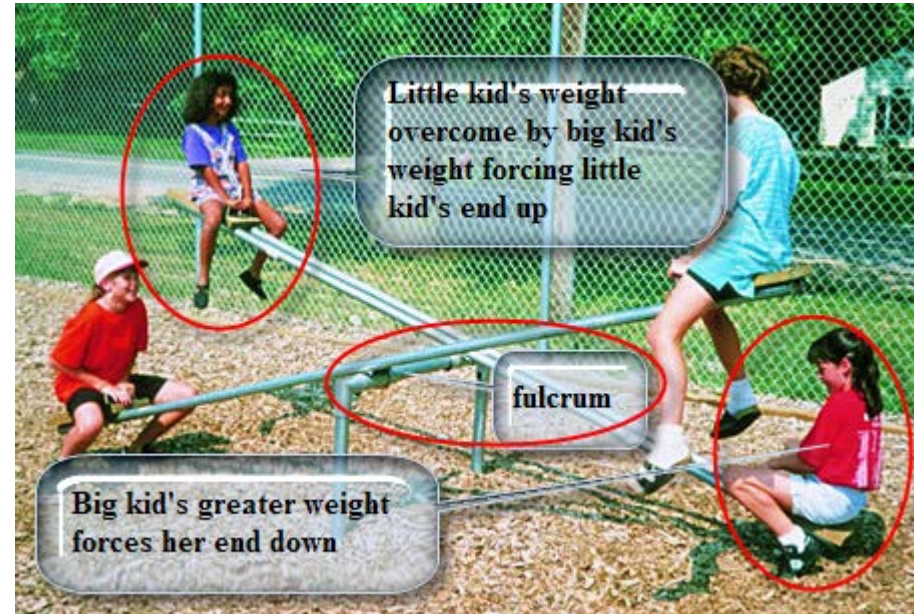
Weight & Balance Concepts from an Elementary School and Middle School Perspective



How Much Can an Airplane Weigh?

- Each airplane has a limitation called the maximum gross takeoff weight. Some airplanes also have a maximum gross landing weight.
- This weight includes everything
 - Airplane (empty)
 - Fuel
 - Pilot and passengers
 - Baggage
- There is another component called “Balance.”
- The entire process is called “Weight and Balance.”

What Does Balance Mean?



- Classic example is the playground seesaw:

- Center bar is the fulcrum which is the center of gravity.
- Heavier weight of “big” kid on one end overcomes lesser weight of “little” kid on other end
- This forces the “little” kid to go up
- Is there a way to make the “big” kid go up without adding weight or changing kids?

Weight & Balance Terms That All Pilots Should Know



Weight & Balance Terms

- **Arm (moment arm)**
 - horizontal distance in inches from the reference datum line to the CG of an item.
 - Arms ahead (forward) of the reference datum are minus (–)
 - Arms behind (aft) of the reference datum are positive (+)
 - When the reference datum is ahead of the airplane, all of the arms are positive and computational errors are minimized
- **Reference Datum**
 - imaginary vertical plane from which all distances are measured
- **Moment**
 - product of the weight of an item multiplied by its arm. Moments are expressed in inch-pounds (in-lb). Total moment = airplane weight * the distance between the datum and the CG.
- **Moment Index**
 - moment divided by a constant such as 100, 1,000, or 10,000. The purpose of using a moment index is to simplify weight and balance computations of aircraft where heavy items and long arms result in large, unmanageable numbers.

Weight & Balance Terms

- **Station**

- a location in the aircraft that is identified by a number designating its distance in inches from the datum. The datum is, therefore, identified as station zero. An item located at station +50 would have an arm of 50 inches.

- **Center of Gravity (CG)**

- imaginary point when aircraft would balance if suspended, i.e. where all of its weight is concentrated

- **CG Limits**

- forward and aft center of gravity locations within which the aircraft must be operated at a given weight

Weight & Balance Terms

- **Usable Fuel**
 - fuel available for flight planning and during flight
- **Unusable Fuel**
 - fuel remaining in the airplane's system after a run-out test
- **Basic Empty Weight**
 - weight of the standard airplane, optional equipment, unusable fuel, and full operating fluids, e.g. full engine oil
- **Total Weight (Gross Weight)**
 - total weight of airplane and everything it is carrying
 - **Takeoff & Landing weight limitations may be different (Note C182, SR20)**
- **Maximum Ramp Weight**
 - maximum weight limit for ground operations such as taxiing
- **Maximum Takeoff Weight**
 - maximum weight limit for taking off; **may be more than landing weight**
- **Maximum Landing Weight**
 - maximum weight limit for landing; **may be less than takeoff weight**

Weight & Balance Terms

- **Maximum Weight**
 - weight limit set by the manufacturer
- **Maximum Zero Fuel Weight**
 - maximum weight exclusive of usable fuel
- **Useful Load**
 - maximum weight minus empty weight; weight available for crew, passengers, baggage, fuel
- **Payload – Important in CAP Context for C172/C182/U206 Missions**
 - useful load minus full fuel; weight available for air crew and baggage
- **Standard Weights**
 - fuel weighs 6 pounds per U.S. gallon
 - oil weighs 7.5 pounds per U.S. gallon or 1.875 pounds per U.S. quart

How to Calculate Weight & Balance



Weight & Balance Computations

Center of Gravity (CG)

- CG Calculation – Computational Method
 - By hand (need for FAA knowledge test)
 - Using an Excel spreadsheet
 - Using ForeFlight on an iPad/iPhone
- CG Calculation – Graphic Method

Weight & Balance Computation Concepts

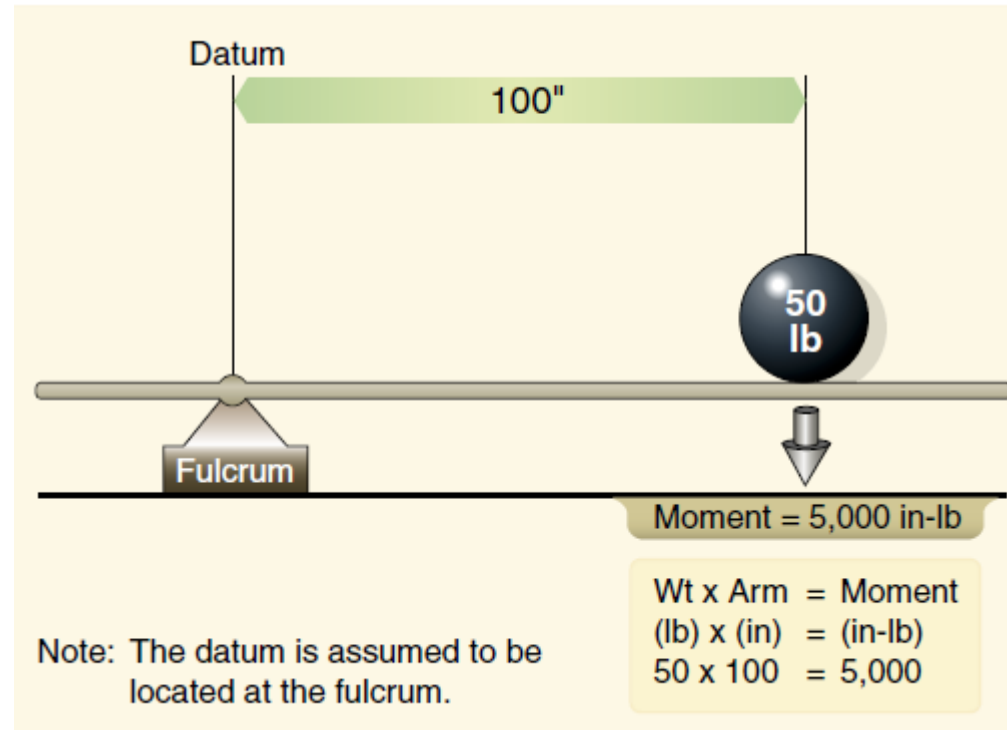
• Calculating the Moment

– Given

- Arm = 100 inches
- Weight = 50 pounds

– Layout the formula

- $Wt \times Arm = Moment$
- $50 \times 100 = 5,000$



Weight & Balance Computation Concepts

Calculating the Balance

– Given

- Arm = 50 inches
- Weight = 50 pounds
- Arm = 25 inches
- Weight = 100 pounds

– Layout the formula

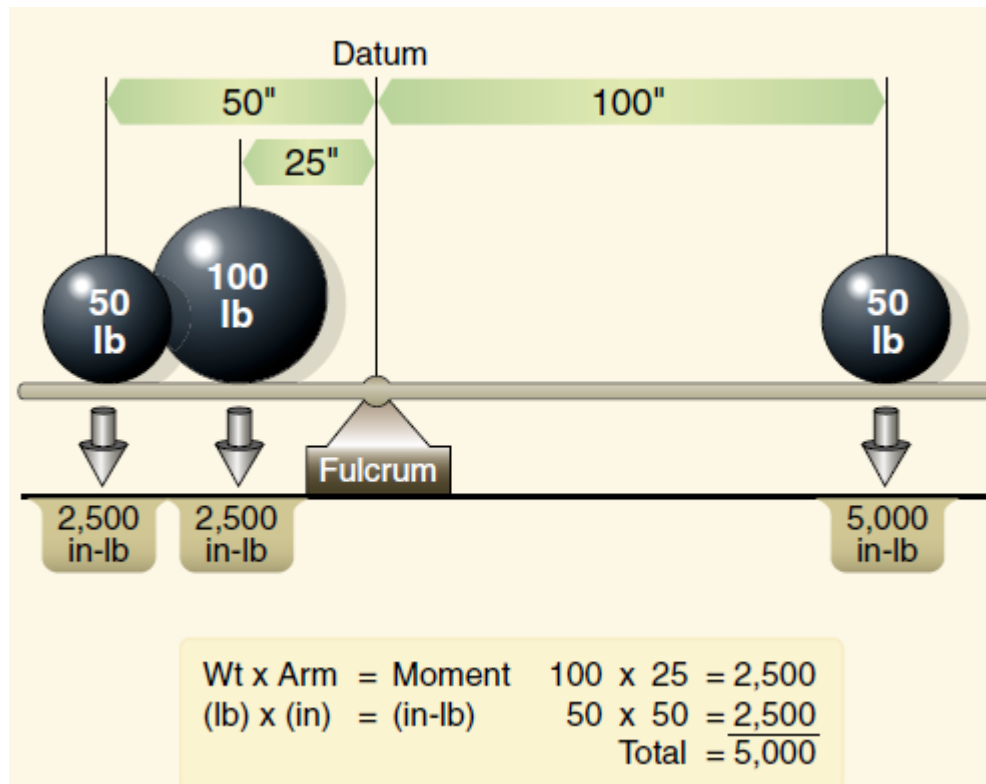
- $Wt \times Arm = Moment$
- $50 \times 50 = 2,500$
- $100 \times 25 = 2,500$
- Total = 5,000

– Arm to balance a 50 lb weight

- $Wt \times Arm = Moment$
- $50 \times ? = 5,000$
- $Moment \div Weight = Arm$
- $5,000 \div 50 = 100$

Playground Seesaw Example

Moving the little kid to balance the big kid



Weight & Balance Computation Concepts

Computational Method

– Aircraft Allowances:

- Maximum gross weight = 3,400 pounds
- CG range = 78–86 inches

– Given:

- Weight of front seat occupants = 340 pounds
- Weight of rear seat occupants = 350 pounds
- Fuel = 75 gallons
- Weight of baggage in area 1 = 80 pounds

– Problem to solve

- Is CG within range?
- Is weight \leq gross weight?

Item	Weight	Arm	Moment
Aircraft Empty Weight	2,100	78.3	
Front Seat Occupants	340	85.0	
Rear Seat Occupants	350	121.0	
Fuel	450	75.0	
Baggage Area 1	80	150.0	
Total			

Item	Weight	Arm	Moment
Aircraft Empty Weight	2,100	78.3	164,430
Front Seat Occupants	340	85.0	28,900
Rear Seat Occupants	350	121.0	42,350
Fuel	450	75.0	33,750
Baggage Area 1	80	150.0	12,000
Total	3,320		281,430
			281,430 ÷ 3,320 = 84.8

Weight & Balance Calculation – Graph Method

1. Find weight for pilot and front seat passenger
2. Read from weight scale to diagonal line then straight down for moment
3. Record moment on worksheet
4. Repeat for rear seat passengers, baggage, and fuel
5. Find total weight and total moment lines on CG envelope graph
6. Check intersection of lines to see if within envelope

Weight & Balance Calculation – Graph Method

Calculating an airplane's CG via Graph Method

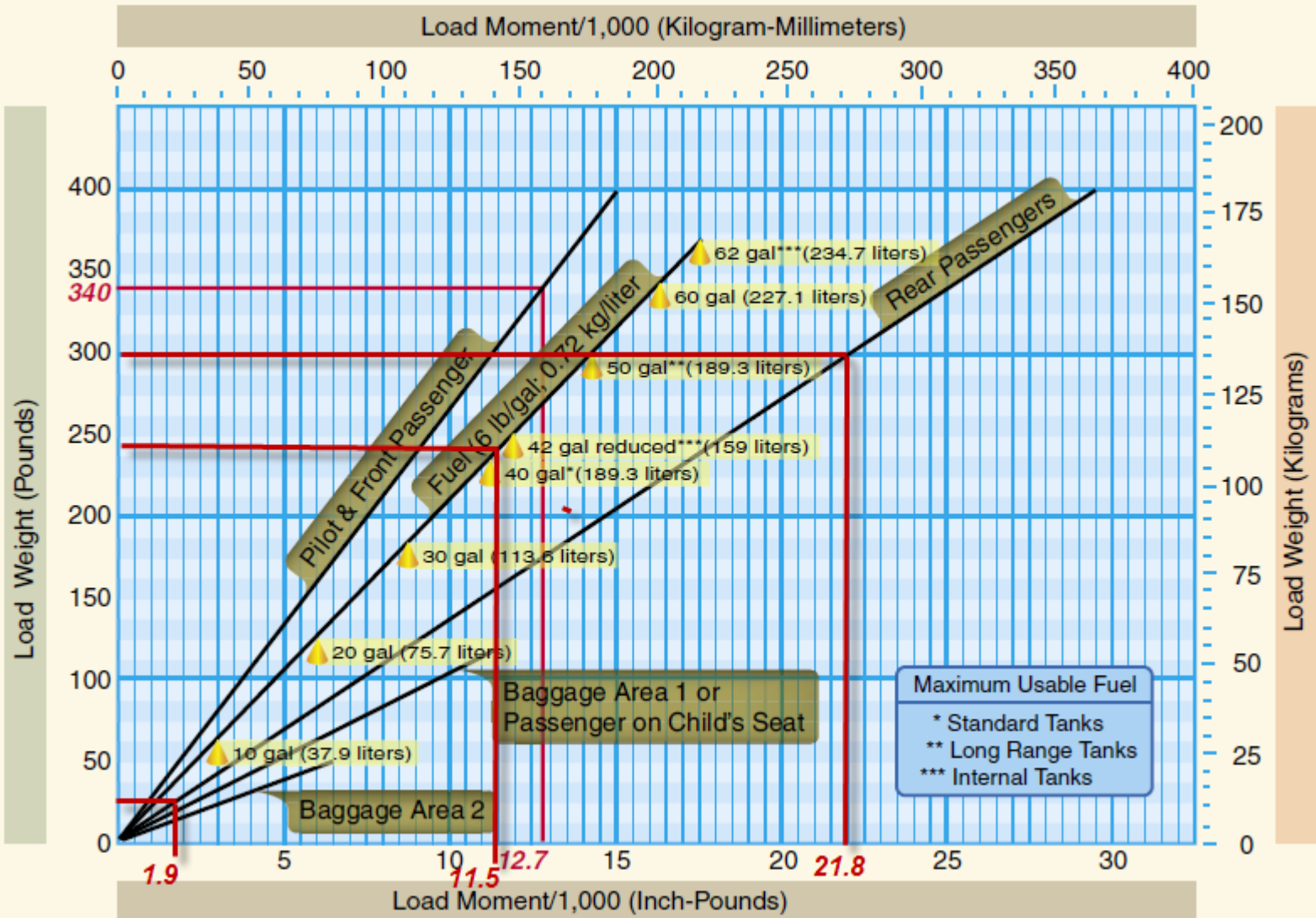
- To simplify calculations, the moment may sometimes be divided by 100, 1,000, or 10,000.
- **Aircraft Allowances:**
 - Maximum gross weight = 2,400 pounds
- **Given:**
 - Weight of front seat occupants = 340 pounds
 - Weight of rear seat occupants = 300 pounds
 - Fuel = 40 gallons
 - Weight of baggage in area 1 = 20 pounds
- **Problem to solve**
 - Is the Moment within range?
 - Is weight <= gross weight?

Sample Loading Problem	Weight (lb)	Moment (In-lb/1,000)
1. Basic Empty Weight (Use data pertaining to aircraft as it is presently equipped.) Includes unusable fuel and full oil	1,467	57.3
2. Usable Fuel (At 6 lb/gal) <ul style="list-style-type: none"> ■ Standard Tanks (40 gal maximum) ■ Long Range Tanks (50 gal maximum) ■ Integral Tanks (62 gal maximum) ■ Integral Reduced Fuel (42 gal) 	240	11.5
3. Pilot and Front Passenger (Station 34 to 46)	340	12.7
4. Rear Passengers	300	21.8
5. Baggage Area 1 or Passenger on Child's Seat (Station 82 to 108, 120 lb maximum)	20	1.9
6. Baggage Area 2 (Station 108 to 142, 50 lb maximum)		
7. Weight and Moment	2,367	105.2

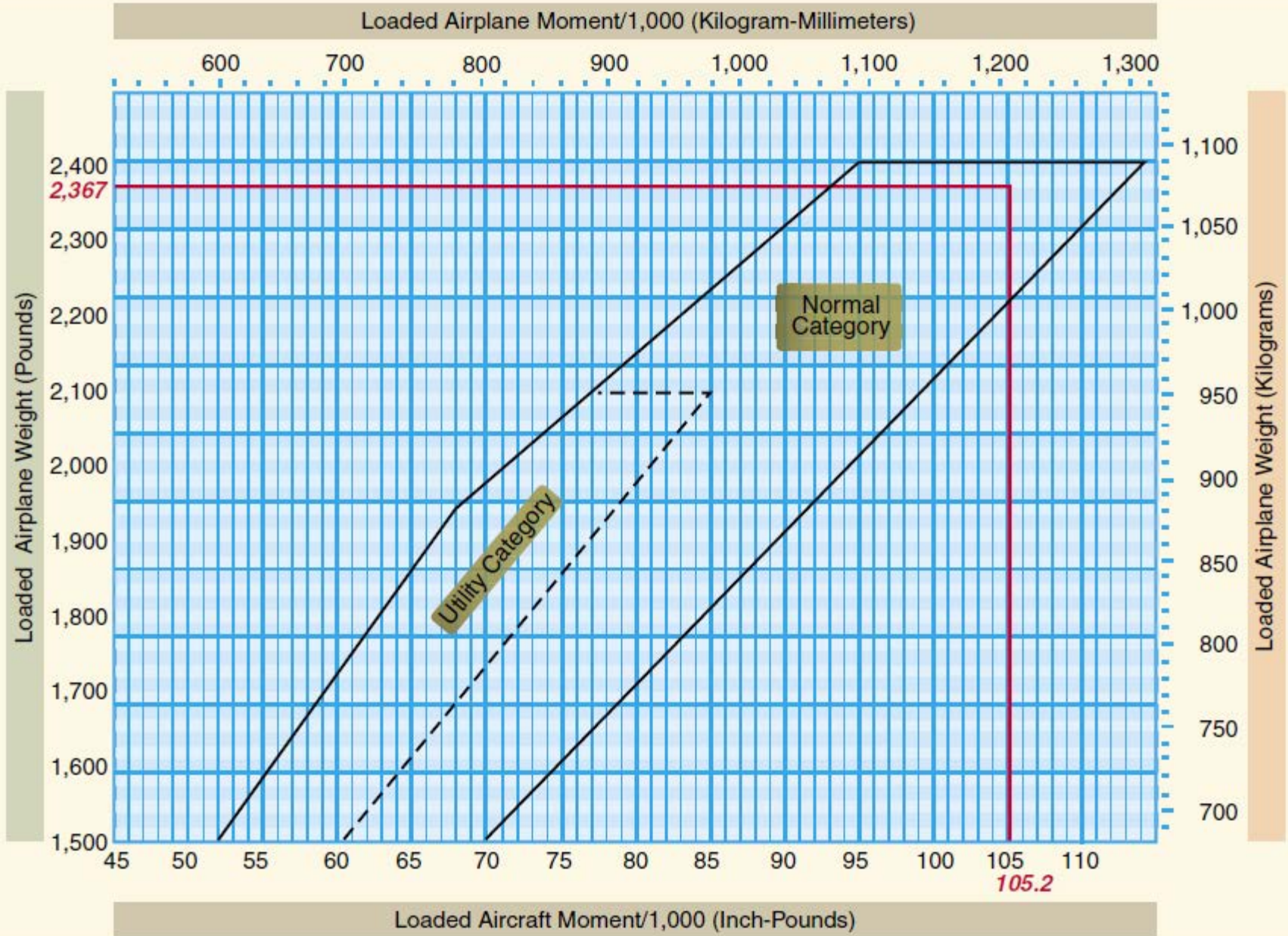
$$\text{CG} = \text{Moment} \times 1000 / \text{Weight} = ?$$

$$\text{CG} = 105.2 \times 1000 / 2367 = 44.44$$

Weight & Balance Calculation – Graph Method



Weight & Balance Calculation – Graph Method



Weight & Balance Computations

- **CG Computation -- Table Method**
- **CG Computation -- Graphic Method**

Flight Scenario	Left Front	Right Front	Left Rear	Right Rear	Fuel in Gallons
#1	Pilot: 280 lbs	Passenger: 200 lbs	N/A	N/A	35
#2	Pilot: 280 lbs	Passenger: 200 lbs	Cameras & Gear: 20 lbs	Passenger: 175 lbs	53

CG Calculation - Computational Method

Excel Spreadsheet – Cessna 172S

- **Individual Items**

- Item Name
- Item Weight
- Item Arm
- Item Moment (weight * arm)

- **CG inches**

- Total Moment / Total Weight

- **CG Worksheet in Excel**

- http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_172S.xls

CG Calculation - Computational Method – Scenario #1

2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	0	0	72.94	0.00
Right Rear	0	0	72.94	0.00
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	35	210	48.00	10.08
Gross Weight		2,445	41.45	101.36
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		2,438	41.44	101.02
Maximum Gross Weight	2,550	Ok		
Maximum Useful Load	795			
Useful Load on this Flight	683			
Available Useful Load	112			

CG Calculation - Computational Method – Scenario #1

Item Name	Input Data	Item Weight	Item Arm	Item Moment: Weight x Arm
2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	0	0	72.94	0.00
Right Rear	0	0	72.94	0.00
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	35	210	48.00	10.08
Gross Weight		2,445	41.45	101.36
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		2,438	41.44	101.02
Maximum Gross Weight	2,550	Ok		
Maximum Useful Load	795			
Useful Load on this Flight	683			
Available Useful Load	112			

Total Weight points to the Total Take Off Weight row.

Gross Weight = Ok points to the Maximum Gross Weight row.

CG: Total Moment / Total Weight points to the Total Moment and Total Weight values.

Total Moment points to the Total Moment value.

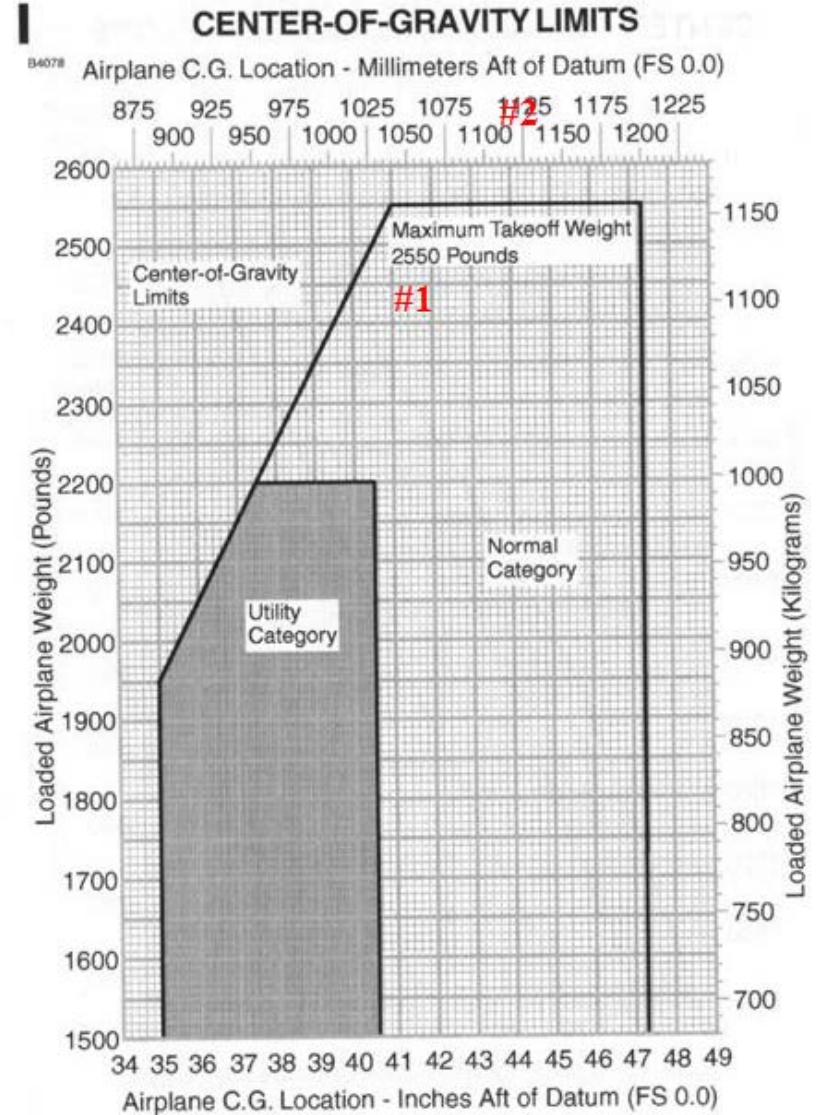
CG Calculation - Computational Method – Scenario #2

2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	20	20	72.94	1.46
Right Rear	175	175	72.94	12.76
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	53	318	48.00	15.26
Gross Weight		2,748	43.94	120.76
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		2,741	43.93	120.42
Maximum Gross Weight	2,550	191	Over Gross	
Maximum Useful Load	795			
Useful Load on this Flight	986			
Available Useful Load	-191			

Cessna 172S Center of Gravity Limits

Scenario #1 is within weight and CG limits

Scenario #2 exceeds weight and CG limits

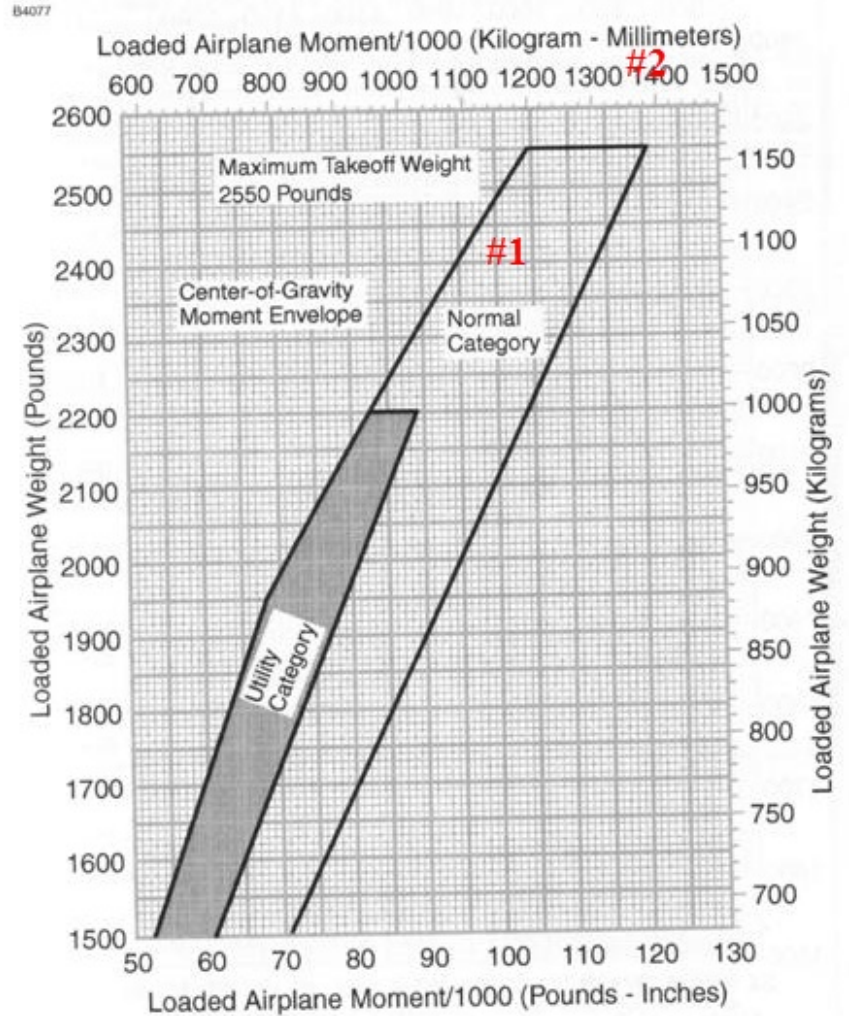


Cessna 172S CG-Moment Envelope

Scenario #1 is within weight and CG limits

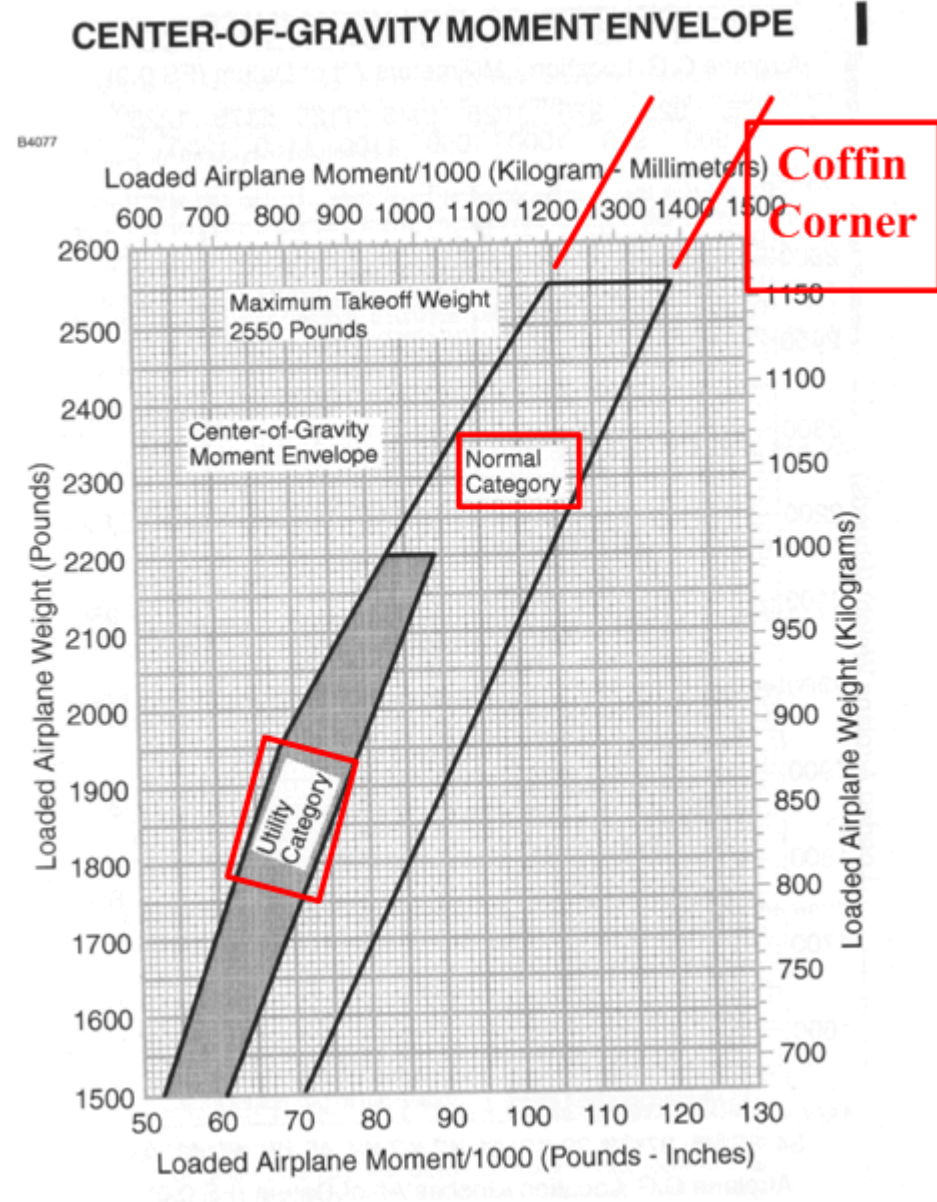
Scenario #2 exceeds weight and CG limits

CENTER-OF-GRAVITY MOMENT ENVELOPE



Cessna 172S CG-Moment Envelope – Dangers and Limitations

- **Coffin Corner –**
 - Above gross weight limit
 - Aft of Aft CG limit
 - Stall-Spin accident in making
- **Normal Category – See POH**
 - No spins
- **Utility Category – See POH**
 - Spins may be okay



Weight Impact on VSPEEDS



Weight Impact on VSpeed

$$\left(\sqrt{\text{Flying Weight} / \text{Gross Weight}} \right) * \text{VSpeed}$$

Excel Formula

SQRT(Flying Weight Cell/Gross Weight Cell)*V_{Speed} Cell

Excel Examples

C172S V _{Speeds}	Weight	V _A	V _{Glide}	V _S	V _{SO}
Maximum Gross Weight	2550	105	68	48	40
Flying Weight	2613	106	69	49	40

C182T V _{Speeds}	Weight	V _A	V _{Glide}	V _S	V _{SO}
Gross Weight	3100	110	76	51	41
Flying Weight	3080	110	76	51	41

U206H V _{Speeds}	Weight	V _A	V _{GLIDE}	V _S	V _{SO}
Gross Weight	3600	110	75	50	40
Flying Weight	3429	107	73	49	39

SR20 V _{Speeds}	Weights	V _O (V _A)	V _{Glide}	V _S	V _{SO}
Gross Weight	3000	131	96	65	56
Flying Weight	2,832	127	93	63	54

Weight & Balance Scenarios



Weight & Balance Scenarios

- Airplanes to be used for a cross country flight from Doylestown (KDYL) to Cape May (KWWD) and back

Airplanes					
Make	Model	Gross Weight	Fuel - Full	Fuel - Tabs	Tabs + 7
Cessna	C172S	2,550	53	35	N/A
Cessna	C182T	3,100	87	64	N/A
Cessna	U206H	3,600	87	64	N/A
Cirrus	SR20	3,000	56	26	40

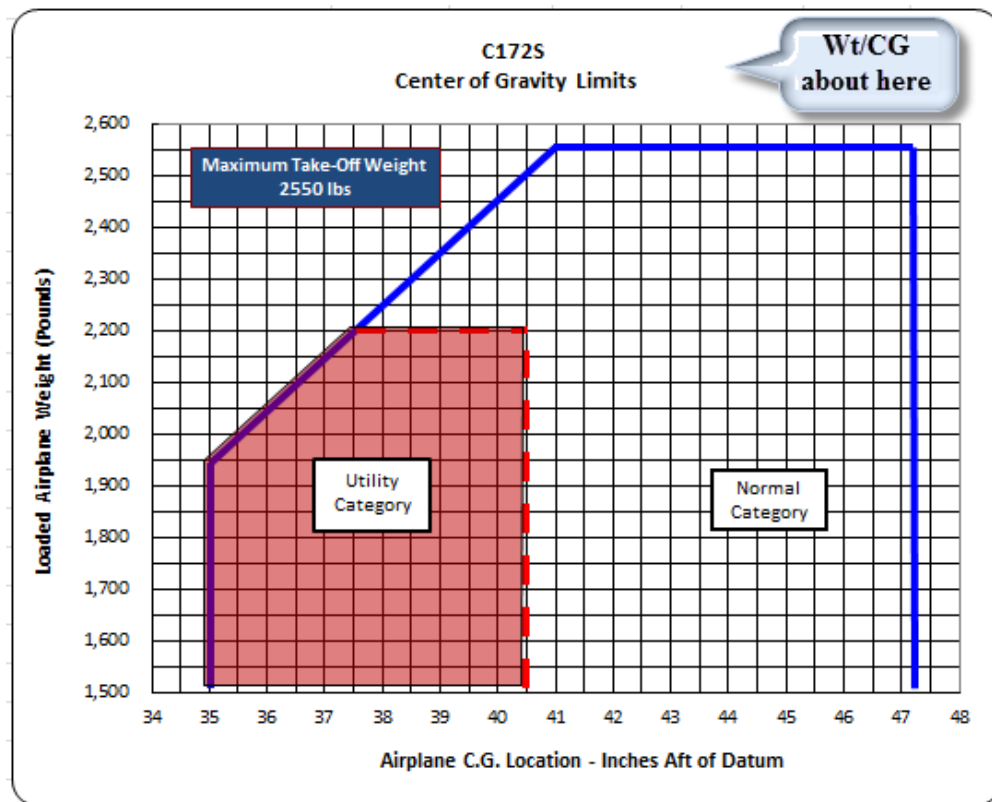
- Crew weights and positions

Crew Weights	
Position	Weight
Front - Left	280
Front - Right	200
Rear - Right	175
Rear - Left	20

- Will each airplane be within weight and CG limits?

Weight & Balance Scenario – C-172S – Full Fuel

2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	20	20	72.94	1.46
Right Rear	175	175	72.94	12.76
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	53	318	48.00	15.26
Gross Weight		2,748	43.94	120.76
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		2,741	43.93	120.42
Maximum Gross Weight	2,550	191	Over Gross	
Maximum Useful Load	795			
Useful Load on this Flight	986			
Available Useful Load	-191			



Airplane 191 pounds overweight

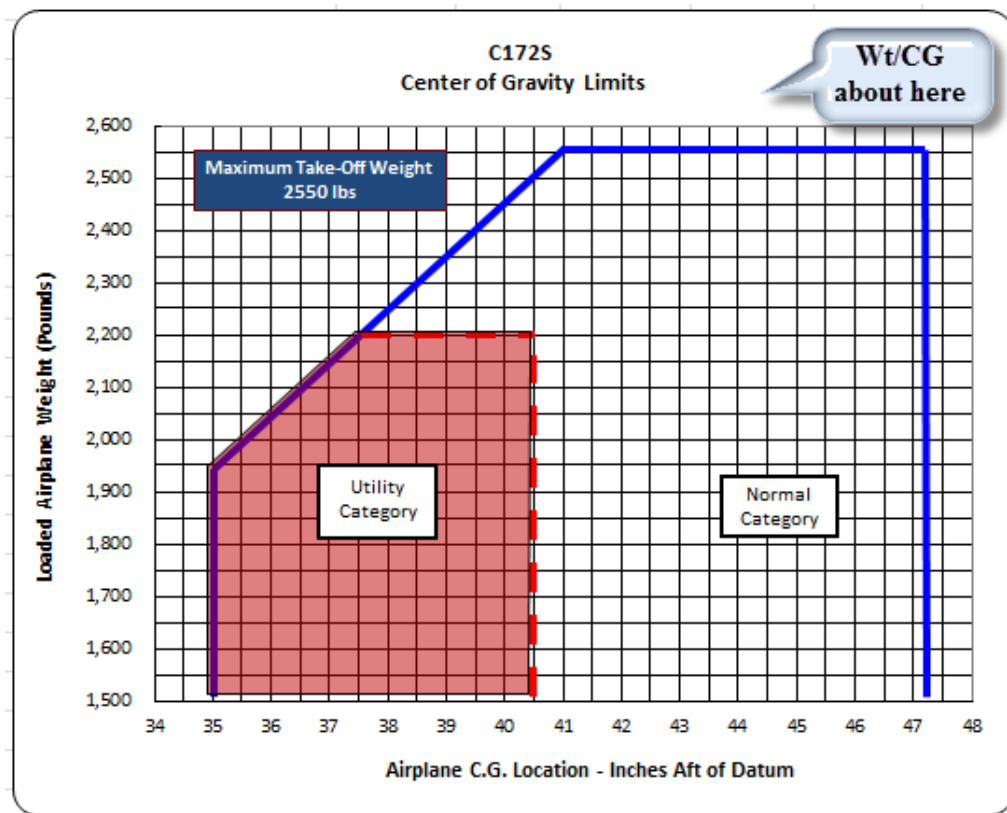
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_172S.xls

Weight & Balance Scenario – C-172S – Fuel to Tabs

2006 C-172S Skyhawk Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	1,755	1,755	41.67	73.14
Crew: Pilot	280	280	37.80	10.58
Co-pilot	200	200	37.80	7.56
Passengers: Left Rear	20	20	72.94	1.46
Right Rear	175	175	72.94	12.76
Baggage	0	0	95.00	0.00
Cargo Area	0	0	123.00	0.00
Fuel (Gallons)	35	210	48.00	10.08
Gross Weight		2,640	43.78	115.58
Less Runup Fuel		-7	48.00	-0.34
Total Take Off Weight		2,633	43.77	115.24
Maximum Gross Weight	2,550	83	Over Gross	
Maximum Useful Load	795			
Useful Load on this Flight	878			
Available Useful Load	-83			



Take Off Weight: 2633

Arm: 43.78

Airplane 83 pounds overweight

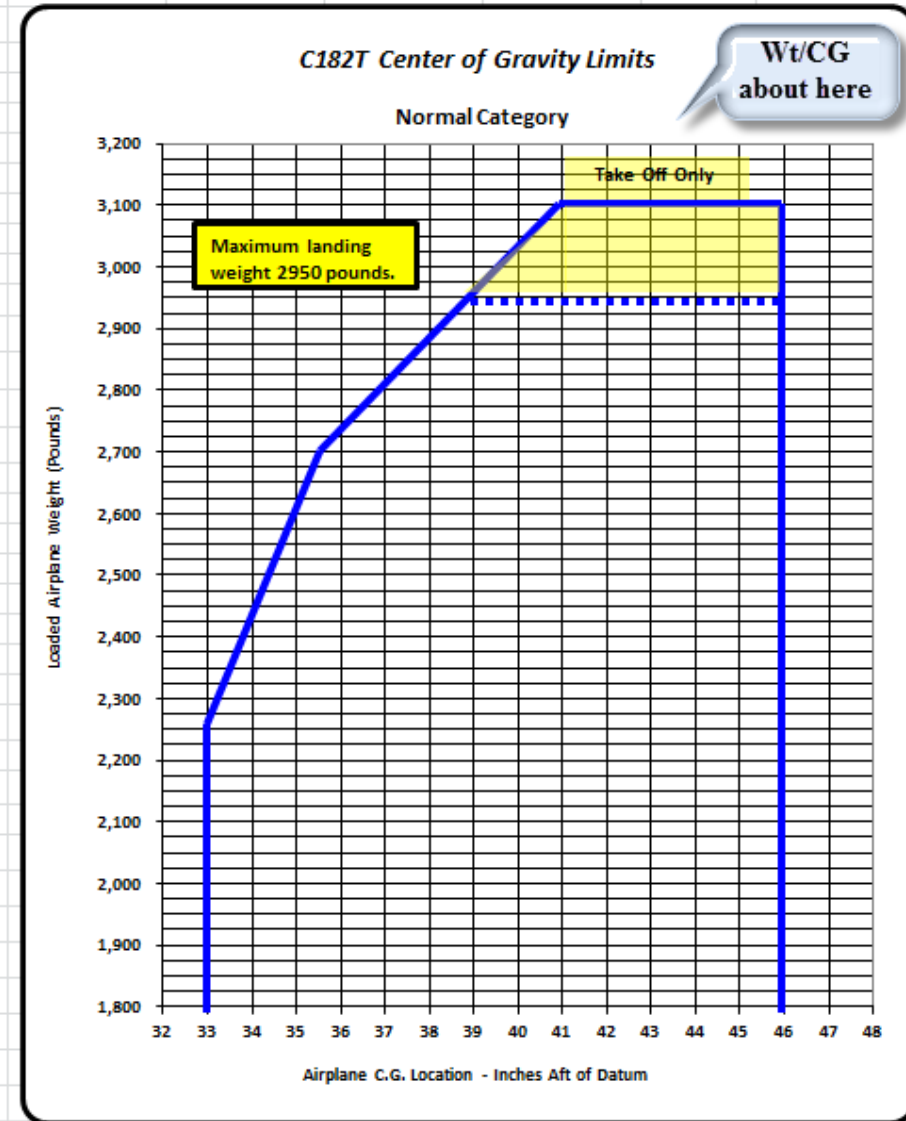
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_172S.xls

Weight & Balance Scenario – C-182T – Full Fuel

2005 C182T Skylane Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,018	2,018	38.84	78.37
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers: Left Rear	20	20	74.00	1.48
Right Rear	175	175	74.00	12.95
Baggage	30	30	97.00	2.91
Rear Baggage Area	0	0	116.00	0.00
Fuel in gallons (Max 87 gallons)	87	522	46.00	24.01
Total Ramp Weight		3,245	42.37	137.48
Minus Runup Fuel		-7	46.00	-0.32
Total Take Off Weight		3,238	42.36	137.16
Maximum Gross Weight	3,100	138	Over Gross	
Maximum Useful Load	1082.2			
Useful Load on this Flight	1220.2			
Available Useful Load	-138			



Take Off Weight: 3238 Arm: 42.36

Airplane 138 pounds overweight

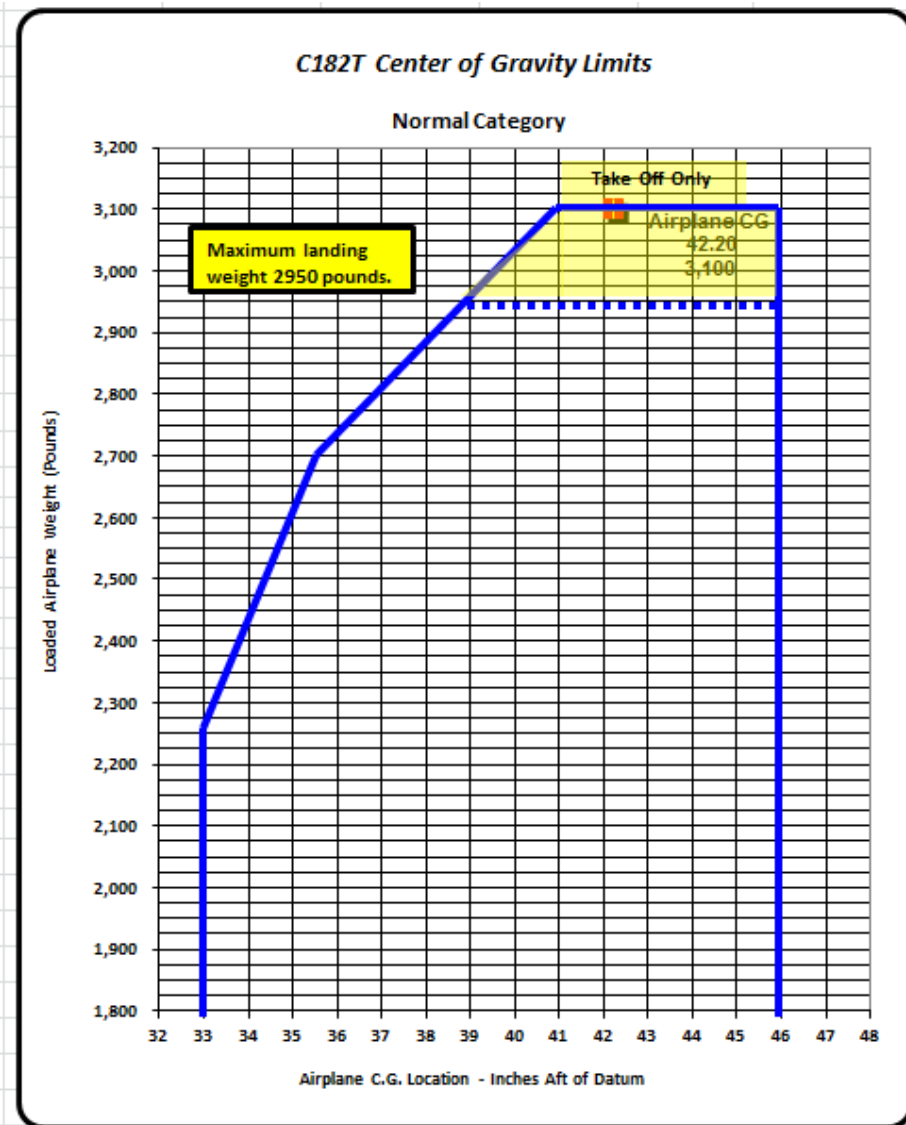
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_Cessna_182T.xls

Weight & Balance Scenario – C-182T – Fuel to Tabs

2005 C182T Skylane Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,018	2,018	38.84	78.37
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers: Left Rear	20	20	74.00	1.48
Right Rear	175	175	74.00	12.95
Baggage	30	30	97.00	2.91
Rear Baggage Area	0	0	116.00	0.00
Fuel in gallons (Max 87 gallons)	64	384	46.00	17.66
Total Ramp Weight		3,107	42.21	131.14
Minus Runup Fuel		-7	46.00	-0.32
Total Take Off Weight		3,100	42.20	130.82
Maximum Gross Weight	3,100	Ok		
Maximum Useful Load	1082.2			
Useful Load on this Flight	1082.2			
Available Useful Load	0			



Take Off Weight: **3100** Arm: **42.2**

Airplane within weight limit

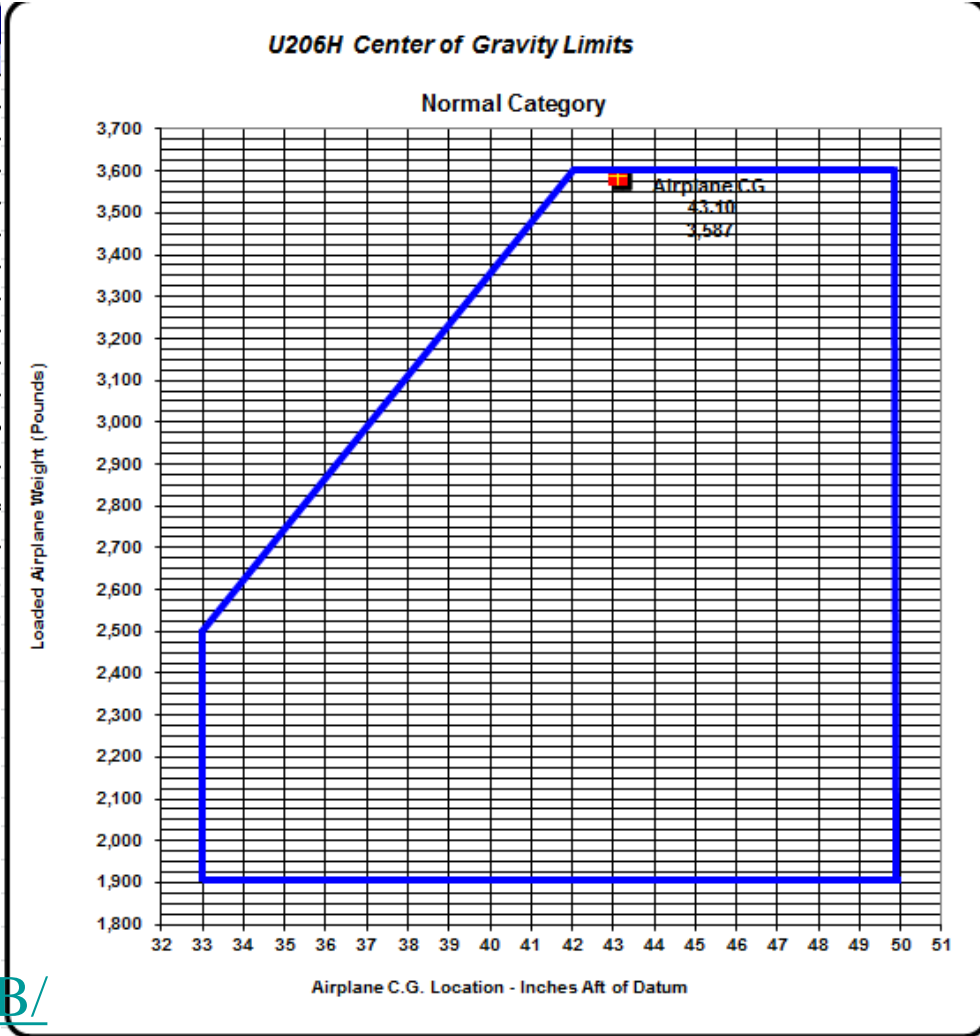
CG within the envelope

Airplane is legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_Cessna_182T.xls

Weight & Balance Scenario – U-206H – Full Fuel

2005 U206 Stationair Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,317	2,317	39.00	90.36
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers (Row 2): Seat 3	20	20	70.00	1.40
Seat 4	175	175	70.00	12.25
Passengers (Row 3): Seat 5	0	0	100.00	0.00
Seat 6	0	0	100.00	0.00
Baggage Area A	50	50	96.00	4.80
Baggage Area B		0	127.00	0.00
Baggage Area C	30	30	136.00	4.08
Fuel in gallons	87	522	46.50	24.27
Total Ramp Weight		3,594	43.11	154.93
Minus Runup Fuel		-7	46.50	-0.33
Total Take Off Weight		3,587	43.10	154.60
Maximum Gross Weight	3,600	Ok		
Maximum Useful Load	1283			
Useful Load on this Flight	1270			
Available Useful Load	13			



Take Off Weight: 3587 Arm: 43.1

Airplane within weight and CG limits

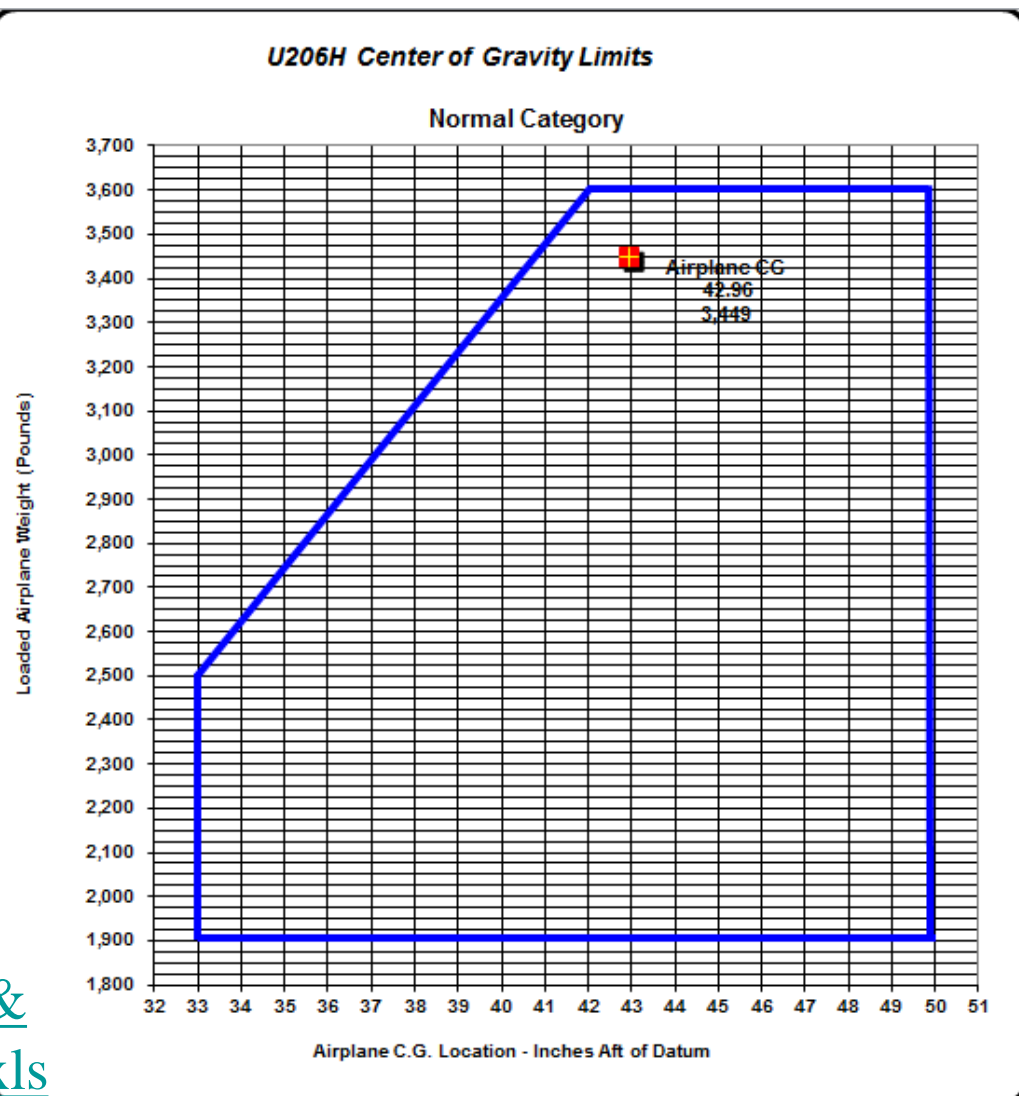
Airplane is legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_U206H.xls



Weight & Balance Scenario – U-206H – Fuel to Tabs

2005 U206 Stationair Weight & Balance				
Item	Input Data	Weight	Arm	Moment
Basic Empty Weight	2,317	2,317	39.00	90.36
Crew: Pilot	280	280	37.00	10.36
Co-pilot	200	200	37.00	7.40
Passengers (Row 2): Seat 3	20	20	70.00	1.40
Seat 4	175	175	70.00	12.25
Passengers (Row 3): Seat 5	0	0	100.00	0.00
Seat 6	0	0	100.00	0.00
Baggage Area A	50	50	96.00	4.80
Baggage Area B		0	127.00	0.00
Baggage Area C	30	30	136.00	4.08
Fuel in gallons	64	384	46.50	17.86
Total Ramp Weight		3,456	42.97	148.51
Minus Runup Fuel		-7	46.50	-0.33
Total Take Off Weight		3,449	42.96	148.18
Maximum Gross Weight	3,600	Ok		
Maximum Useful Load	1283			
Useful Load on this Flight	1132			
Available Useful Load	151			



Airplane within weight and CG limits

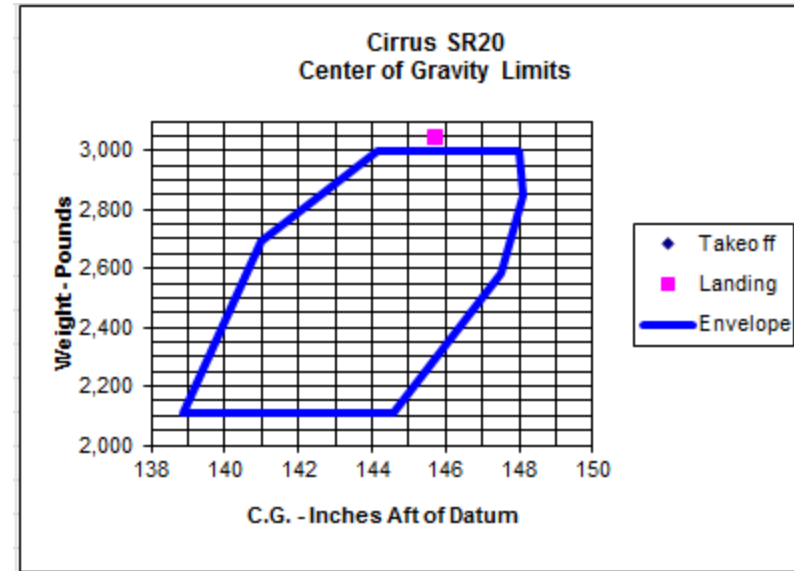
Airplane is legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_U206H.xls

Weight & Balance Scenario – Cirrus SR20 – Full Fuel

Cirrus SR20 Weight & Balance

<i>Position</i>	<i>Item</i>	<i>Weight</i>	<i>Arm</i>	<i>Moment</i>
Basic Empty Weight	<i>Cirrus SR20</i>	2,119	141.572	299.992
Pilot Name & Weight	PIC	280	143.500	40.180
Fuel (Gallons)	56	336	153.800	51.677
<i>Pax Position</i>	<i>Pax Names</i>	<i>Pax Weight</i>		
Front Right	Pax #1	200	143.500	28.700
Rear Left	Gear	20	180.000	3.600
Rear Right	Pax #2	175	180.000	31.500
Bags	<i>No more than 130 lbs</i>	0	208.000	0.000
Runup Fuel	<i>Less runup fuel</i>	-7	153.800	-1.077
TOTAL WEIGHT AND CG		3,123	145.901	455.649
Useful Load Available		-123	Over Gross!	



Airplane 123 pounds overweight

CG above the envelope

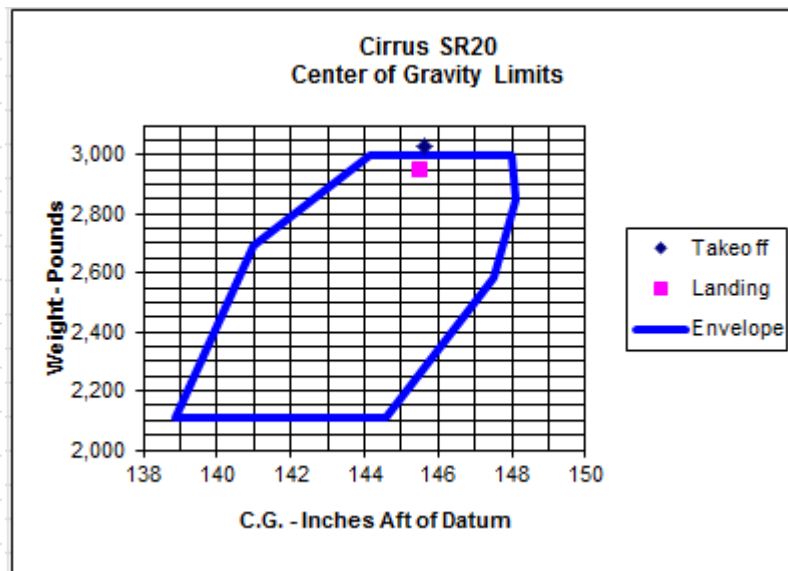
Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_&Balance_Cirrus_SR20.xls

Weight & Balance Scenario – Cirrus SR20 – Tabs + 7

Cirrus SR20 Weight & Balance

<i>Position</i>	<i>Item</i>	<i>Weight</i>	<i>Arm</i>	<i>Moment</i>
Basic Empty Weight	<i>Cirrus SR20</i>	2,119	141.572	299.992
Pilot Name & Weight	PIC	280	143.500	40.180
Fuel (Gallons)	40	240	153.800	36.912
<i>Pax Position</i>	<i>Pax Names</i>	<i>Pax Weight</i>		
Front Right	Pax #1	200	143.500	28.700
Rear Left	Gear	20	180.000	3.600
Rear Right	Pax #2	175	180.000	31.500
Bags	<i>No more than 130 lbs</i>	0	208.000	0.000
Runup Fuel	<i>Less runup fuel</i>	-7	153.800	-1.077
TOTAL WEIGHT AND CG		3,027	145.650	440.884
Useful Load Available		-27	Over Gross!	



Airplane 27 pounds overweight

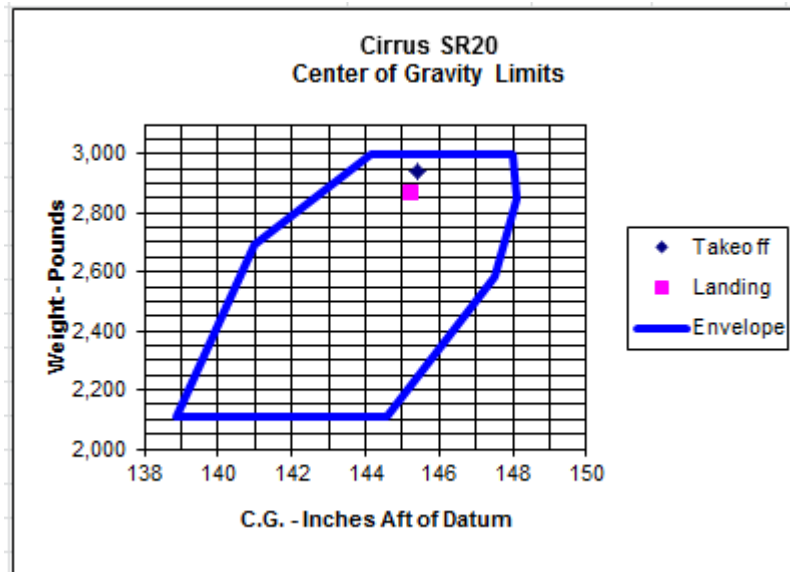
CG above the envelope

Airplane not legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_&Balance_Cirrus_SR20.xls

Weight & Balance Scenario – Cirrus SR20 – Fuel to Tabs

Cirrus SR20 Weight & Balance				
Position	Item	Weight	Arm	Moment
Basic Empty Weight	<i>Cirrus SR20</i>	2,119	141.572	299.992
Pilot Name & Weight	PIC	280	143.500	40.180
Fuel (Gallons)	26	156	153.800	23.993
Pax Position	Pax Names	Pax Weight		
Front Right	Pax #1	200	143.500	28.700
Rear Left	Gear	20	180.000	3.600
Rear Right	Pax #2	175	180.000	31.500
Bags	<i>No more than 130 lbs</i>	0	208.000	0.000
Runup Fuel	<i>Less runup fuel</i>	-7	153.800	-1.077
TOTAL WEIGHT AND CG		2,943	145.418	427.965
Useful Load Available		57	Okay	



Airplane within weight and CG limits

Airplane legal to fly

http://williamjdoylejr.net/FAAST/W&B/Weight_&_Balance_Cirrus_SR20.xls

Planning

a

Flight

*Calculating Weight & Balance
Using ForeFlight Mobile Version 9.6
Apple iPad Air, iOS 11.3*



Planning the Flight – Weight & Balance

- 2005 Cessna 182T Weight Limitations – Is everything good to go?
 - Gross Takeoff Weight = 3,100 pounds
 - Basic Empty Weight = 2,060 pounds
 - Maximum Useful Load = 1,040 pounds
 - Crew, Fuel, and Flight Kits
 - Pilot (left front) – 200 pounds
 - Passenger (right front) – 245 pounds
 - Pilot Flight Kit (left rear) – 10 pounds
 - Passenger Flight Kit (right rear) – 10 pounds
 - Baggage (chocks, tie-down ropes, oil, etc.) – 30 pounds
 - Fuel (64 gallons - tabs) – 384 pounds

Planning the Flight – Weight & Balance

- See Pilot's Guide to ForeFlight Mobile Version 9.6
 - <http://www.foreflight.com/ipad/guide/pdf>
 - Aircraft – creating & deleting Pilot's Guide pages 220-224
 - Weight & Balance - Pilot's Guide page 219
- See ForeFlight Mobile computation of weight & balance on following slides

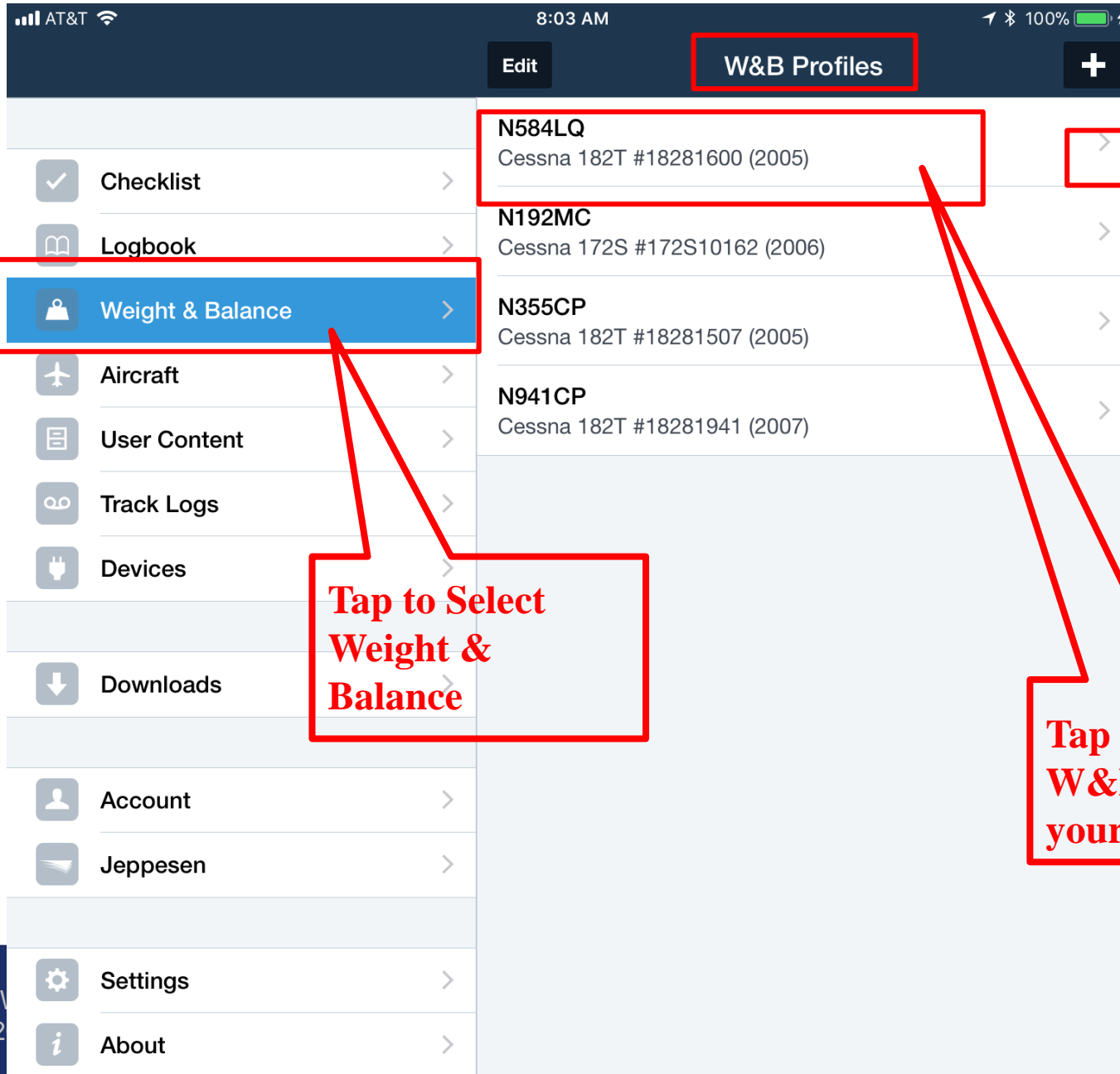
ForeFlight Mobile Weight & Balance

- **You can use these steps to start Weight & Balance calculation**
 - Launch ForeFlight Mobile
 - Tap the “More” button to see menu
 - Tap “Weight & Balance” in left pane of next slide



**Tap “More”
to See Menu**

ForeFlight Mobile Weight & Balance



**Tap to Select
Weight &
Balance**

**Tap to Select
W&B Profile for
your airplane**

ForeFlight Mobile Weight & Balance – Setting Up An Airplane

IDENTIFICATION	
Tail Number	N584LQ
Profile Name	
Make	Cessna
Model	182T #18281600 (2005)
STATIONS	
Front Seats	37 in
Aft Seats	74 in
Baggage Area A (limit 120 lb)	97 in
Baggage Area B (limit 80 lb)	116 in
Fuel Tanks 🔧 (limit 87 usg avgas)	46 in
EMPTY AIRCRAFT	
Weight	2,018 lb
CG	38.8 in
Moment	78,372.35 in-lb
WEIGHT LIMITS	
Ramp	3,110 lb
Takeoff	3,100 lb
Landing	2,950 lb

Zero Fuel	None
FORWARD CG LIMITS	
40.9 in	3,100 lb
35.5 in	2,700 lb
33 in	2,250 lb
33 in	2,100 lb
AFT CG LIMITS	
46 in	3,100 lb
46 in	2,100 lb
UNITS	
Length	in
Weight	lb
Additional Fuel Unit	usg
Fuel Type	avgas
Fuel Density	6 lb/usg

This data is available from the weight & balance document in your airplane's POH

Edit
Load
Setup



ForeFlight Mobile Weight & Balance – For A Given Flight

FRONT SEATS

–	Pilot	200 lb	≡
–	Co-pilot	245 lb	≡

+ Add New Load

AFT SEATS

–	Passenger	Flight Kits	10 lb	≡
–	Passenger	Flight Kits	10 lb	≡

+ Add New Load

BAGGAGE AREA A

–	Chocks, Tie-down Ropes, Oil, etc.	30 lb	≡
+			

BAGGAGE AREA B

–		0 lb	≡
---	--	------	---

+ Add New Load

FUEL TANKS

–	Filled to Tabs	64 usg avgas	≡
---	----------------	--------------	---

+ Add New Load

Done

Load

Setup

This data is unique to a given flight.

Crew weights, baggage weights, and fuel on board can vary.

ForeFlight Mobile Weight & Balance – For A Given Flight

FRONT SEATS	
<input checked="" type="checkbox"/> Pilot	200 lb
<input checked="" type="checkbox"/> Co-pilot	245 lb
AFT SEATS	
<input checked="" type="checkbox"/> Passenger	10 lb
<input checked="" type="checkbox"/> Passenger	10 lb
BAGGAGE AREA A	
<input checked="" type="checkbox"/>	30 lb
BAGGAGE AREA B	
<input checked="" type="checkbox"/>	0 lb
FUEL TANKS	
<input checked="" type="checkbox"/>	64 usg avgas

Aircraft load is within limits

Edit

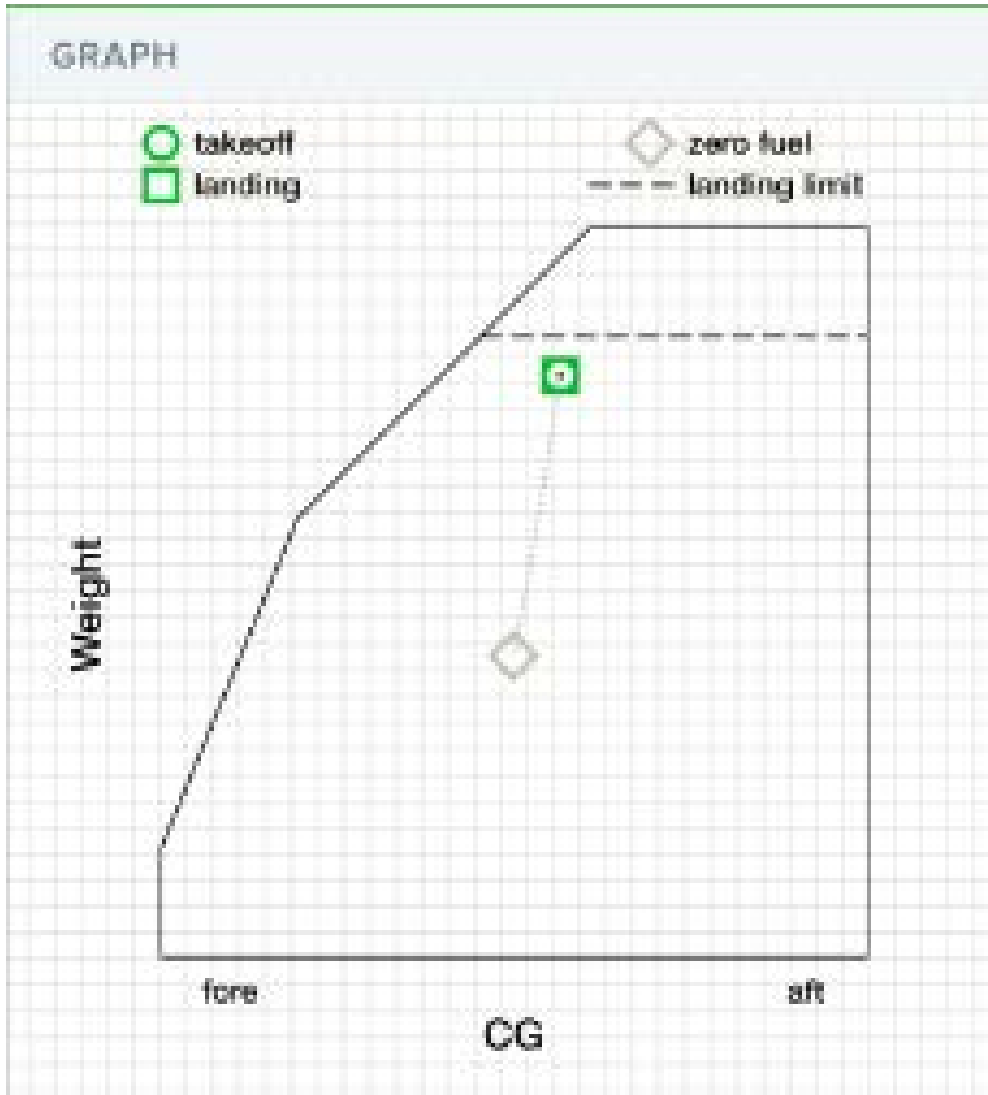
Load

Setup

This data is unique to a given flight.

Crew weights, baggage weights, and fuel on board can vary.

ForeFlight Mobile Weight & Balance – For A Given Flight



Aircraft load is within limits

Compare this graph to the CG envelope in the Weight & Balance section of your airplane's POH

ForeFlight Mobile Weight & Balance – For A Given Flight

Aircraft load is within limits

RAMP (MAX 3,110 LB)

Ramp Weight 2,897 lb

Ramp Fuel 64 usg avgas

TAKEOFF (MAX 3,100 LB)

Takeoff Weight 2,897 lb

CG (38.2 to 46) 40.3 in

Takeoff Fuel 64 usg avgas

LANDING (MAX 2,950 LB)

Landing Weight 2,897 lb

CG (38.2 to 46) 40.3 in

Fuel Remaining 64 usg avgas

ZERO FUEL

Zero Fuel Weight 2,513 lb

CG (34.5 to 46) 39.5 in

STATION LIMITS

Baggage Area A 30 of 120 lb

Baggage Area B 0 of 80 lb

Fuel Tanks 64 of 87 usg avgas



Quickie Quiz

- Use ForeFlight Mobile to do a weight & balance computation:
 - Setup your airplane
 - Enter the following weights:
 - Pilot & passenger
 - Baggage
 - Fuel in US gallons
 - Determine the following:
 - Is the airplane legal to fly based on its gross weight?
 - Is the airplane legal to fly based on its CG envelope?

How to Query the NTSB Database




Accessing the NTSB Database

- Use your web browser to access the NTSB Database
 - http://www.nts.gov/_layouts/nts.aviation/index.aspx

NTSB Aviation Accident

Secure | https://www.nts.gov/_layouts/nts.aviation/index.aspx

Web Mail Facebook Wells Fargo FAASTeam - FAASafe TaxSlayer Access Link AARP Tax-Aide Tool AARP - Volunteer Port AARP AARP Volunteer Port

 NATIONAL TRANSPORTATION SAFETY BOARD

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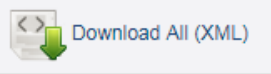
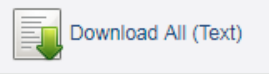
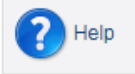
Home

Aviation Accident Database & Synopses

The NTSB aviation accident database contains information from 1962 and later about civil aviation *accidents* and selected *incidents* within the United States, its territories and possessions, and in international waters. Generally, a **preliminary** report is available online within a few days of an accident. **Factual** information is added when available, and when the investigation is completed, the preliminary report is replaced with a **final** description of the accident and its probable cause. Full narrative descriptions may not be available for dates before 1993, cases under revision, or where NTSB did not have primary investigative responsibility.

- [Monthly lists](#) - accidents sorted by date, updated daily.
- [Investigations Nearing Completion](#) - List of investigations with estimated dates of publishing probable cause.
- [Downloadable datasets](#) - one complete dataset for each year beginning from 1982, updated monthly in Microsoft Access 2000 MDB format; this site also provides weekly "change" updates and complete documentation.
- [GILS record](#) - complete description of the accident database, including definition of "accident" and "incident".
- [FAA incident database](#) - complete information about incidents, including those not investigated by NTSB, is provided by the Federal Aviation Administration.
- [Data & Information Products](#) - lists other sources of information about aviation accidents, including publications, dockets, and press releases

Search the Aviation Accident Database

 Download All (XML)  Download All (Text)  Help

Accessing the NTSB Database

Accident/Incident Information

Event Start Date (mm/dd/yyyy)

01/01/2000

Event End Date (mm/dd/yyyy)

12/31/2017

Month

All

City

State

Anywhere

Country

United States

Investigation Type

Accident

Injury Severity

All

Aircraft

Category

Airplane

Amateur Built

All

Make

Model

Registration

Damage

All

Number of Engines

Engine Type

Reciprocating

Operation

Operation

Part 91:General Aviation

Purpose of Flight

All

Schedule

All

Air Carrier

Creating an NTSB Database Query

NTSB Status

Accident Number	<input type="text"/>
Report Status	All ▼
Probable Cause Issue Start Date (mm/dd/yyyy)	<input type="text"/>
Probable Cause Issue End Date (mm/dd/yyyy)	<input type="text"/>

Event Details

Airport Name	<input type="text"/>
Airport Code	<input type="text"/>
Weather Condition	None ▼
Broad Phase of Flight	All ▼

Enter your word string below: (Searches both synopsis and full narrative; will slow the query performance)

"weight and balance" or "weight & balance" or "weight limitations"

Location information available for most cases in the United States since 2002. Refer to query help for limitations of location information.

Latitude	<input type="text"/>	
Longitude	<input type="text"/>	within <input type="text" value="0"/> ▼ miles

Submit Query

Download XML

Download Delimited Text

Reset



Creating an NTSB Database Query

Download XML

Download Delimited Text

(Estimated) Report Publish Date(s)	Report(s)	Event Date	Location	Make/Model	Registration Number	NTSB No.	Event Severity	Type of Air Carrier Operation and Carrier Name (Doing Business As)
Factual 02/12/2018	Factual Report PDF HTML	12/24/2017	Riverton, WY	PIPER PA 28R-200	N550D	CEN18LA052	Nonfatal	
Preliminary 08/17/2017	Preliminary Report PDF HTML	08/11/2017	West Jordan, UT	PIPER PA 28R-200	N33732	WPR17LA183	Nonfatal	
Preliminary 07/19/2017	Preliminary Report PDF HTML	07/04/2017	San Juan, PR	PIPER PA28	N9427J	ERA17LA227	Nonfatal	
Factual 08/30/2017 Final 09/22/2017	Final Report PDF HTML Data Summary (PDF)	06/16/2017	Watervliet, MI	AERONCA 11AC	N9404E	GAA17CA347	Nonfatal	
Factual 01/17/2018 Final 02/12/2018	Final Report PDF HTML Data Summary (PDF)	05/27/2017	Salcha, AK	ARCTIC AIRCRAFT CO INC S 182	N57AT	ANC17FA026	Fatal(2)	
Preliminary 06/05/2017	Preliminary Report PDF HTML	05/26/2017	Sheboygan Falls, WI	AEROTEK PITTS S 2A	N67PN	CEN17FA197	Fatal(2)	
Preliminary 04/03/2017	Preliminary Report PDF HTML	02/27/2017	Berthoud, CO	CESSNA 172S	N2461N	CEN17FA111	Fatal(2)	
Preliminary 02/27/2017	Preliminary Report PDF HTML	02/12/2017	Ramona, CA	CESSNA 172S	N2179L	WPR17FA063	Fatal(1)	
Factual 02/21/2018 Final 03/14/2018	Final Report PDF HTML Data Summary (PDF)	01/02/2017	Payson, AZ	CESSNA T210K	N272EF	WPR17FA045	Fatal(4)	
Factual 10/02/2017 Final 12/14/2017	Final Report PDF HTML Data Summary (PDF)	10/19/2016	Cedar Key, FL	CESSNA 172	N1827Y	ERA17LA024	Nonfatal	

478 items in 48 pages

478 items in 48 pages



How Many Weight & Balance Accidents in PA in Last 17 Years?

Accident/Incident Information

Event Start Date (mm/dd/yyyy)

01/01/2000

Event End Date (mm/dd/yyyy)

12/31/2017

Month

All

City

State

Pennsylvania

Country

United States

Investigation Type

Accident

Injury Severity

All

Aircraft

Category

Airplane

Amateur Built

All

Make

Model

Registration

Damage

All

Number of Engines

Engine Type

Reciprocating

How Many Weight & Balance Accidents in PA in Last 17 Years?

Operation

Operation

Part 91:General Aviation ▼

Purpose of Flight

All ▼

Schedule

All ▼

Air Carrier

NTSB Status

Accident Number

Report Status

All ▼

Probable Cause Issue Start Date (mm/dd/yyyy)

Probable Cause Issue End Date (mm/dd/yyyy)

Event Details

Airport Name

Airport Code

Weather Condition

None ▼

Broad Phase of Flight

All ▼

Enter your word string below: (Searches both synopsis and full narrative; will slow the query performance)

"weight and balance" or "weight & balance" or "weight limitations"

Location information available for most cases in the United States since 2002. Refer to query help for limitations of location information.

Latitude

Longitude

within 0 ▼ miles

How Many Weight & Balance Accidents in PA in Last 17 Years?

Download XML

Download Delimited Text

Page size: 10 14 items in 2 pages

(Estimated) Report Publish Date(s)	Report(s)	Event Date	Location	Make/Model	Registration Number	NTSB No.	Event Severity	Type of Air Carrier Operation and Carrier Name (Doing Business As)
Factual 11/05/2014 Final 02/11/2015	Final Report PDF HTML Data Summary (PDF)	09/20/2014	Clarion, PA	BARGER JERRY L CHALLENGER II	N4017C	ERA14LA450	Nonfatal	
Factual 11/21/2014 Final 12/10/2014	Final Report PDF HTML Data Summary (PDF)	09/11/2013	Smoketown, PA	JOSEPH BENDER MUSTANG II	N691LB	ERA13FA412	Nonfatal	
Factual 05/06/2014 Final 06/02/2014	Final Report PDF HTML Data Summary (PDF)	06/01/2013	Doylestown, PA	WILSON WILLIAM M CRICKET MC12	N2SZ	ERA13LA263	Fatal(1)	
Factual 06/14/2013 Final 06/19/2013	Final Report PDF HTML Data Summary (PDF)	05/09/2012	Sterling, PA	MOONEY M20J	N9154K	ERA12FA327	Fatal(2)	
Factual 01/05/2012 Final 03/08/2012	Final Report PDF HTML Data Summary (PDF)	05/11/2011	Tarentum, PA	BEECH F33A	N17825	ERA11FA293	Nonfatal	
Factual 06/23/2009 Final 09/30/2009	Final Report PDF HTML Data Summary (PDF)	11/02/2007	Greenville, PA	Daniel R. Lloyd Trish's Ride Home	N289DT	NYC08FA023	Fatal(1)	
Factual 06/02/2008 Final 06/30/2008	Final Report PDF HTML Data Summary (PDF)	05/05/2007	Stewartstown, PA	Lee Stevens Sorrell SNS-2 Guppy	None	MIA07LA091	Fatal(1)	
Factual 03/19/2008 Final 12/13/2016	Final Report PDF HTML Data Summary (PDF)	10/09/2006	Brownsville, PA	Mooney M20F	N3447N	NYC07FA003	Fatal(2)	
Factual 08/13/2007 Final 08/30/2007	Final Report PDF HTML Data Summary (PDF)	08/06/2006	Bellefonte, PA	Piper PA-46- 350P	N9227U	NYC06LA197	Nonfatal	
Factual 12/11/2005 Final 02/28/2006	Final Report PDF HTML Data Summary (PDF)	06/25/2005	Fairview, PA	Piper PA-28- 235	N235G	NYC05FA105	Fatal(3)	

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How Many Weight & Balance Accidents in PA in Last 17 Years?

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(Estimated) Report Publish Date(s)	Report(s)	Event Date	Location	Make/Model	Registration Number	NTSB No.	Event Severity	Type of Air Carrier Operation and Carrier Name (Doing Business As)
Factual 12/22/2004 Final 02/24/2005	Final Report PDF HTML Data Summary (PDF)	11/25/2004	York, PA	Piper PA 28-181	N720GP	IAD05CA018	Nonfatal	
Factual 01/11/2006 Final 03/28/2006	Final Report PDF HTML Data Summary (PDF)	08/03/2004	Phillipsburg, PA	Piper PA-24-180	N6311P	NYC04LA187	Nonfatal	
Factual 05/14/2004 Final 06/30/2004	Final Report PDF HTML Data Summary (PDF)	04/24/2003	Newport, PA	Aviat Pitts S-2B	N6085U	NYC03FA088	Fatal(2)	
Factual 11/29/2000 Final 03/02/2001	Final Report PDF HTML Data Summary (PDF)	06/17/2000	FREEDOM, PA	Cessna 182	N5746B	NYC00LA166	Nonfatal	
⏪ ⏩ 1 2 ⏪ ⏩ Page size: 10 ▾ 14 items in 2 pages								



How Many Weight & Balance Accidents in NJ in Last 17 Years?

Accident/Incident Information

Event Start Date (mm/dd/yyyy)	1/1/2000
Event End Date (mm/dd/yyyy)	12/31/2017
Month	All
City	
State	New Jersey
Country	United States
Investigation Type	Accident
Injury Severity	All

Aircraft

Category	Airplane
Amateur Built	All
Make	
Model	
Registration	
Damage	All
Number of Engines	
Engine Type	Reciprocating

Operation

Operation	Part 91: General Aviation
Purpose of Flight	All
Schedule	All
Air Carrier	

How Many Weight & Balance Accidents in NJ in Last 17 Years?

Event Details

Airport Name

Airport Code

Weather Condition

None ▼

Broad Phase of Flight

All ▼

Enter your word string below: (Searches both synopsis and full narrative; will slow the query performance)

"weight and balance" or "weight & balance" or "weight limitations"

Location information available for most cases in the United States since 2002. Refer to query help for limitations of location information.

Latitude

Longitude

within 0 ▼ miles

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How Many Weight & Balance Accidents in NJ in Last 17 Years?

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(Estimated) Report Publish Date(s)	Report(s)	Event Date	Location	Make/Model	Registration Number	NTSB No.	Event Severity	Type of Air Carrier Operation and Carrier Name (Doing Business As)
Factual 05/18/2015 Final 06/01/2015	Final Report PDF HTML Data Summary (PDF)	05/31/2013	Linden, NJ	DIAMOND AIRCRAFT IND INC DA 20-C1	N176MA	ERA13FA259	Fatal(1)	
Factual 12/21/2011 Final 03/08/2012	Final Report PDF HTML Data Summary (PDF)	02/15/2010	Farmingdale, NJ	CESSNA T337G	N12NA	ERA10FA140	Fatal(5)	
Factual 08/15/2011 Final 10/17/2011	Final Report PDF HTML Data Summary (PDF)	11/14/2009	Dennisville, NJ	PIPER PA-28R-200	N4499T	ERA10FA062	Fatal(2)	
Factual 06/09/2011 Final 06/01/2017	Final Report PDF HTML Data Summary (PDF)	08/21/2009	Teterboro, NJ	RAYTHEON AIRCRAFT COMPANY 58	N167TB	ERA09LA469	Fatal(1)	
Factual 06/23/2010 Final 08/12/2010	Final Report PDF HTML Data Summary (PDF)	08/12/2009	Sussex, NJ	CESSNA 150	N6676S	ERA09LA459	Nonfatal	
Factual 03/11/2009 Final 06/11/2009	Final Report PDF HTML Data Summary (PDF)	12/21/2008	Linden, NJ	BEECH C23	N2109W	ERA09FA100	Nonfatal	
Factual 03/05/2010 Final 04/22/2010	Final Report PDF HTML Data Summary (PDF)	05/17/2008	West Creek, NJ	CESSNA 337A	N5382S	NYC08FA184	Fatal(2)	
Factual 09/27/2004 Final 12/03/2004	Final Report PDF HTML Data Summary (PDF)	08/29/2004	Ocean City, NJ	Piper PA-24-180	N7573P	IAD04CA042	Nonfatal	

Parting Thoughts



Weight & Balance Suggestions for Non-Owners

- **Set Yourself Up to Succeed**
 - Purchase the Airplane Information Manual for each non-owned airplane you fly
 - Get a copy of the weight & balance sheet from the POH for each airplane you fly
 - Get some sort of a weight & balance program for each airplane you fly
 - Setup a ForeFlight weight & balance profile for each airplane you fly
 - Build your own weight & balance spreadsheet for each airplane you fly
 - If you are not computer savvy, find someone who is and ask them to help you build one
 - Buy a weight & balance tablet app for each airplane you fly
- **Find out the fuel policies for the non-owned planes you fly**
 - Civil Air Patrol
 - Cessna 172 – full (40 gallons or 50 gallons depending on whether tanks are long range)
 - Cessna 182 – tabs (64 gallons); NJWG uses 50 gallons
 - Cirrus SR20 Flying Club
 - Tabs + 7 (40 gallons)
 - Cessna NAV III (G1000) Flying Club
 - Cessna 172S – 35 gallons
 - Cessna 182T – 64 gallons (tabs)



Weight & Balance Pre-flight Planning

- **Do all weight & balance computations at home before you leave for the airport**
 - Get dressed weight from each passenger; explain to them the importance of accuracy
 - Do a computerized calculation with your weight and your passenger(s) weights
 - Figure out how much weight is available for fuel and luggage
 - Tell your passenger(s) how much luggage they can bring
- **Don't be afraid to “manage” your passenger(s)**
 - Explain to them how the regulations and **safety** apply to weight & balance
 - Don't be afraid to tell them that not everyone will “fit” onboard
 - Don't be afraid to tell them that certain luggage items will not “fit”
- **Do a thorough flight planning and fuel needs analysis**
 - Don't cut the fuel too close – there could be unexpected complications

The Three Most Useless Things to a Pilot

- **The runway behind you**
 - **Moral: know your aircraft's take-off minimums and calculate the weight and balance for your flight, your airport's runway length, density altitude, any obstacles to be cleared**
- **The altitude above you**
 - **Moral: know your aircraft's power settings for climb, cruise, and descent**
- **The fuel on the ground below you**
 - **Moral: know your aircraft's fuel capacity, fuel system, GPH burn rate, and winds aloft for the route of flight.**
- **Utilize superior judgment to avoid needing to use superior skill**

Flight Service Transitions to Leidos Pilot Web Portal

Notice Number: NOTC7670

DUATS Discontinued

Effective 05/16/2018



Flight Service Transitions to Leidos Pilot Web Portal





- The FAA will discontinue the Direct User Access Terminal Service (DUATS II) Program, effective May 16, 2018.
 - Internet services, including access to weather and aeronautical information, flight plan filing and automated services will remain available at no charge to pilots at www.1800wxbrief.com.
- To continue to receive free services, users are encouraged to register with www.1800wxbrief.com.
 - Over the next 60 days, the FAA will work with current DUATS II providers on transition activities, including conducting pilot outreach, establishing commercial interfaces, and providing user migration assistance.

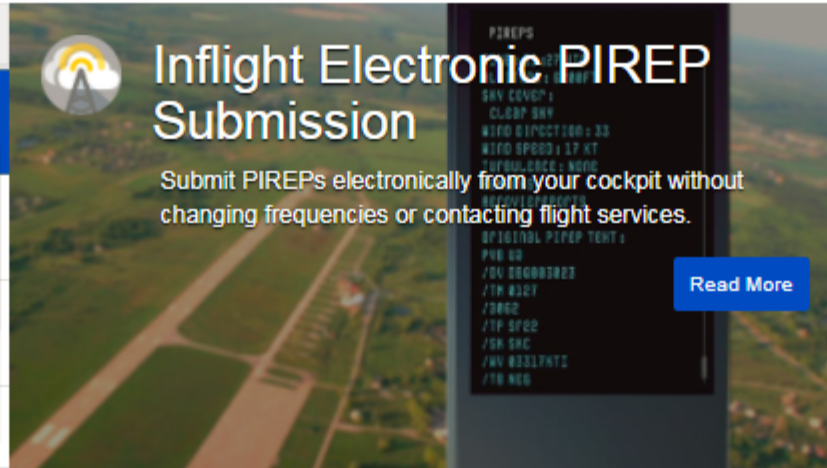
Flight Service Transitions to Leidos Pilot Web Portal

<https://www.1800wxbrief.com>

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Featured Capabilities

-  **Inflight Electronic PIREP Submission**
-  **ACAS - Adverse Condition Alerting Service**
-  **NGB - Next Generation Briefings**
-  **SE-SAR - Surveillance-Enhanced Search and Rescue**



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News & Announcements

February 7, 2018

FAA Items of Interest



- For information on the FAA's Remote Communication Outlets Infrastructure Reduction Plan, visit www.faa.gov/go/flightservice for a list of frequencies, coverage area maps and frequently asked questions. To review the Federal Register Notice, [Click Here](#)
- The FAA welcomes your feedback! Tell us about your experience on 1800wxbrief.com [Click Here](#)

[READ MORE >](#)

Upcoming Events

- APR 10-15 2018**
Sun 'n Fun - Lakeland, FL (KLAL)
- JUN 15-16 2018**
AOPA Fly-In, Missoula, MT (KMSO)
- JUN 19-22 2018**
The Air Race Classic (ARC)
- JUL 23-29 2018**
EAA AirVenture Oshkosh, WI (OSH)
- SEP 14-15 2018**

How-To Videos

Flight Service Transitions to Leidos Pilot Web Portal

<https://www.1800wxbrief.com>



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Just a Real Nice Picture



Credits and Information



References and Information

- **Author of Presentation**
 - William J. Doyle, Jr., CFI A&I, AGI, IGI, Cessna CFAI
 - FAA FFAST Team Representative, PHL FSDO
- **Downloading this presentation and associated spreadsheets**
 - http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_2018.pptx
 - http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_2018.pdf
 - http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_172S.xls
 - http://williamjdoylejr.net/FAAST/W&B/Weight_and_Balance_Cessna_182T.xls
 - http://williamjdoylejr.net/FAAST/W&B/Weight_Balance_Cessna_U206H.xls
 - http://williamjdoylejr.net/FAAST/W&B/Weight_&_Balance_Cirrus_SR20.xls
- **Maj Tom Woods (deceased), FFAST Rep PHL FSDO and NJWG/LGM**
 - for creating the W&B spreadsheets for Cessna 172S, 182T, and U206H
- **907 Flight Squadron and the Cirrus Owners and Pilots Association**
 - for sourcing the Cirrus SR20 W&B spreadsheet to me

References and Information

- **Dr. Al Schnur**
 - formula for recalculating Vspeeds for weights below gross weight.
- **FAA Airplane Flying Handbook – FAA-H-8083-3B**
 - https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook/
- **Pilot's Handbook of Aeronautical Knowledge – FAA-H-8083-25B**
 - https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/
 - Chapter 10 – Weight & Balance
 - https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/12_phak_ch10.pdf
- **FAA Aircraft Weight & Balance Handbook – FAA-H-8083-1B**
 - https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/FAA-H-8083-1.pdf
- **NTSB Accident Database**
 - https://www.nts.gov/_layouts/ntsb.aviation/Index.aspx

References and Information

- **Electronic Code of Federal Regulations – Title 14 Chapter I--
Federal Aviation Administration, Department of Transportation,
Subchapter D – Airmen**
 - https://www.ecfr.gov/cgi-bin/text-idx?SID=c568dda2ee8f3a2cf796dcd614c3b4de&mc=true&tpl=/ecfrbrowse/Titl e14/14cfrv2_02.tpl#0



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Appendix

Weight Change Formulas



Weight Change Formula

- **Basic formula:**

- Total Moment ÷ Total Weight

- **Changes in Weight and Moment:**

- (Total Moment ± Δ in Moment)

÷

- (Total Weight ± Δ in Weight)

- Where

- ± is plus or minus

- Δ is change (delta)

Basic Formula

$$\frac{\sum \text{Moment}}{\sum \text{Weight}} = \frac{108200}{2460} = 43.98$$

Changes in Weight and Moment

$$\frac{(\sum M) \pm \Delta M}{(\sum W) \pm \Delta W} = \frac{108200 - 18960}{2460 - 260} = \frac{89240}{2200} = 40.56$$

Weight Change Formula

- Airplane takes off with the following:
 - Weight = 6,230 lbs
 - CG = 79.0
- What is the CG after 50 gallons of fuel burned from station 87?

Solution

$$\frac{(\sum M) \pm \Delta M}{(\sum W) \pm \Delta W} = \frac{(6230 \times 79) - (300 \times 87)}{6230 - 300} = \frac{492170 - 26100}{5930} = \frac{466070}{5930} = 78.6$$

Weight Change Formula

- Airplane takes off with the following:
 - Weight = 3,000 lbs
 - CG = 60.0
- After takeoff
 - 25 gallons fuel burned at station 65
 - 200 lb passenger moves from station 50 to station 90
- What is the resulting CG?

Solution

$$\frac{(\sum M) \pm \Delta M}{(\sum W) \pm \Delta W} = \frac{(3000 \times 60) - (150 \times 65) + (200 \times (90 - 50))}{3000 - 150} = \frac{180000 - 9750 + 8000}{2850} = \frac{178250}{2850} = 62.54$$

Weight Shift Formula - CG Shifted by Weight Move

- Airplane Gross Weight = 10,000 lbs; 500 lbs cargo shifts 50 inches.
- How far does the CG move?

$$\frac{\text{Weight Moved}}{\text{Weight of Airplane}} = \frac{\text{Distance CG Moves}}{\text{Distance Between Arms}}$$
$$\frac{500 \text{ pounds}}{10,000 \text{ pounds}} = \frac{b}{50 \text{ inches}}$$

$$\frac{500}{10,000} = \frac{b}{50} \quad b = \frac{500 \times 50}{10,000} = \frac{25,000}{10,000} = 2.5$$

$$b = 2.5 \text{ inches}$$

Weight Shift Formula - Weight Shifted to Move CG Two Inches

$$\frac{\text{Weight Moved}}{\text{Weight of Airplane}} = \frac{\text{Distance CG Moves}}{\text{Distance Between Arms}}$$

$$\frac{a}{2,550 \text{ pounds}} = \frac{2 \text{ inches}}{36 \text{ inches}}$$

$$\frac{a}{2,550} = \frac{2}{36} \qquad a = \frac{2,550 \times 2}{36}$$

$$a = 141.7 \text{ pounds}$$

Weight Shift Formula - CG Shifted by Weight Move

$$\frac{\text{Weight Moved}}{\text{Weight of Airplane}} = \frac{\text{Distance CG Moves}}{\text{Distance Between Arms}}$$

$$\frac{142 \text{ pounds}}{2,550 \text{ pounds}} = \frac{b}{36 \text{ inches}}$$

$$\frac{142}{2,550} = \frac{b}{36}$$

$$b = \frac{142 \times 36}{2,550}$$

$$b = 2.0 \text{ inches}$$

Weight Shift Formula - How Far to Move Weight to Shift CG

$$\frac{\text{Weight Moved}}{\text{Weight of Airplane}} = \frac{\text{Distance CG Moves}}{\text{Distance Between Arms}}$$

$$\frac{142 \text{ pounds}}{2,550 \text{ pounds}} = \frac{2.0 \text{ inches}}{c}$$

$$\frac{142}{2,550} = \frac{2.0}{c} \qquad c = \frac{2,550 \times 2.0}{142}$$

$$c = 35.9 \text{ inches}$$

This Completes

Airplane Weight & Balance

The Inherent Dangers of Weight and Balance Procedural Complacency

What You Don't Know Can Get You and Your Passengers Killed!

FAA Customer Feedback Website

http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/qms/

PHL FSDO FAAST Program Manager – Eric Sieracki -

Eric.Sieracki@faa.gov

