

For proper loading + safe operation.

OBJECTIVE

TO DEVELOP THE STUDENT'S ABILITY TO PROPERLY USE PILOT'S OPERATING HANDBOOKS AND FAA APPROVED AIRPLANE FLIGHT MANUALS; AND TO DEVELOP THE STUDENT'S ABILITY TO PERFORM BASIC WEIGHT AND BALANCE COMPUTATIONS.

ELEMENTS

1. WEIGHT AND BALANCE
 - A. TERMS AND DEFINITIONS.
 - B. EFFECTS OF ADVERSE BALANCE.
 - C. FINDING LOADED WEIGHT.
 - D. FINDING C.G. - WHEN WEIGHT IS ADDED OR REMOVED - WHEN WEIGHT IS SHIFTED.
2. PREDICTING PERFORMANCE
 - A. TAKEOFF AND LANDING DISTANCES.
 - B. FUEL CONSUMPTION AND RELATED CHARTS.
 - C. MAXIMUM RANGE POWER SETTINGS.
 - D. MAXIMUM ENDURANCE POWER SETTINGS.

SCHEDULE

ONE HOUR AND THIRTY MINUTES.

EQUIPMENT

HANDOUTS, AIRPLANE, POH. *FTH 300+*

INSTRUCTOR'S ACTIONS

DISCUSS LESSON OBJECTIVES AND ELEMENTS:

1. PART ONE: WEIGHT & BALANCE
 - A. WEIGHT AND BALANCE TERMS.
 - B. EFFECT OF WEIGHT AND BALANCE ON PERFORMANCE.
 - C. METHODS OF WEIGHT AND BALANCE CONTROL.
 - D. DETERMINATION OF TOTAL WEIGHT AND CENTER OF GRAVITY AND THE CHANGES THAT OCCUR WHEN ADDING, REMOVING, OR SHIFTING WEIGHT.
2. PART TWO: PREDICTING PERFORMANCE
 - A. DEMONSTRATE THE USE OF PERFORMANCE CHARTS, TABLES, AND OTHER DATA IN DETERMINING PERFORMANCE IN VARIOUS PHASES OF FLIGHT.
 - B. EFFECTS OF EXCEEDING LIMITATIONS.
 - C. EFFECTS OF ATMOSPHERIC CONDITIONS ON PERFORMANCE.
 - D. FACTORS TO BE CONSIDERED IN DETERMINING THAT THE REQUIRED PERFORMANCE IS WITHIN THE AIRPLANE'S CAPABILITIES.

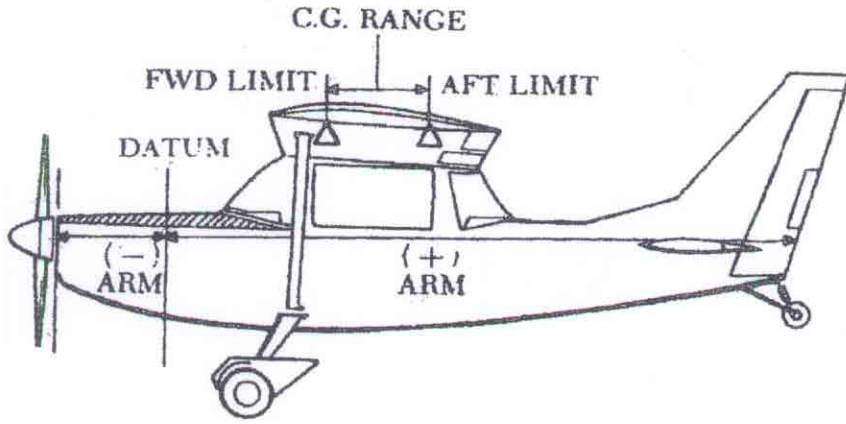
STUDENT'S ACTIONS

LISTEN, ASK QUESTIONS, AND TAKE NOTES.

COMPLETION STANDARDS

THE LESSON WILL HAVE BEEN SUCCESSFULLY COMPLETED WHEN, BY AN ORAL TEST AND DEMONSTRATION, THE STUDENT DISPLAYS A BASIC KNOWLEDGE OF POH AND FAA APPROVED AIRPLANE FLIGHT MANUALS; WHEN THE STUDENT IS ABLE TO PERFORM BASIC WEIGHT AND BALANCE COMPUTATIONS.

TERMS



- ✓ DATUM
- ✓ ARM
- ✓ STATION

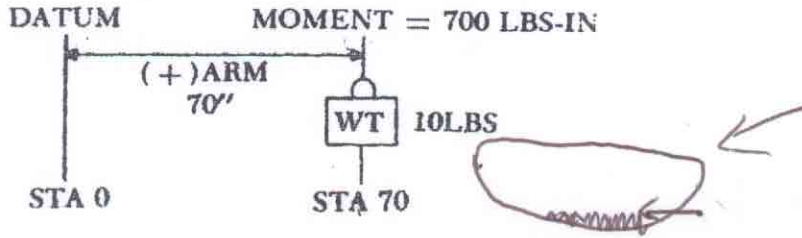


Figure 4-2. Weight and balance illustrated.

Licensed
BASIC EMPTY WEIGHT

Std + optional eqv. unusable fuel

UNUSABLE FUEL

✓ USABLE FUEL

✓ STANDARD EMPTY WEIGHT *- paint + optional eqv*

USEFUL LOAD

Hydraulic fluid undrainable engine oil

C.G. ARM

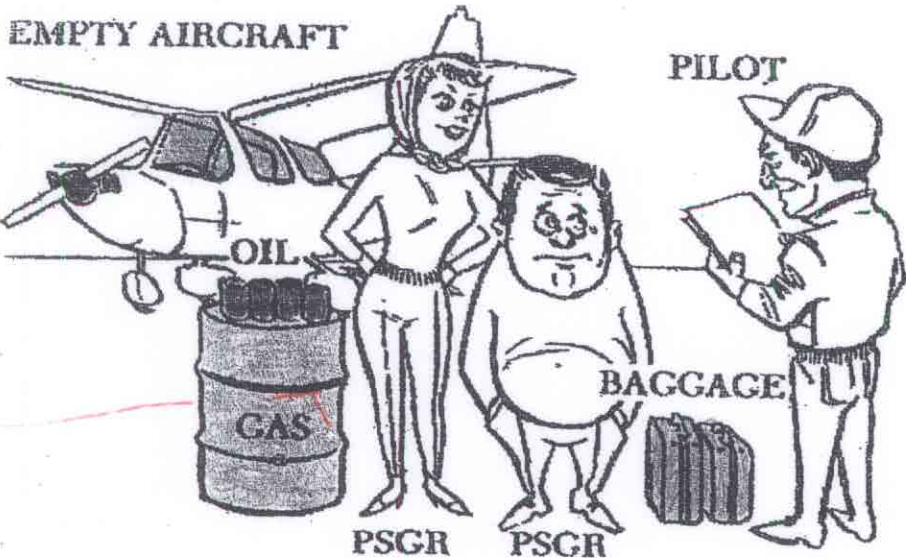
MOMENT

CENTER OF GRAVITY (C.G.)

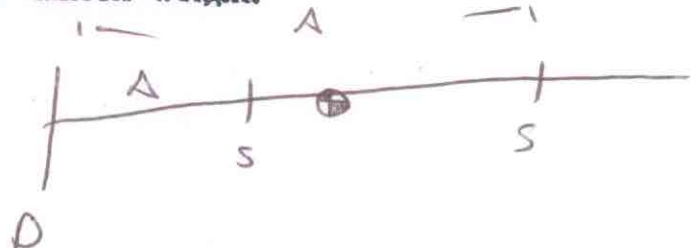
MAXIMUM WEIGHT

2650 arrow II

C.G. LIMITS



Empty weight + useful load = takeoff weight.



EXCESSIVE WEIGHT

Reduces the Flight Performance because OVERWEIGHT aircraft will have a :

HIGHER - Takeoff Speed

LONGER - Takeoff Roll

REDUCED - Rate and Angle of Climb

LOWER - Maximum Altitude

SHORTER - Operational Range

REDUCED - Cruise Speed

REDUCED - Maneuverability

REDUCED - Controllability

HIGHER - Stall Speed

HIGHER - Approach Speed

LONGER - Landing Roll

The airplane will Accelerate More Slowly with the Same Power Output and a Higher Airspeed is Needed to Generate enough Lift for Takeoff.

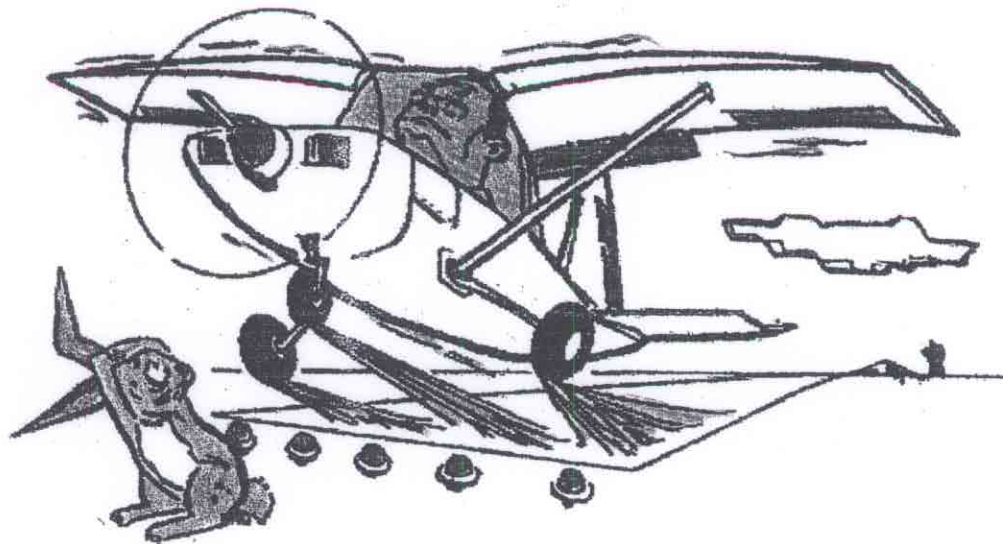
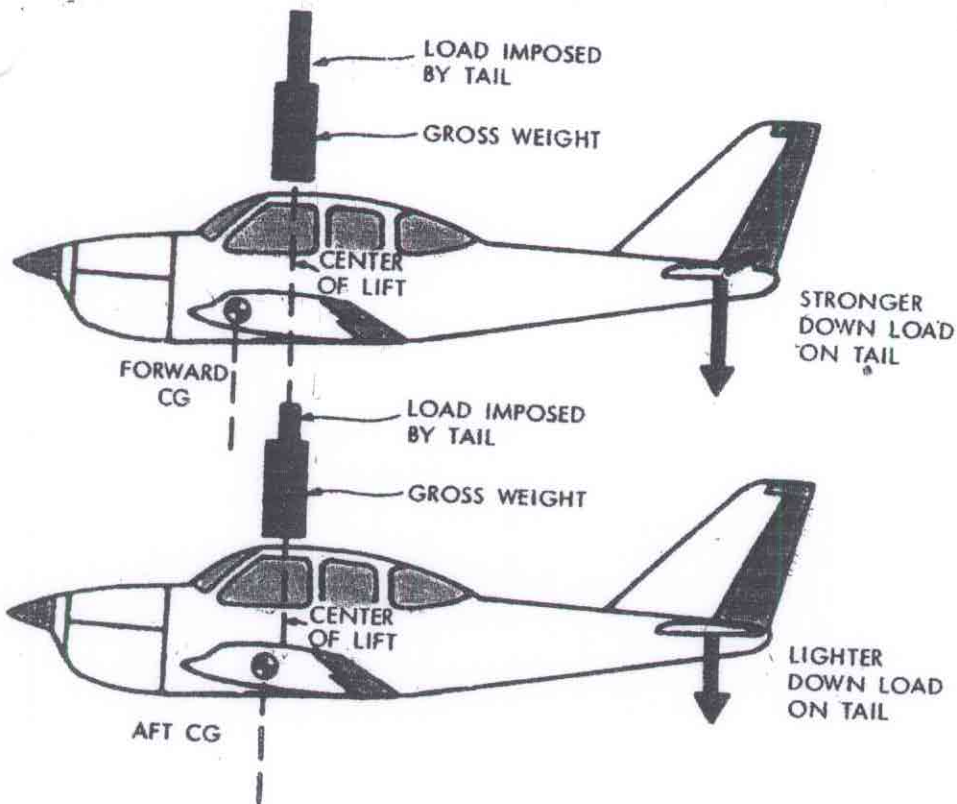
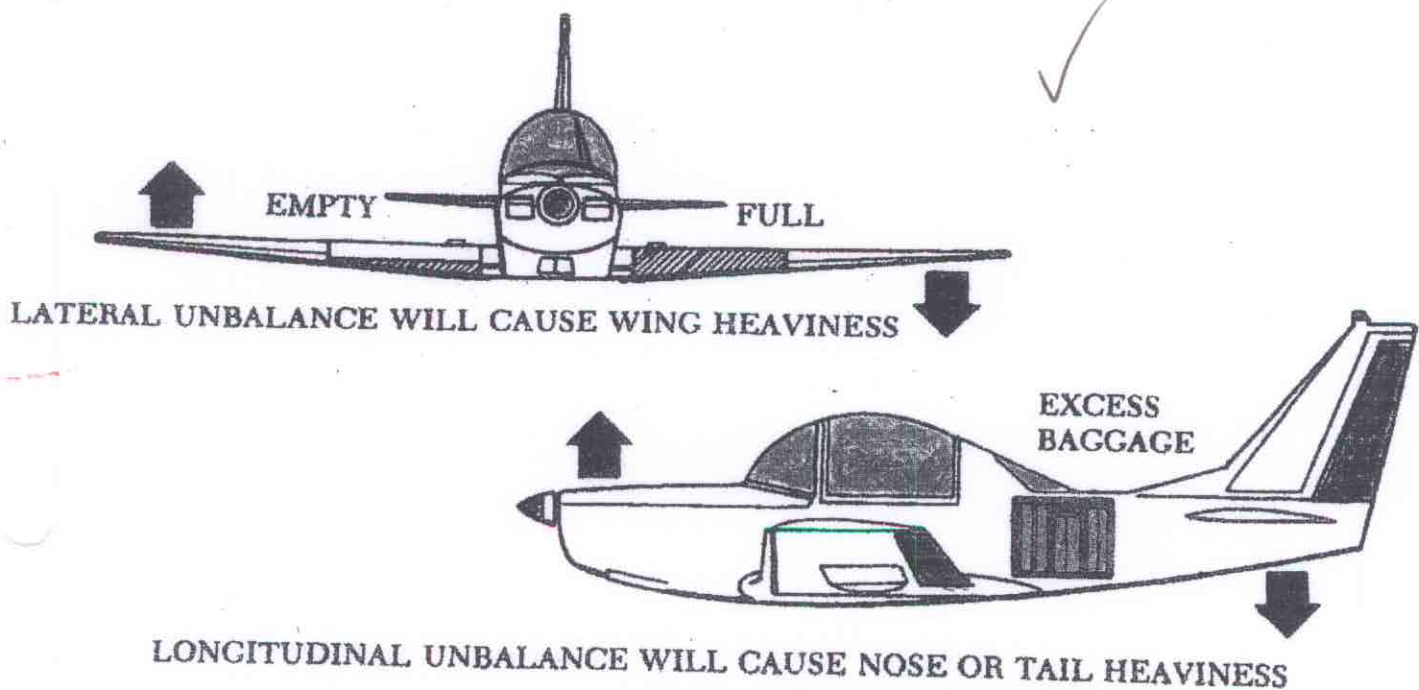


FIGURE 2. Overweight causes longer takeoff run.



Explain:
 Longitudinal stability
 about ~~the~~ the lateral axis

Figure 17-51 Load Distribution Affects Balance



CENTER OF GRAVITY TOO FAR AFT

LOWER - Stall speed

HIGHER - Cruise Speed

LESS - Stable

*good for cargo operations
→ more fuel efficient*

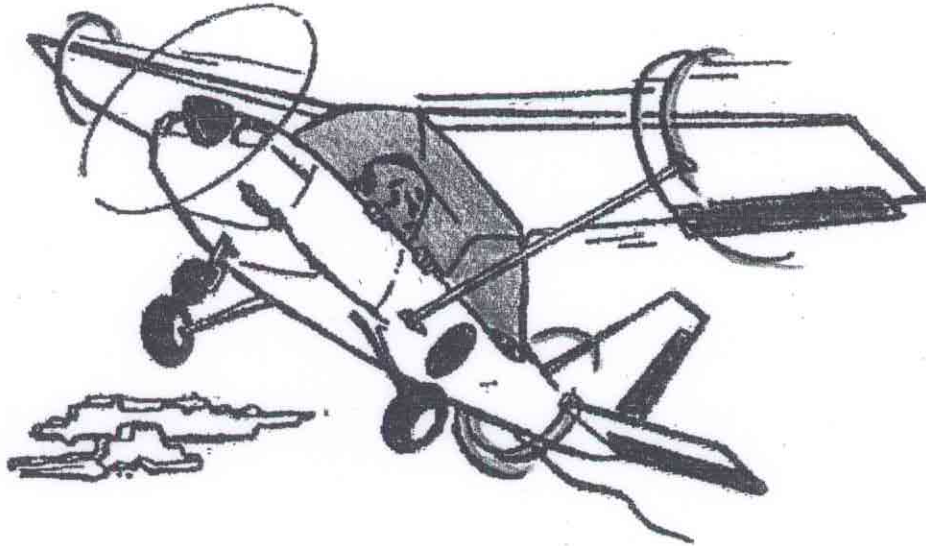


FIGURE 5. Aft c.g. critical in a stall.

Lower stall speed -- less wing loading

Higher cruise speed -- reduced drag; smaller angle of attack is required to maintain altitude.

Less stable -- Stall and spin recovery more difficult; the C.G. is closer to the C.P., causing longitudinal instability.

CENTER OF GRAVITY TOO FAR FORWARD

✓ HIGHER - Stall Speed

✓ SLOWER - Cruise Speed

✓ MORE - Stable

GREATER - back elevator pressure required

*more stable
less fuel efficient*



*watch trim
on landing*

FIGURE 4. Forward c.g. critical on landing.

Higher stall speed -- **Stalling AOA** is reached at a higher speed due to increased wing loading.

Slower cruise speed -- **Increased drag; greater AOA** is required to maintain altitude.

More stable -- **The C.G. is farther forward fm the C.P.** which increases longitudinal stability.

Greater back elevator press required -- **Longer T-O roll; Higher approach speeds & problems w/ flare.**

HEROKEE ARROW II

WEIGHTS

- * GAS = 6 lbs./ gal.
- TURBO FUEL = 6.7 lbs./ gal.
- OIL = 7.5 lbs./ gal.
- WATER = 8.5 lbs./ gal.
- PEOPLE = 170 lbs./ EACH

AIRCRAFT	WEIGHT	ARM	MOMENT	MGWT
N15379	1660	86.3	143397.48	2650
N16344	1634.8	85	139029.3	2650

N39WT

1527.2

85.4

130344

2650

WEIGHT & BALANCE

ARROW II	WEIGHT (lbs)	ARM AFT DATUM (Inches)	MOMENT (In-Lbs)
Empty Weight	1527.2	85.4	130344
Oil (8 quarts)	15	24.5	368
Pilot and Front Passenger	360	80.5	28980
Aft Passengers (Rear Seat)	30	118.1	3543
* Fuel (Max 48 Gal = 288 lbs)	288.16	95.0	27360
Moment due to Retracting of Landing Gear	—	—	819
* Baggage (Max 200 lbs)	0	142.8	0
Total Loaded Airplane	2220.2	86.21	191414

↑
8.5 to 93 in e
this wt

* Check Aft C.G. Between 150 lbs and 200 lbs.

FORMULAS

WEIGHT × ARM = MOMENT

TOTAL MOMENT _____ ÷ TOTAL WEIGHT _____ = C.G. LOCATION _____