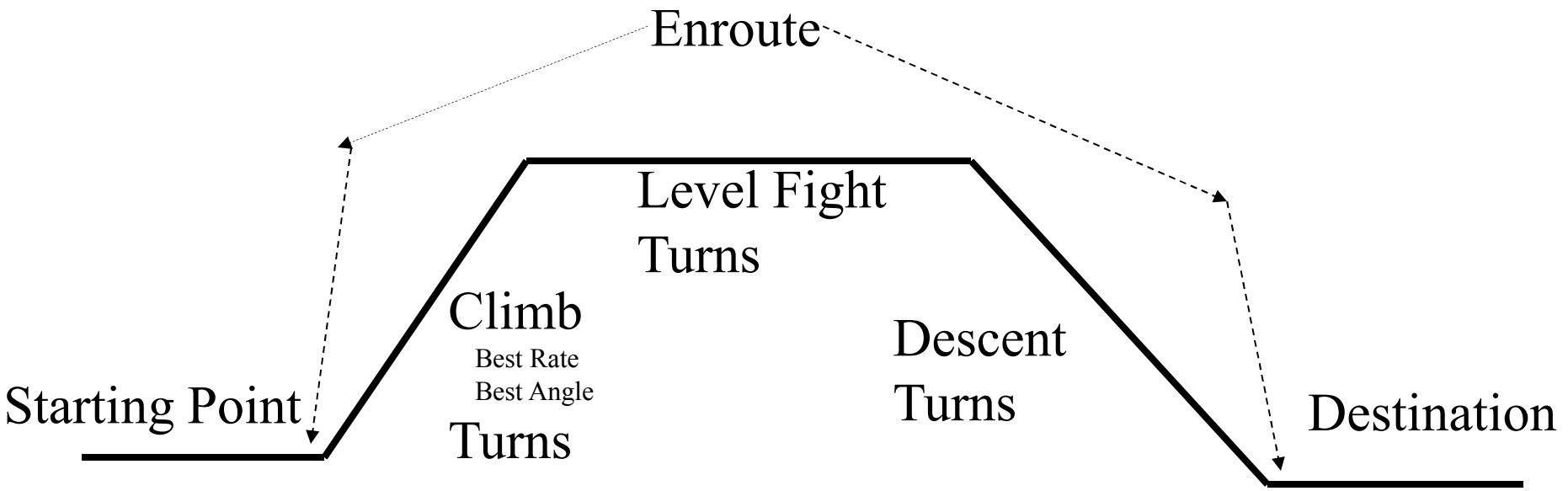
Course Progression



Flight Planning
Weight and Balance
Pre-Flight
Take-Off Roll

Ground Effect
Landing Roll


N15143
N95300
SEP 9 2006


SEP 9 2006


SEP 9 2006

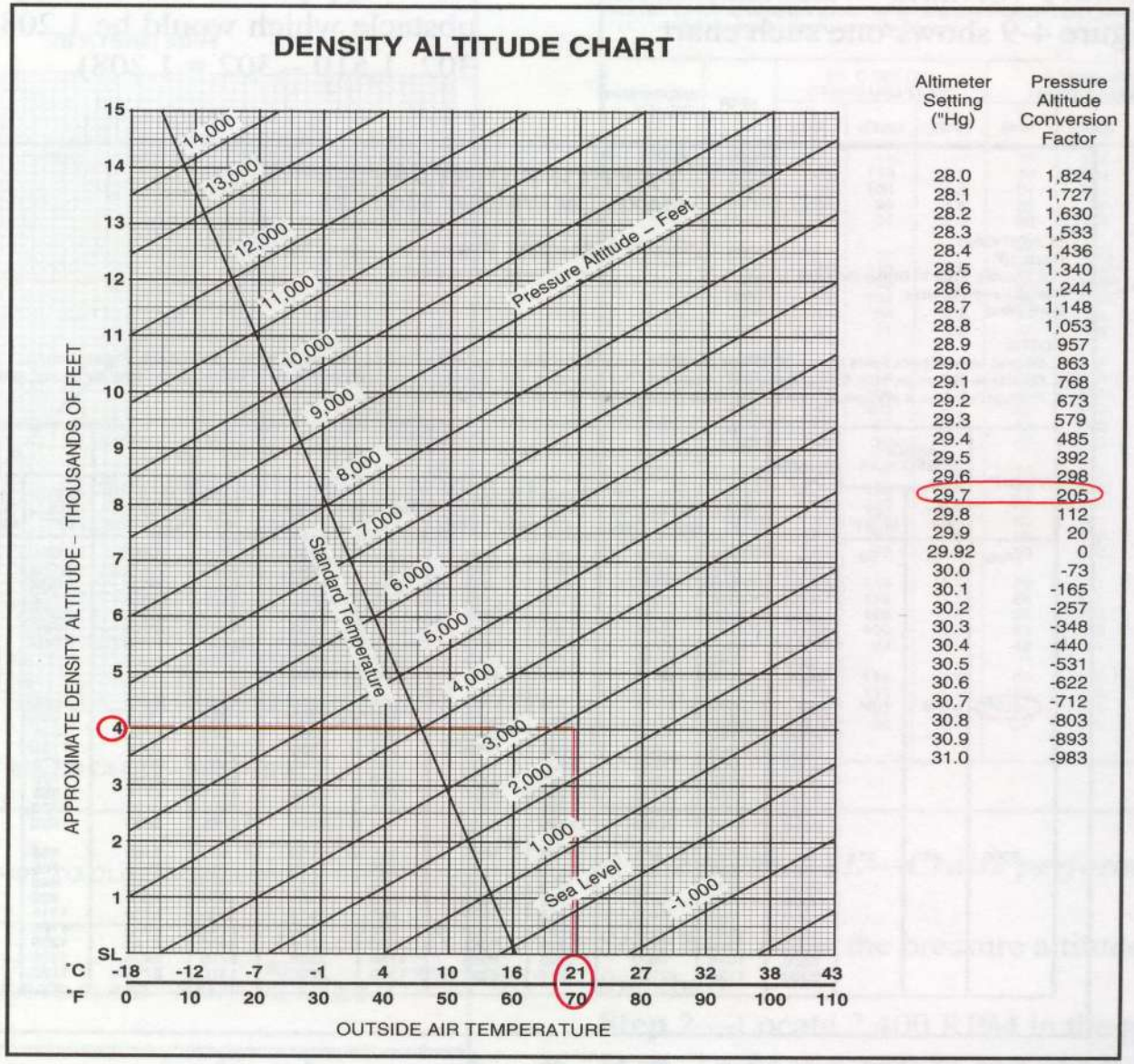


FIGURE 4-8.—Pressure altitude and density altitude chart.

See pages 359 – 361
Equations 6.85, 6.86 and 6.90

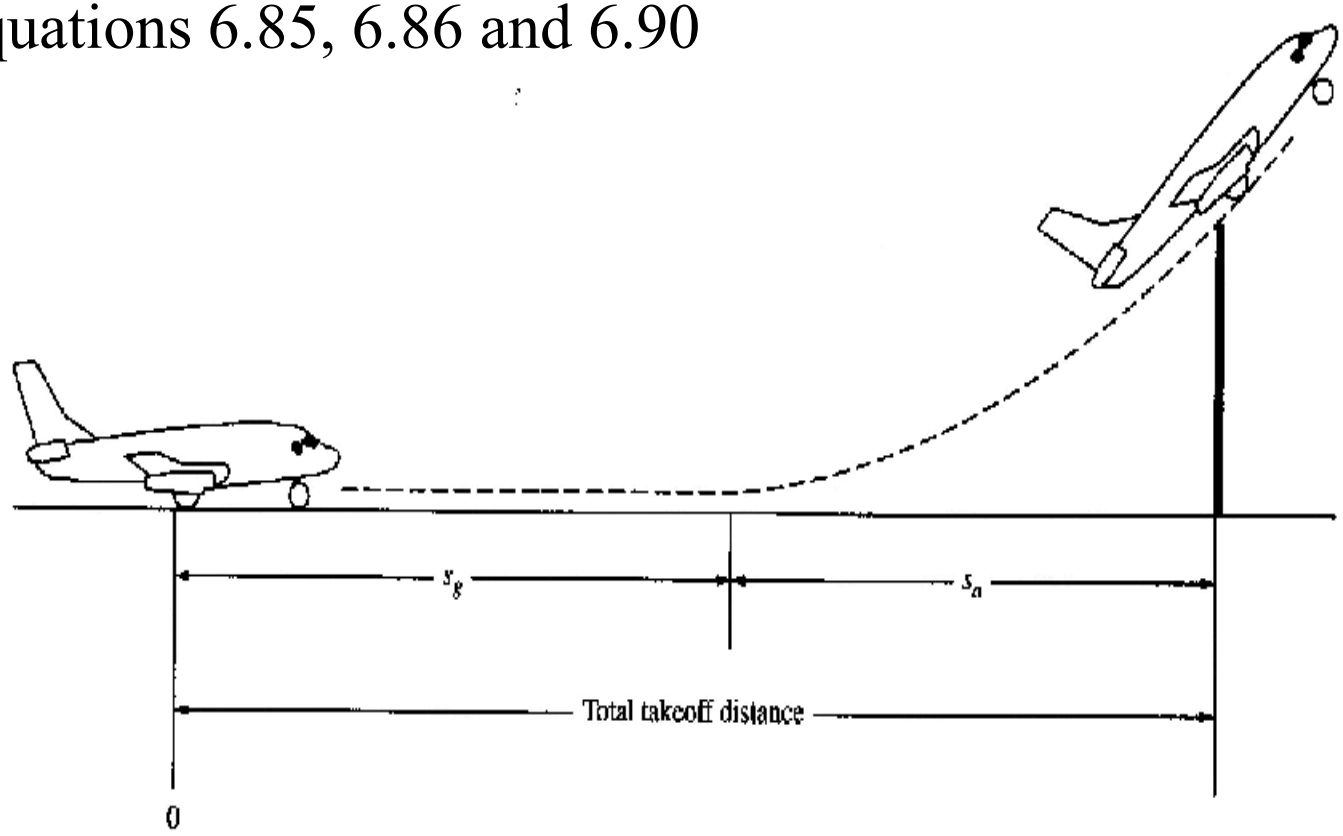


Figure 6.12 Illustration of ground roll s_g, airborne distance s_a, and total takeoff distance.

PA-28-181
Flaps Up Takeoff Performance
Full Throttle before Brake Release. Paved, Level, Dry Runway

WEIGHT LBS.	TAKEOFF SPEEDS I.A.S. - ZERO INSTRUMENT ERROR			
	LIFTOFF		50 FT.	
	MPH	KTS	MPH	KTS
2550	61	53	67	58
2450	59	51	65	57
2250	57	50	63	55
2050	55	48	60	52

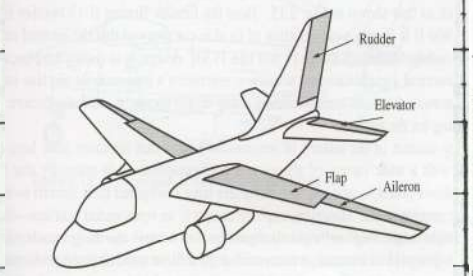
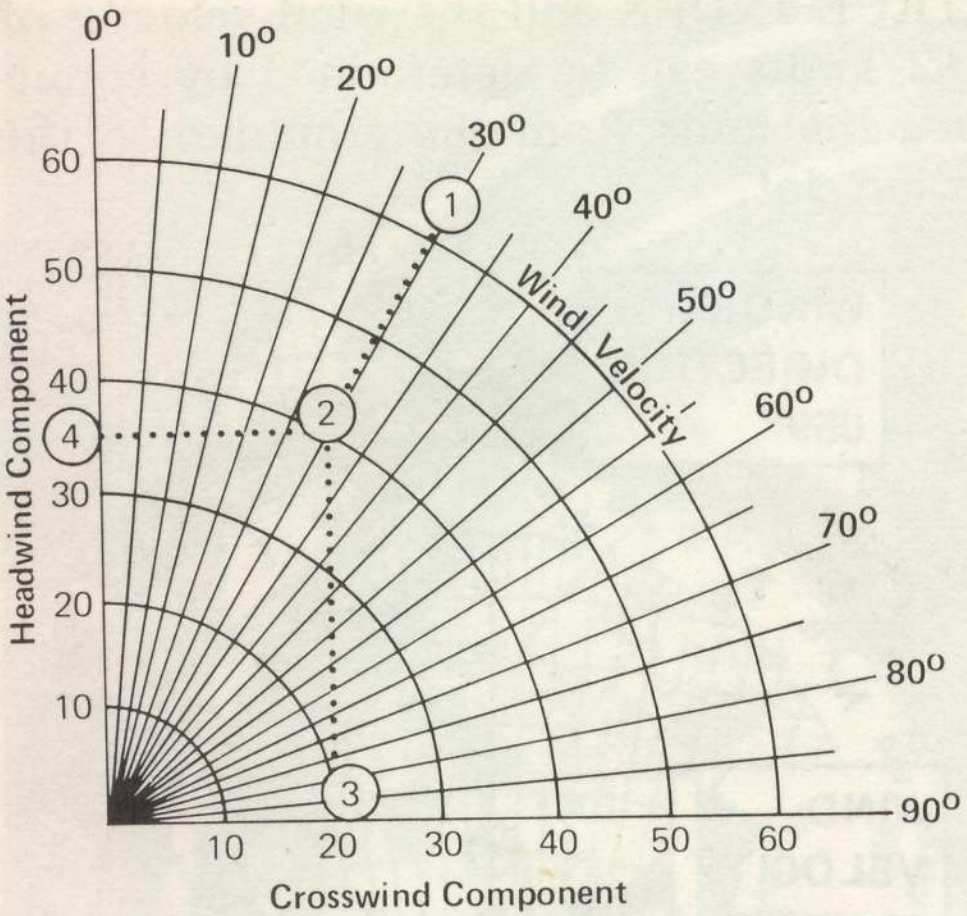


Figure 2.12 Control surfaces and flaps.



EXAMPLE: 40-knot wind at 30° angle

(1) 30° angle between wind and runway

(2) 40 knots total wind velocity

(3) 20 knot crosswind component

(4) 35 knot headwind component

Fig. 8-34. Wind Component Chart

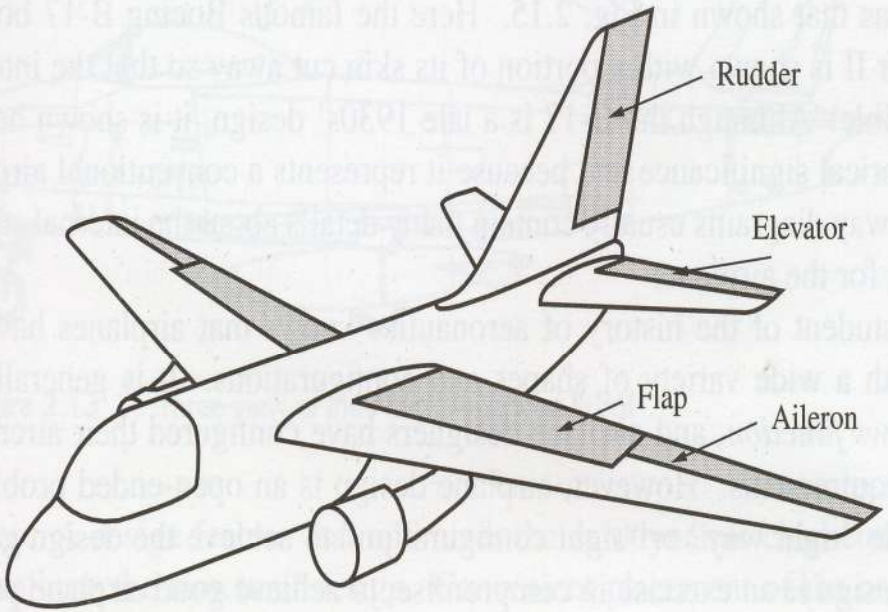


Figure 2.12 Control surfaces and flaps.

NORMAL PROCEDURE TAKEOFF GROUND ROLL

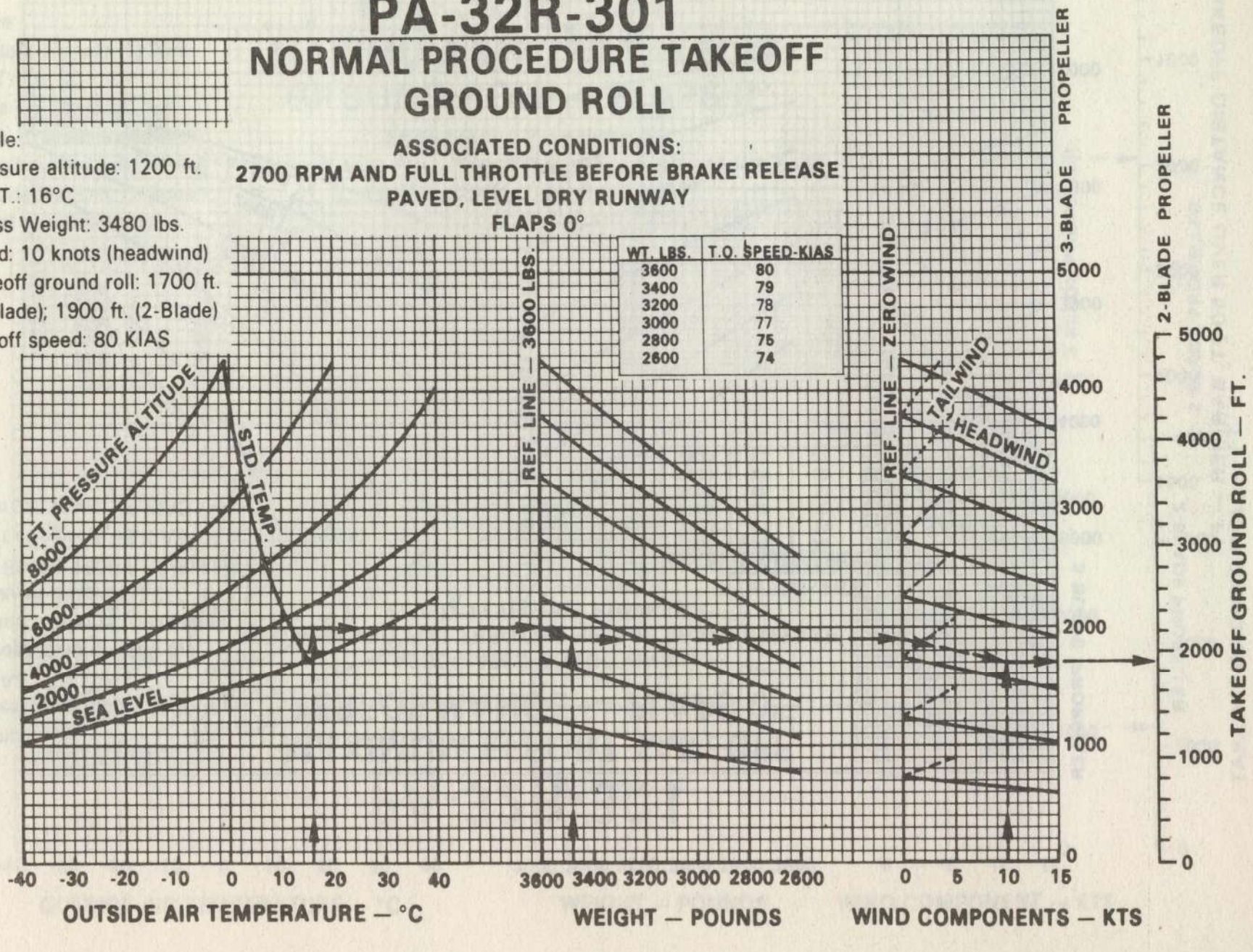
PA-32R-301

NORMAL PROCEDURE TAKEOFF GROUND ROLL

Example:
Pressure altitude: 1200 ft.
O.A.T.: 16°C
Gross Weight: 3480 lbs.
Wind: 10 knots (headwind)
Takeoff ground roll: 1700 ft. (3-Blade); 1900 ft. (2-Blade)
Lift off speed: 80 KIAS

ASSOCIATED CONDITIONS:
2700 RPM AND FULL THROTTLE BEFORE BRAKE RELEASE
PAVED, LEVEL DRY RUNWAY
FLAPS 0°

WT. LBS.	T.O. SPEED-KIAS
3600	80
3400	79
3200	78
3000	77
2800	75
2600	74



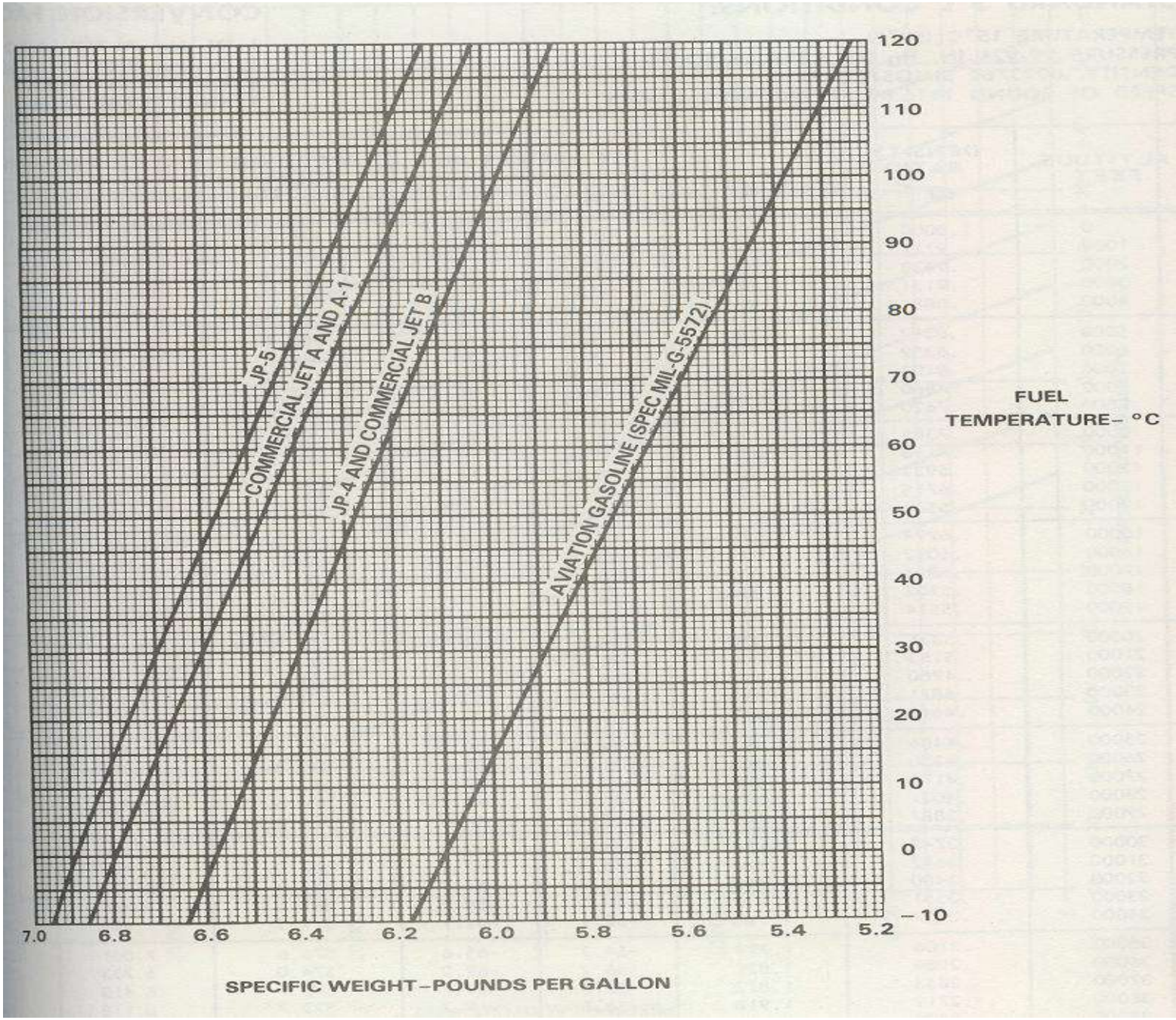
Key Weight Components in an Airplane

Empty weight (W_{empty}). The basic empty weight of the airplane which includes the structure, gear,communication equipment and all basic fluid except useable fuel.

Fuel weight (W_{fuel}). The weight of the fuel in the fuel tanks

Crew weight (W_{crew}). The crew comprises the people necessary to operate the airplane in flight.

Payload weight ($W_{payload}$). The payload is what the airplane is intended to transport i.e. passengers, baggage, freight, etc. If the airplane is intended for military combat use the payload includes bombs, rockets flares, bullets and other disposable ordnance.


JP-5
COMMERCIAL JET A AND A-1
JP-4 AND COMMERCIAL JET B
AVIATION GASOLINE (SPEC MIL-G-5572)
120
110
100
90
80
70
60
50
40
30
20
10
0
– 10
FUEL
TEMPERATURE– °C
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
SPECIFIC WEIGHT–POUNDS PER GALLON

Airplanes that are overloaded will have REDUCED performance

- Higher stall **speed**
- Higher takeoff **speed** and longer takeoff run
- Poor climb performance, angle and rate
- Lower cruising altitude
- Less maneuverability
- Higher fuel consumption, less range and endurance
- Reduce cruise **speed** for a given power setting
- Higher landing **speeds** and longer landing distances
- Greater braking requirements when stopping

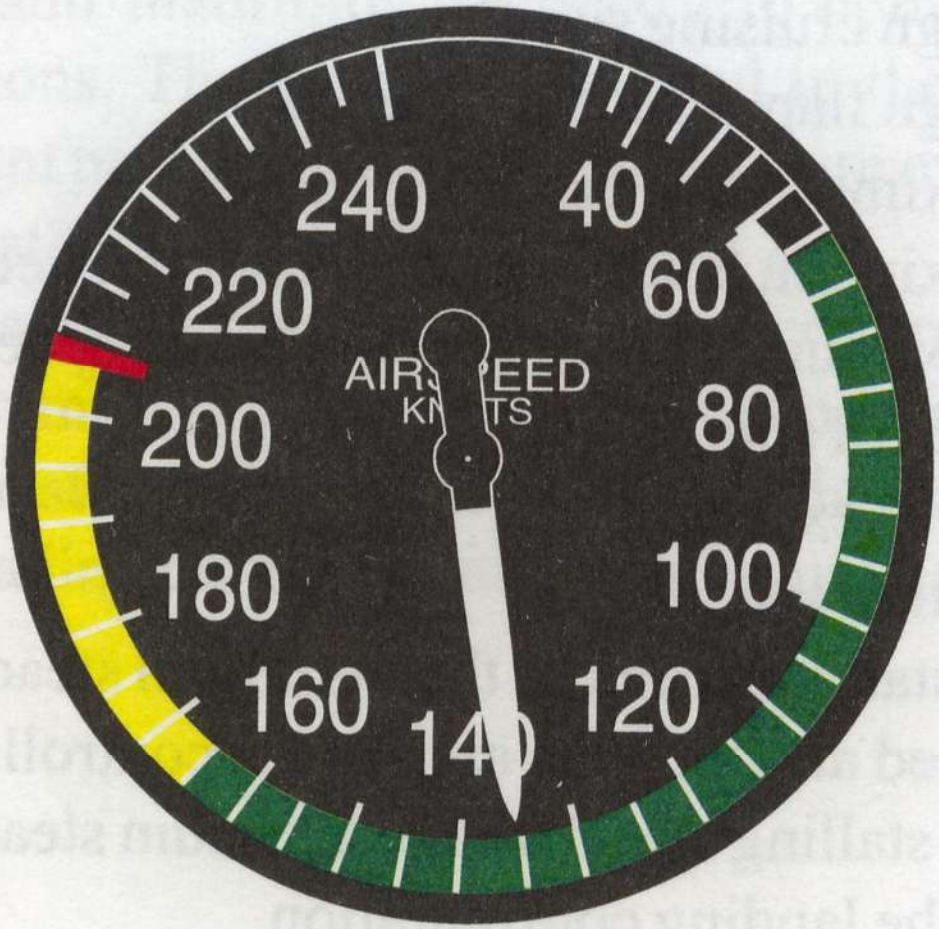


FIGURE 3-4.—Airspeed indicator.

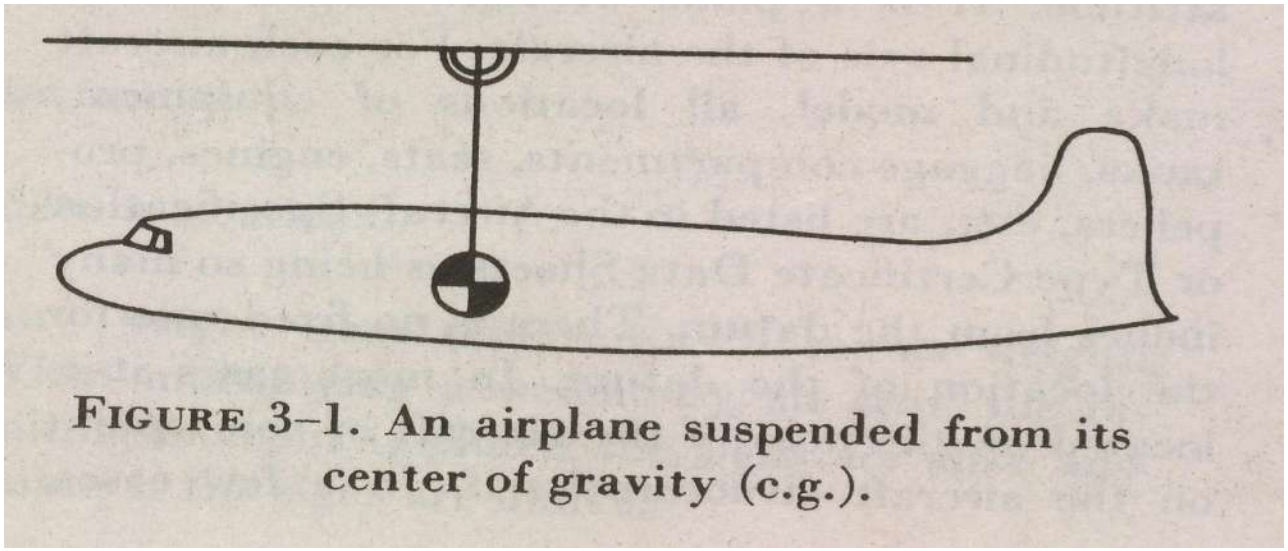
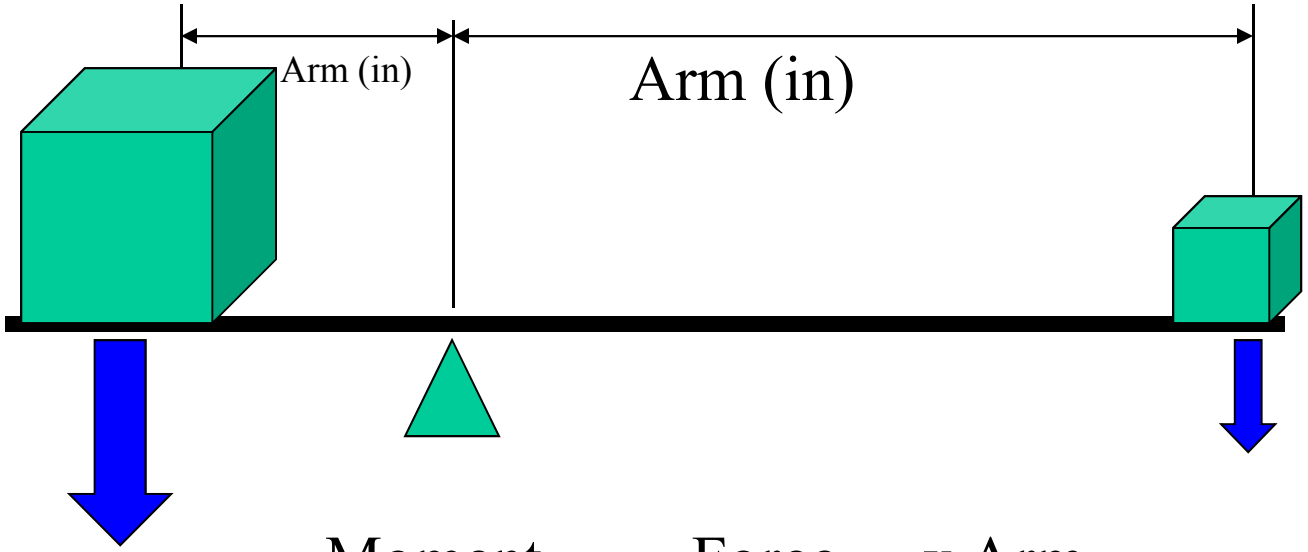
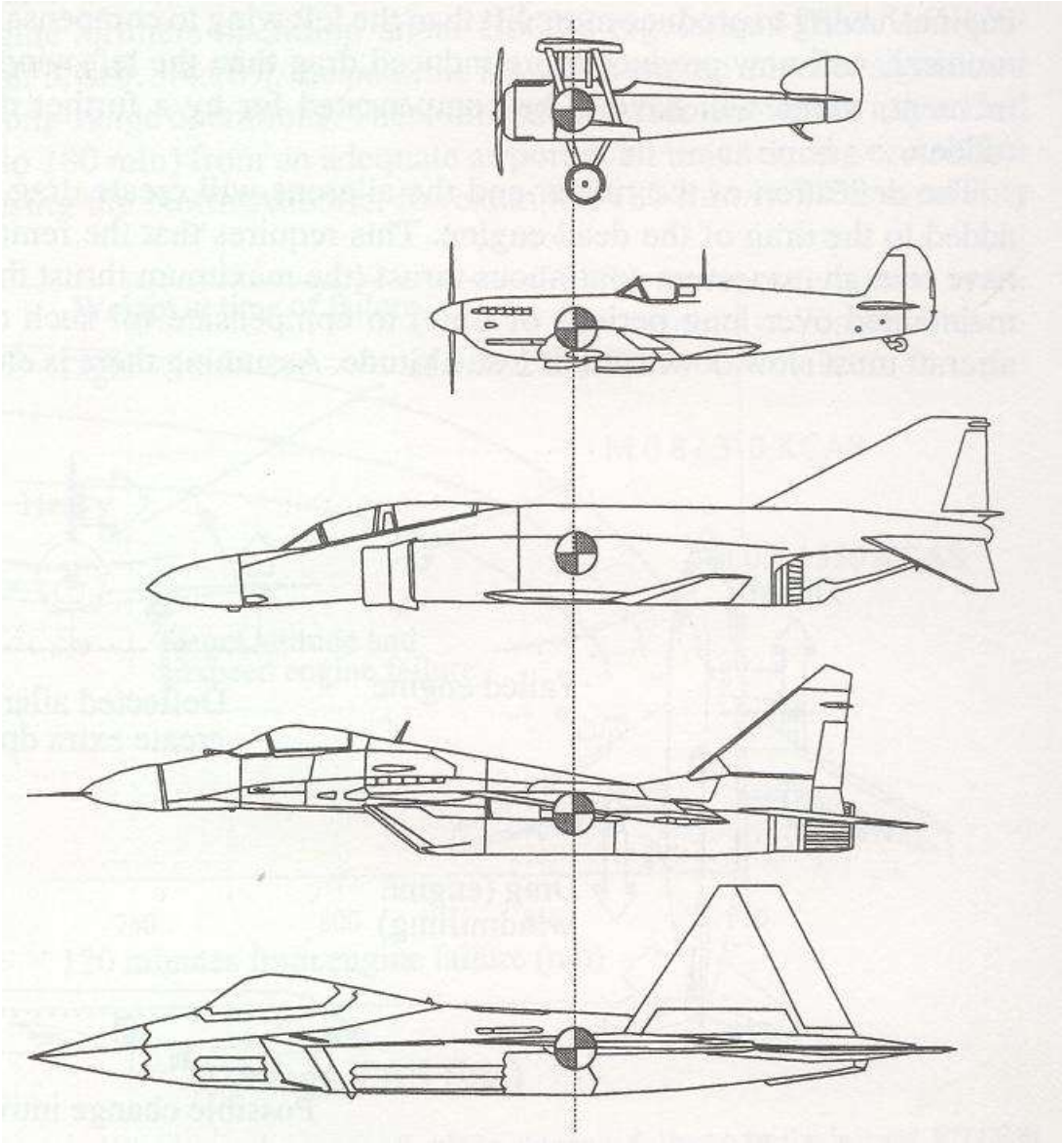


FIGURE 3–1. An airplane suspended from its center of gravity (c.g.).



$$\text{Moment}_{(\text{lb-in})} = \text{Force}\ (\text{lb}) \times \text{Arm}\ (\text{in})$$

Center of Gravity



Reference Datum Locations

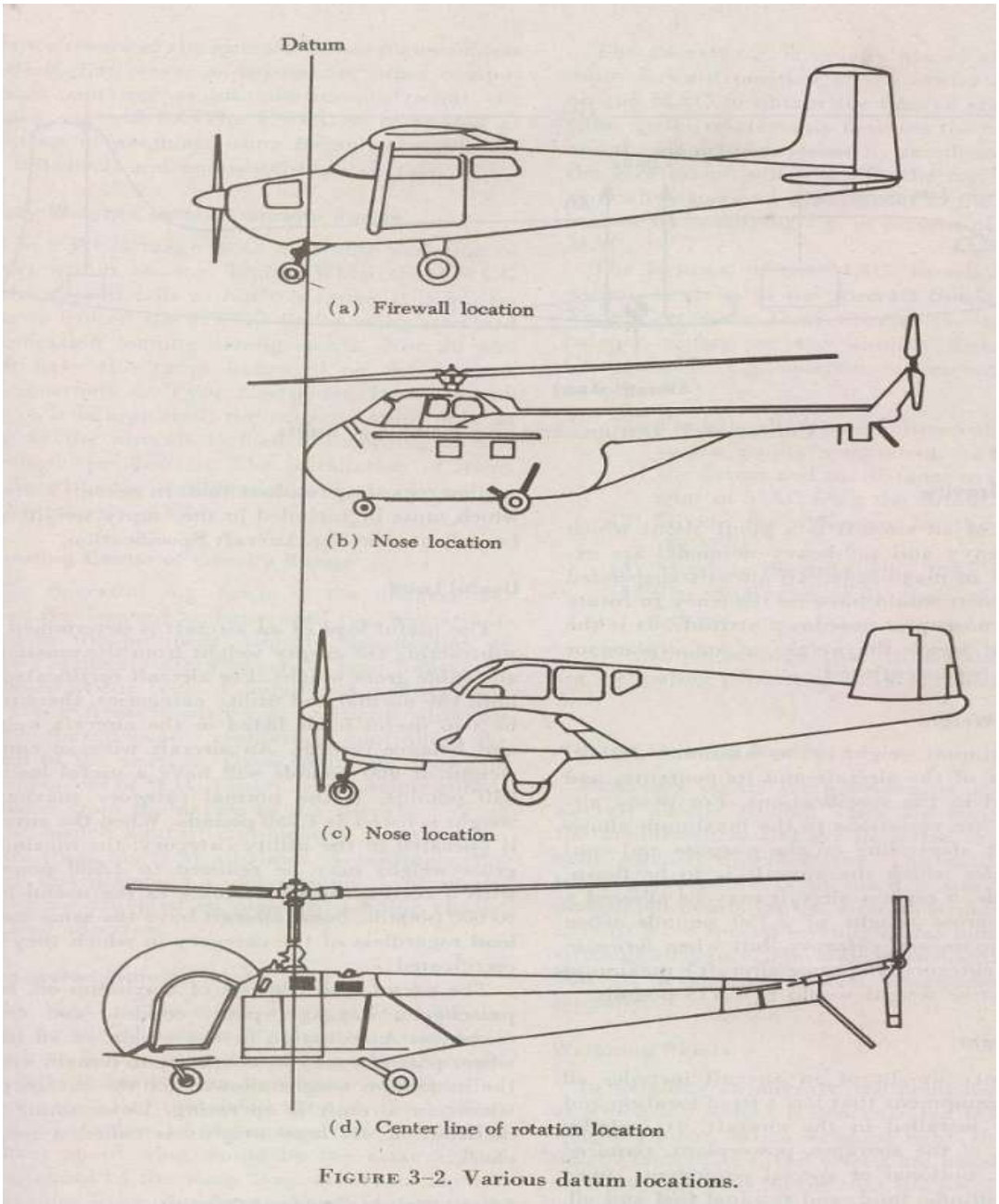
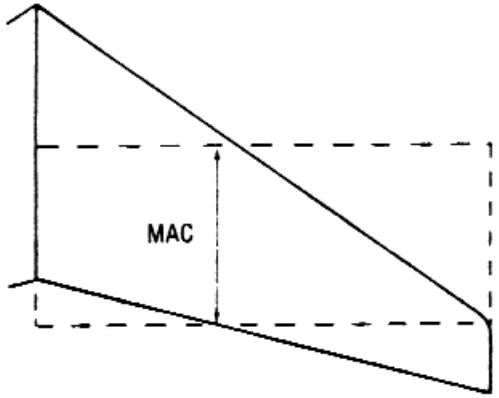
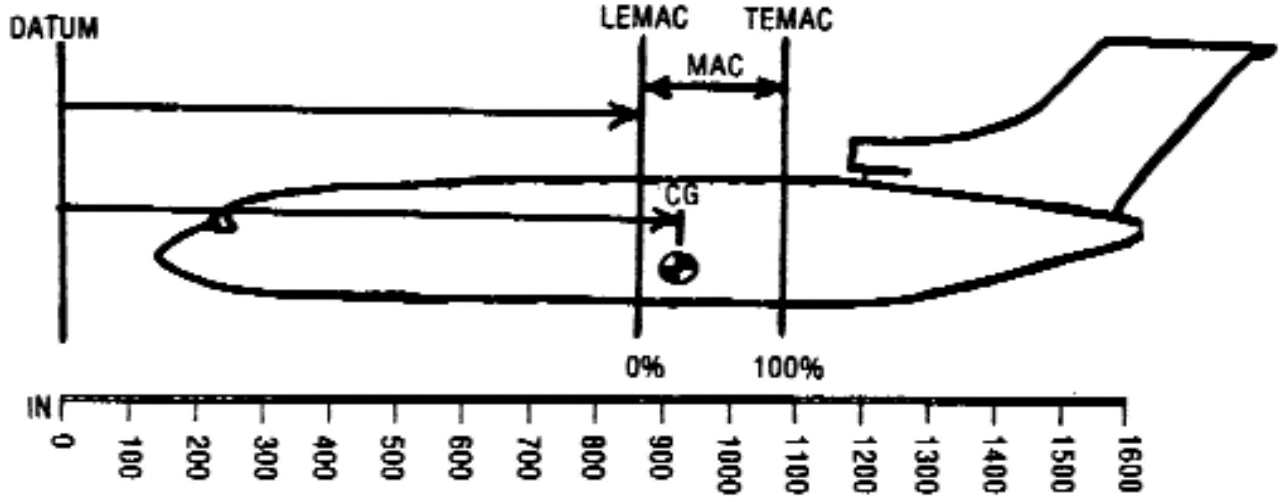
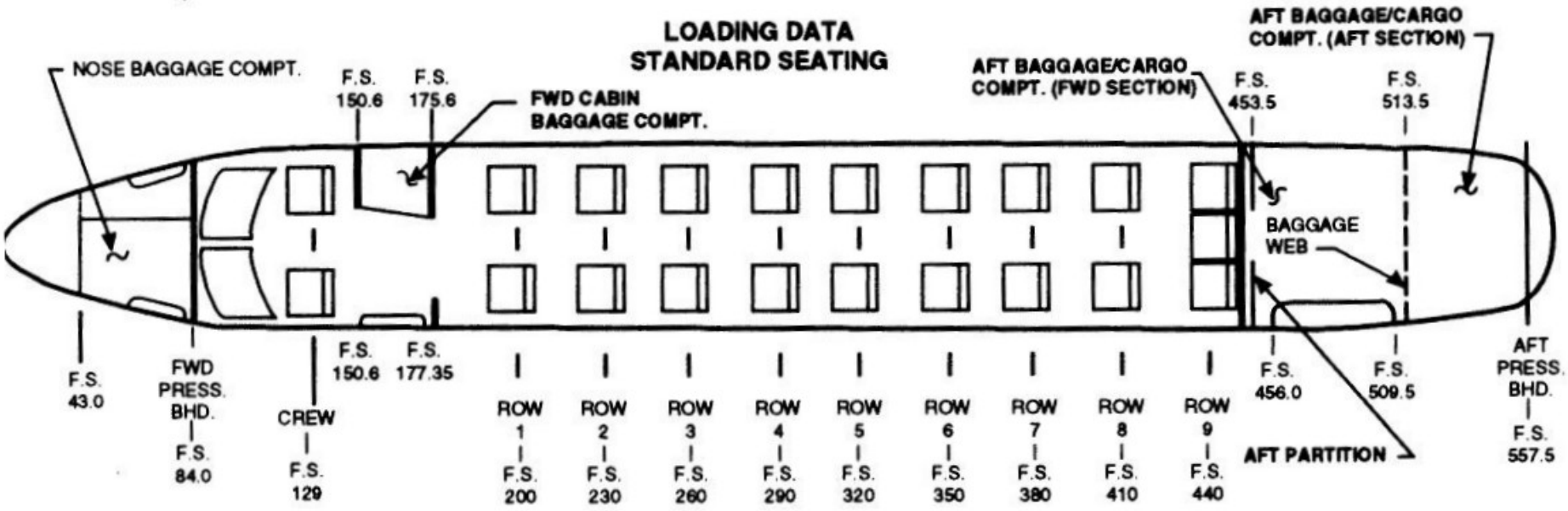


FIGURE 3–2. Various datum locations.

The **MEAN AERODYNAMIC CHORD (MAC)** is the average distance from the leading edge to the trailing edge of the wing. The MAC is specified for an aircraft by determining the average chord of an imaginary wing which has the same aerodynamic characteristics as the actual wing.







BAGGAGE/CARGO LOCATION		CAPACITY – POUNDS	CENTROID (FUSELAGE STATION)
NOSE BAGGAGE COMPARTMENT		150	65.5
FORWARD CABIN BAGGAGE COMPARTMENT (INCLUDES UP TO 100 POUNDS WHICH MAY BE SUSPENDED FROM CLOTHES ROD)		250	163.6
AFT BAGGAGE/CARGO COMPARTMENT	– FWD SECTION	880	483.5
	– AFT SECTION	630	533.0

NOTE:

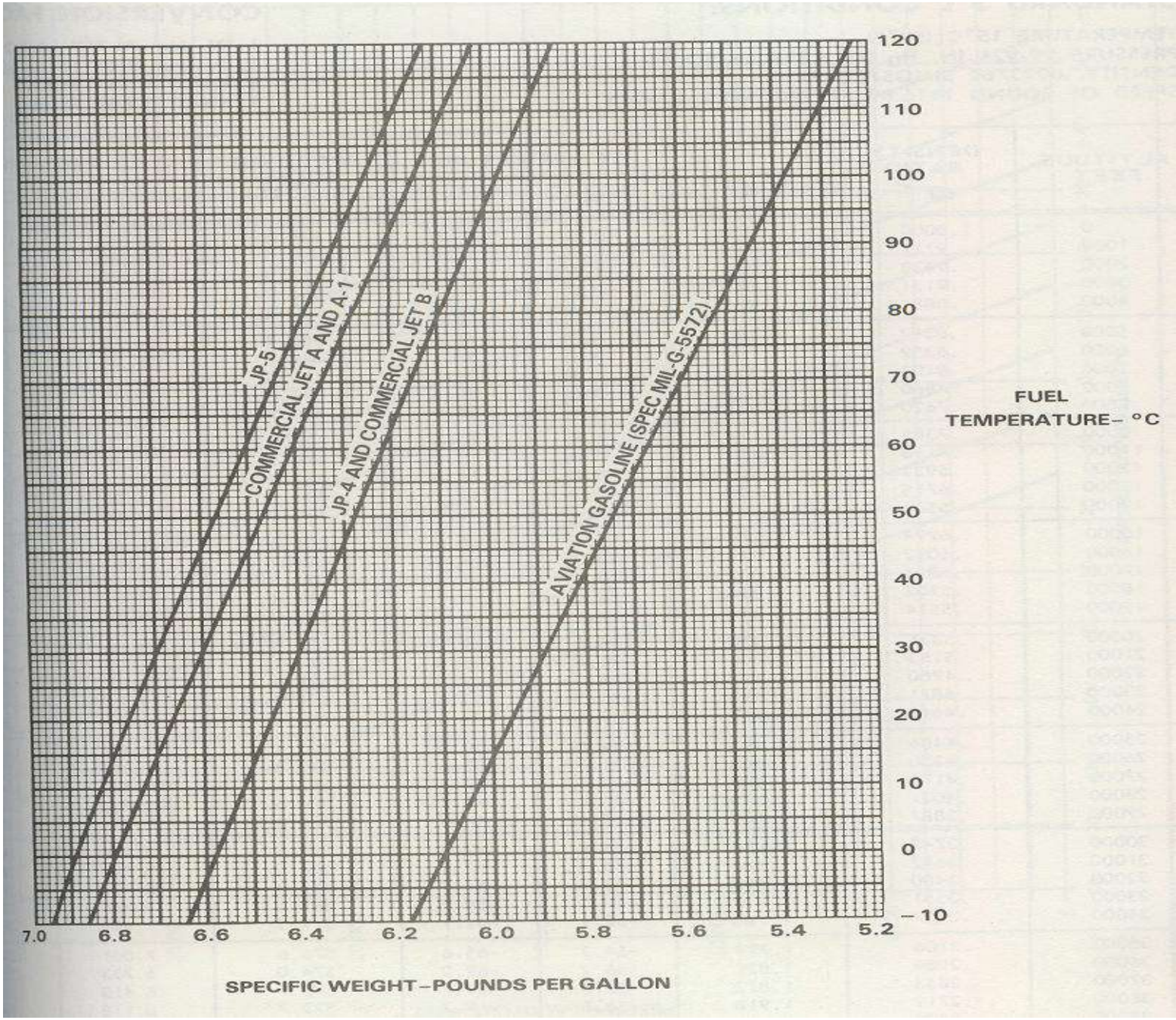
1. For compartment loadings which result in only partial utilization of total compartment volume, load items must be distributed or secured in a manner to preclude

BASIC EMPTY WEIGHT 9,226 LB
BASIC MOMENT/100 25,823

Note Fuel Density is 6.8lb/gal
What type of fuel is used?

OPERATING CONDITIONS	BE-11	BE-12	BE-13	BE-14	BE-15
BASIC EMPTY WT					
WEIGHT	9,225	9,100	9,000	8,910	9,150
MOM/100	25,820	24,990	24,710	24,570	25,240
CREW WEIGHT	340	380	360	400	370
PASS AND BAG					
WEIGHT	4,200	4,530	4,630	4,690	4,500
MOM/100	15,025	16,480	16,743	13,724	13,561
FUEL (6.8 LB/GAL)					
RAMP LOAD-GAL	360	320	340	310	410
USED START AND TAXI	20	20	10	20	30
REMAIN AT LDG	100	160	140	100	120

FIGURE 5.—Beech 1900 – Loading Limitations


JP-5
COMMERCIAL JET A AND A-1
JP-4 AND COMMERCIAL JET B
AVIATION GASOLINE (SPEC MIL-G-5572)
120
110
100
90
80
70
60
50
40
30
20
10
0
– 10
FUEL
TEMPERATURE– °C
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
SPECIFIC WEIGHT–POUNDS PER GALLON

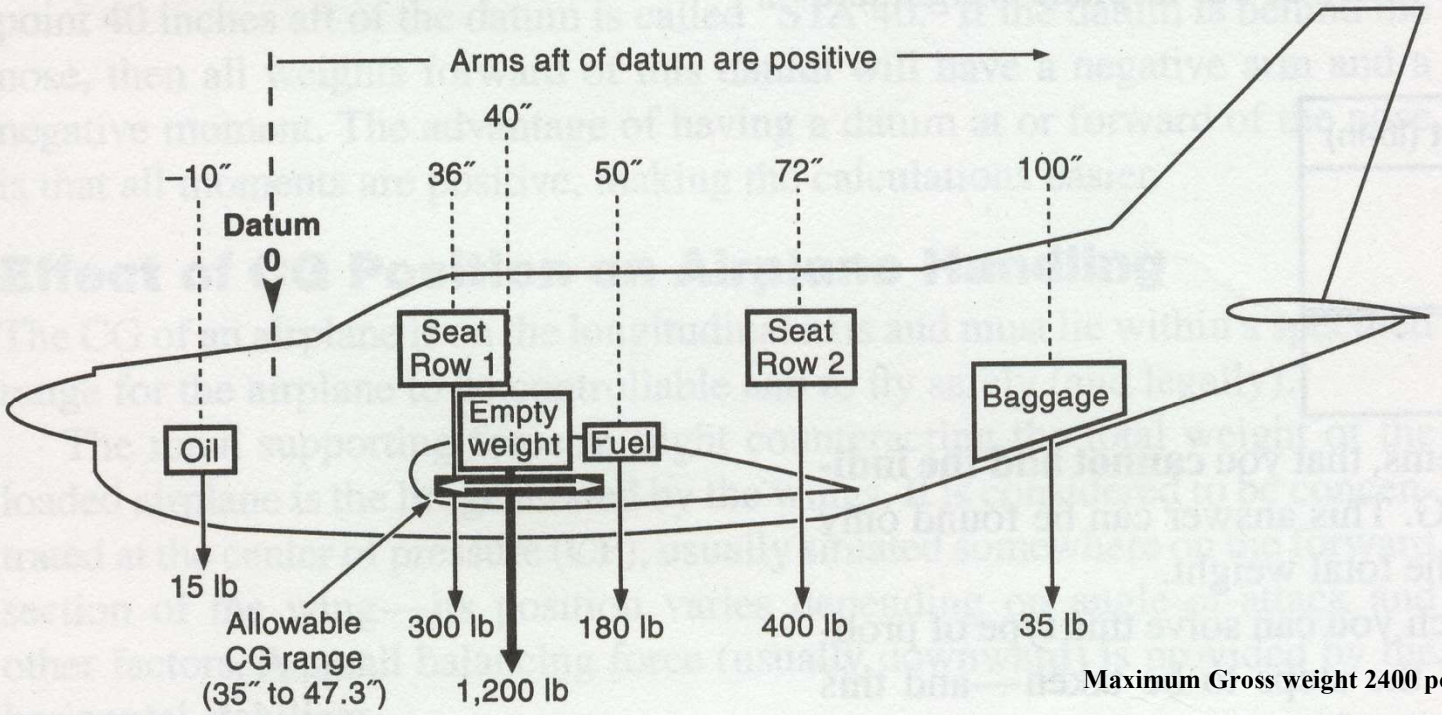
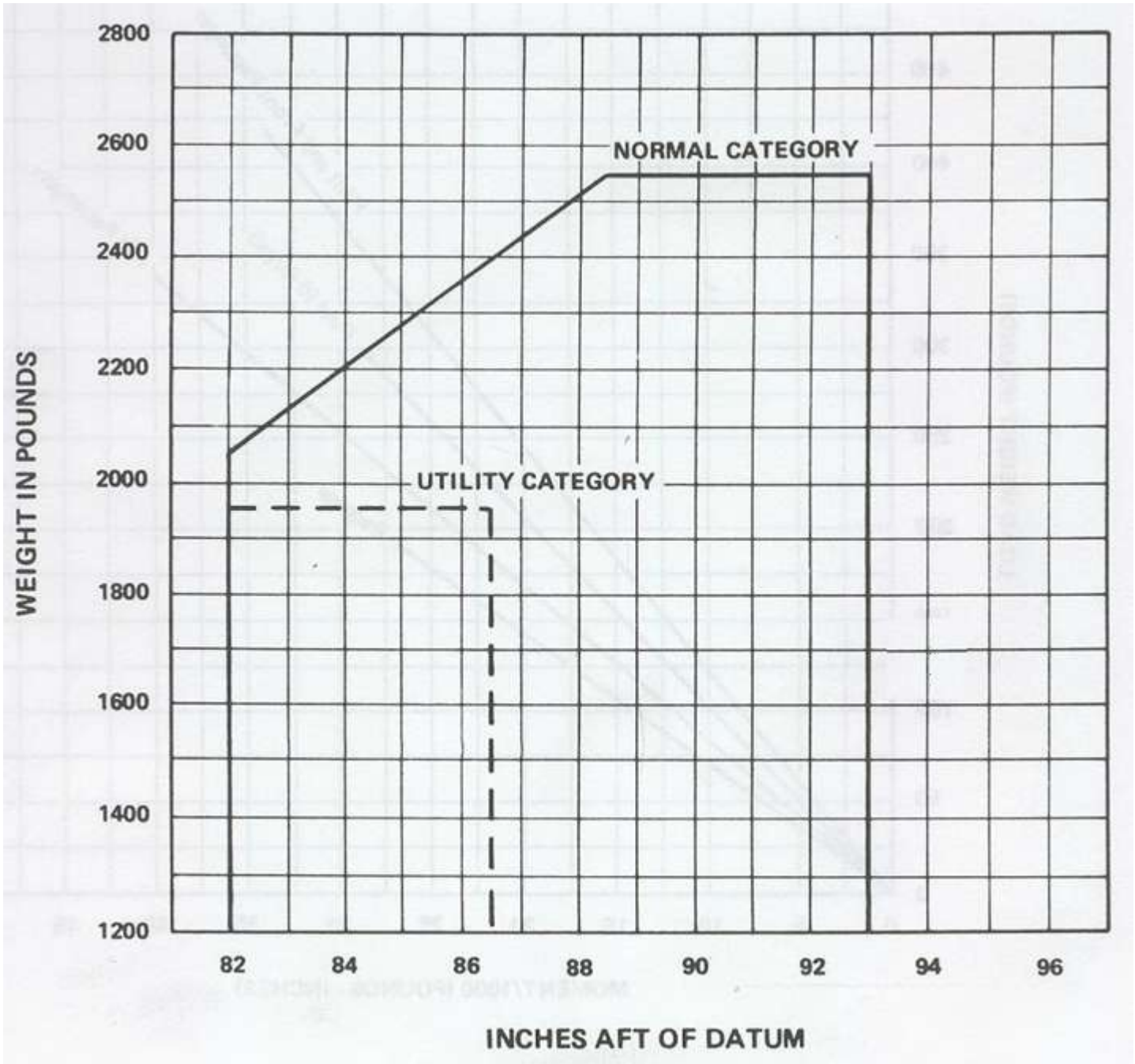


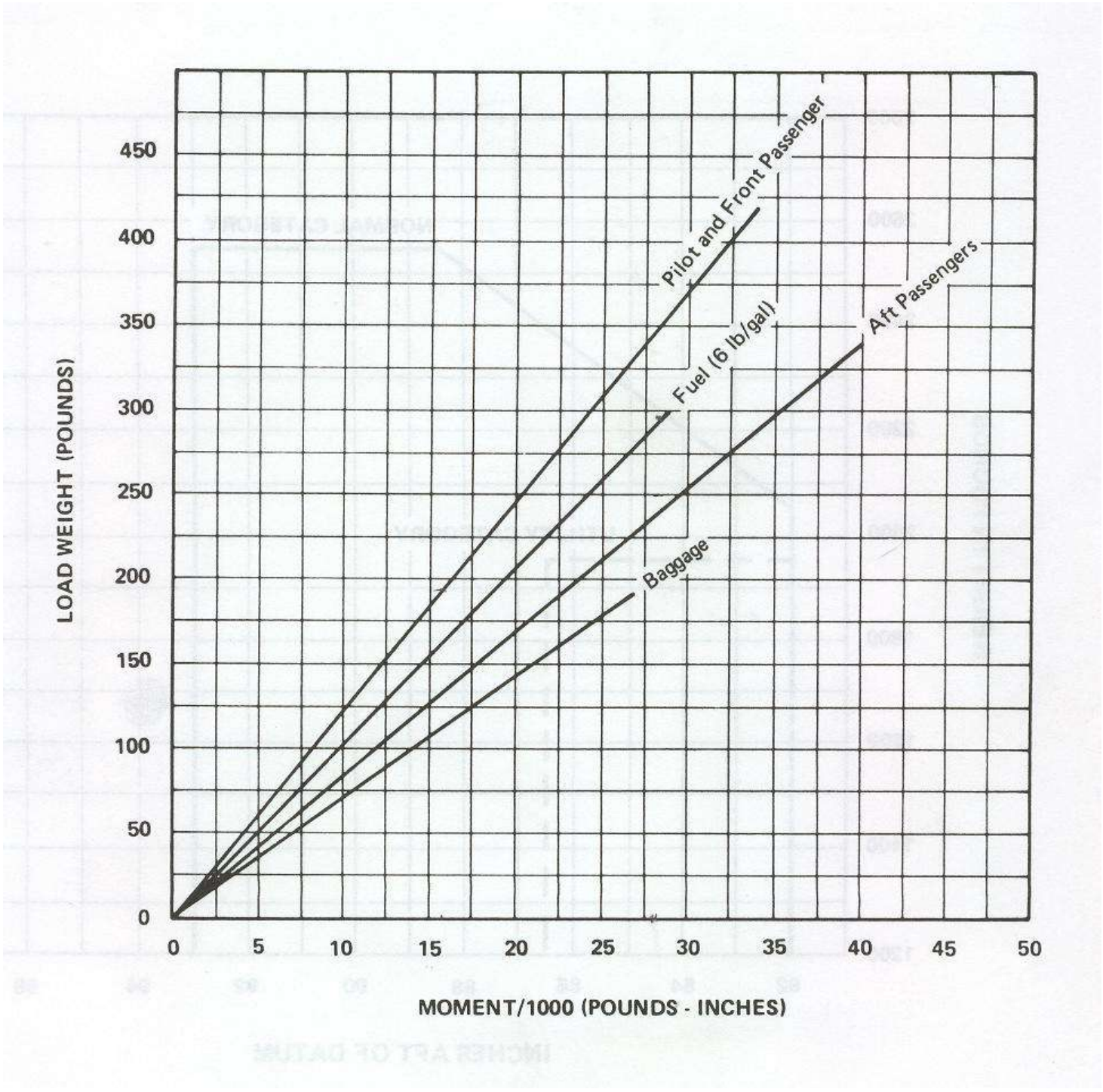
Figure 12-12. The loaded airplane

Maximum Gross weight 2400 pounds

Fuel density at Standard Conditions

Item	Weight	Arm	Moment
Empty Weight			
Pilot and Front Passenger			
Rear Passengers			
Baggage			
Fuel			
Oil (8 qts@ 7.5lb/gal)			
Totals			


2800
2600
2400
2200
2000
1800
1600
1400
1200
WEIGHT IN POUNDS
NORMAL CATEGORY
UTILITY CATEGORY
82
84
86
88
90
92
94
96
INCHES AFT OF DATUM


LOAD WEIGHT (POUNDS)
450
400
350
300
250
200
150
100
50
0
Pilot and Front Passenger
Fuel (6 lb/gal)
Aft Passengers
Baggage
0
5
10
15
20
25
30
35
40
45
50
MOMENT/1000 (POUNDS - INCHES)

Homework Problem

Using the data given during class determine the Basic Empty Weight and the Basic Moment Arm in inches for the PA-28-181.

Hint: use an Excel Spreadsheet to solve this problem.

Homework Problem

An aircraft was loaded with the load distribution given in Table 2, copy and complete the table. Find the centre of gravity at takeoff and plot it in the safety envelope provided. Comment whether the aircraft is safe to fly.

Table 2: Load Distribution in an Aircraft

Item	Weight (lb)	Arm (in)	Moment (lb-in)
Basic Empty Weight	1200	40	
Pilot and Front Passenger	420	36	
Passenger Rear seat	350	72	
Baggage	50	100	
Fuel	180	50	
Oil	10	-10	
Total			

Hint: use an Excel Spreadsheet to solve this problem.