

**Chapter 6
Weight and Balance**

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General

This chapter provides weight and balance calculation procedures for the Piper PA-28R Arrow. The procedures are standardized and can be applied to various Arrow aircraft models operated by Bridgewater State College. Where differences exist, those items are identified within this chapter. All pilots will be familiar with and follow the procedures as outlined.

Flight Crew Procedures

PA-28R-200 Arrow Takeoff and Landing Data (TOLD) Card

The Takeoff and Landing Data (TOLD) Card is used by flight crewmembers for computing and recording the Zero Fuel Weight, Takeoff Weight, Adjusted Takeoff Weight, and Landing Weight for the aircraft before every flight. The following sections provide instructions for the completion of the TOLD card.

Basic Empty Weight

From the dispatched aircraft can enter the basic empty weight, arm, and moment of the aircraft on the Weight and Balance side of the TOLD card.

NOTE

If any discrepancies are found between data contained on the can and in the AFM in the aircraft, refer to the W/B data included in the Pilot's Information Manual/ Airplane Flight Manual.
Report any discrepancies between data sources to BSC Dispatch.

NOTE

The reference datum for the PA-28R-200 Arrow is located 78.4 inches forward of the wing leading edge at the inboard intersection of the straight and tapered section.

Pilot & Passengers

Enter the weight of the pilot and front seat passenger. To determine moment, use one of the following methods:

1. Using the Bridgewater State College FSM or the aircraft's Pilot's Information Manual / Airplane Flight Manual, plot the moment from the Center of Gravity and Weight Range Graph.
2. Use aircraft's Pilot's Information Manual/ Aircraft Flight Manual, look up the arm from the Loading Arrangements graph and compute the moment for that weight (moment = weight x arm).

Rear Passengers

Enter the weight of any rear passengers or baggage to be carried in the rear seat, if appropriate. Use the same methods as described in “Pilot & Passengers” to determine the moment.

Baggage

Enter weight of any baggage to be stowed in the under-seat baggage area. Use the methods previously described to determine the moment.

Maximum Weight in Baggage Compartment 200 lbs

Zero Fuel Weight

Determine Zero Fuel Weight and Balance by adding the weights and moments from Basic Empty Weight, Pilot & Passenger, Rear Passengers, and Baggage. Divide moment by weight to determine arm. Determine that the Zero Fuel Weight center-of-gravity is within limits.

Fuel

Enter the weight of all useable fuel on board the aircraft. Use either method 1 or 2 to determine the moment.

Ramp Weight

Determine Ramp Weight and Balance by adding the weights and moments from Zero Fuel Weight and Fuel. Divide moment by weight to determine arm. Compare the Ramp Weight to the Maximum Ramp Weight found in the Bridgewater State College FSM or the aircraft Pilot’s Information Manual/ Airplane Flight Manual.

Start / Taxi / Run-up

From the Bridgewater State College FSM or aircraft Pilot’s Information Manual/ Airplane Flight Manual, determine the weight and moment of fuel used during engine start, taxi, and run-up.

NOTE

Fuel Burn for Engine Start, Taxi & Run-up	- 8 Lbs.	95.0”	- 760 In-Lbs
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Takeoff Weight

Subtract the weights and moments from Start / Taxi / Run-up from Ramp Weight. Divide moment by weight to determine arm. Determine whether the aircraft is within Maximum Takeoff Weight and center-of-gravity limits by using the Center-of-Gravity Limits Graph in the Bridgewater State College FSM or the aircraft Pilot’s Information Manual/ Airplane Flight Manual.

Load Adjustments

Passenger

Enter the amount of passenger(s) weight / moment, if appropriate, to be adjusted. Put a plus sign for adding weight / moment or a minus sign to subtract the weight / moment (example +150 or –150 lbs.). Enter a “0” or put a line through the space for no adjustment.

Baggage

Enter the amount of baggage weight / moment, if appropriate, to be adjusted. Put a plus sign for adding weight / moment or a minus sign to subtract the weight / moment (example +30 or –30 lbs.). Enter a “0” or put a line through the space for no adjustment.

Fuel

Enter the amount of fuel weight / moment, if appropriate, to be adjusted. Put a plus sign for adding weight / moment or a minus sign to subtract the weight / moment (example +100 or –100 lbs.). Enter a “0” or put a line through the space for no adjustment.

Adjusted Center of Gravity Change Due to Nose Gear Retraction

Moment change due to retracting landing gear: +819 inch/lbs. Enter the Takeoff Weight (or Adjusted Takeoff Weight) in the Weight Column. Then enter +819 as a change to the moment in the Moment Column. Divide moment by weight to determine arm.

Adjusted Takeoff Weight

Add and / or subtract all weight(s) / moment(s), if appropriate, to determine the Adjusted Takeoff Weight. Divide moment by weight to determine arm. Determine whether the aircraft is within Maximum Takeoff Weight and center-of-gravity limits by using the Center-of-Gravity Limits Graph in the Bridgewater State College FSM or the aircraft Pilot’s Information Manual/ Airplane Flight Manual.

Fuel Burn

Enter the estimated amount of fuel burned weight / moment to complete the flight. See Chapter 5 Performance for fuel burn calculations.

Landing Weight

Subtract the estimated amount of fuel burned weight / moment from the Takeoff Weight or Adjusted Takeoff Weight, as appropriate, to determine Landing Weight.

Minimum Fuel Load

Enter Minimum Fuel Load. This is the minimum amount of fuel, including reserve, required to complete the flight.

WARNING

No pilot may commence a flight if the aircraft is unable to carry the minimum fuel load required for the flight.

NOTE

Loading Graph information is based on seats positioned for *average* occupants and baggage loaded in the center of the baggage areas as shown on the Weight and Balance Loading Form shown on page 10. For non-standard loading conditions, perform additional moment calculations based on the *actual weight and C.G. arm* (fuselage station). Determine total weights and moments and calculate the new values.

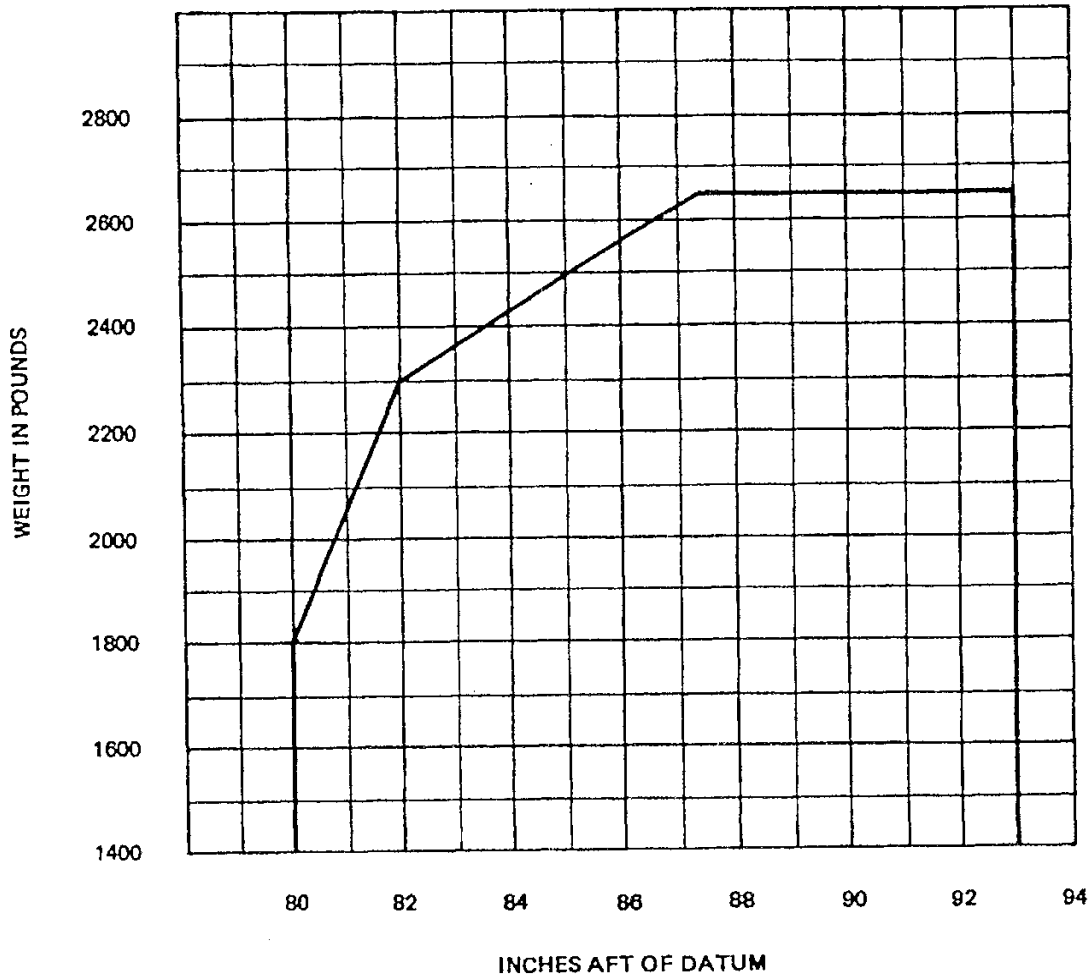
Take Off and Landing Data (TOLD) Card
(Weight and Balance Only)

PA-28R-200 Arrow Takeoff and Landing Data (TOLD) Card			
Weight and Balance Data			
	WEIGHT	ARM	MOMENT
Basic Empty Weight	_____	_____	_____
Pilot and Passenger	_____	_____	_____
Rear Passengers	_____	_____	_____
Baggage (200 lbs. max)	_____	_____	_____
Zero Fuel Weight	_____	_____	_____
Fuel	_____	_____	_____
Ramp Weight	_____	_____	_____
Start/Taxi/Run-up (-8 lbs fuel)	_____	_____	_____
Takeoff Weight (2650 max)	_____	_____	_____
Load Adjustments	_____	_____	_____
Passenger	_____	_____	_____
Baggage (200 lbs. max)	_____	_____	_____
Fuel	_____	_____	_____
Nose Gear (Retracted)	XX	XX	+819
Adjusted Takeoff Weight	_____	_____	_____
Fuel Burn	_____	_____	_____
Landing Weight	_____	_____	_____
Minimum Fuel Load _____ Gallons			

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Center-of-Gravity Range and Weight
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C. G. RANGE AND WEIGHT

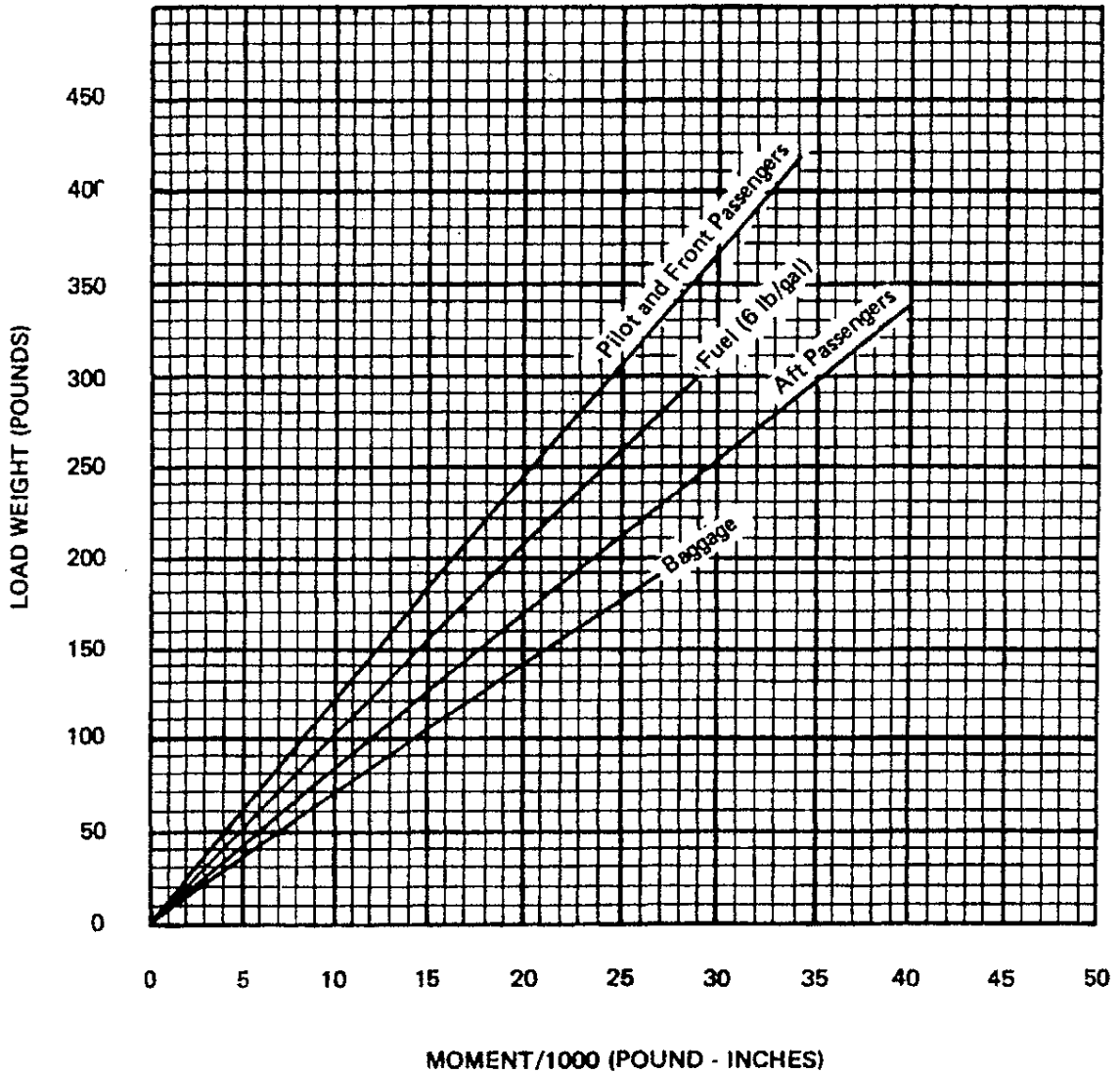


MOMENT DUE TO RETRACTING LANDING GEAR = +819 IN - LBS

Loading Graph

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LOADING GRAPH



Sample Weight and Balance Loading Form

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Item	Weight (Lbs)	X C.G. Arm (Inches Aft of Datum)	= (In-Lbs) Moment
Standard Empty Weight Computed	1513.0	83.5	126,310
Optional Equipment	92.9	94.7	8,801
Usable Fuel (13 1/3 Pints)	10.0	103.0	1030
Licensed Empty Weight = Total of above items	1615.9	84.3	136,141
* Standard Empty Weight includes paint, hydraulic fluid and undrainable engine oil.			

Sample Weight and Balance Loading Problem

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Item	Weight (Lbs)	Arm Aft Datum (Inches)	Moment (In-Lbs)
Licensed Empty Weight	1615.9	84.3	136,141
Oil (8 quarts)	15	24.5	368
Pilot and Front Passenger	340	80.5	27,370
Passengers, Aft (Rear Seat)	340	118.1	40,154
Fuel (50 Gal. Maximum)	300	95.0	28,500
Baggage	39.1	142.8	5,584
Moment Change / Nose Gear Retraction	NA	NA	+819
Total Loaded Airplane	2650	90.2	238,936

The center of gravity (C.G.) in this sample loading problem is at 90.2 inches aft of the reference datum. Locate this point (90.2) on the C.G. range and weight graph. Since this point is within the weight – C.G. envelope, this loading meets the weight and balance requirements.

CAUTION

It is the responsibility of the Pilot-In-Command to ensure that the aircraft is loaded properly before every flight.

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