Patuxent River Navy Flying Club

ARROW CHECKOUT

PRNFC

PO BOX 332

PATUXENT RIVER MD 20670

(301) 342-1110

OVERVIEW

Airframe

Engine/Prop

Takeoffs and Landings

Garmin GNS-530W

Instrument Approaches

Flight Planning

AIRFRAME - WING

Our PA-28R-200 has the short, “Hershey Bar” wing.

Airframe	Wingspan
Arrow	32 feet, 2 inches
Warrior	35 feet
T-41	36 feet, 2 inches
C-172	36 feet

The Arrow wing design is OK, but not very efficient. It was probably economical to build.

Flaps make a big difference during takeoff and landing!

AIRFRAME - LOADING

The Arrow is the heaviest of our airplanes.

Airframe	Fuel in Gallons	Useful Load (lbs.)	Zero-fuel Weight	Max Gross Weight
Arrow	48	948	2362	2650
Warrior	48	926	2152	2440
T-41	51	1068	2194	2500
C-172	40	831	2060	2300

Since it carries the most weight with the smallest wing, it must fly faster.

AIRFRAME – LANDING GEAR

The Arrow has retractable landing gear that is electrically controlled and hydraulically driven.

- The hydraulic pump is driven by an electric motor. The motor is only activated when actuating the switch above the pilot's right knee.

The three gear lights may not be visible with the Panel Lights rheostat (the one on the right) out of the "Off" position.

The gear warning horn sounds when:

- The MAP is at or below 14 inches (approximately).
- The flaps are extended past 10 degrees with the gear up.

An emergency landing gear extension is easily accomplished by following the checklist and pressing the lever down (in front of the trim wheel) to release the hydraulic pressure holding the gear up.

ENGINE/PROP

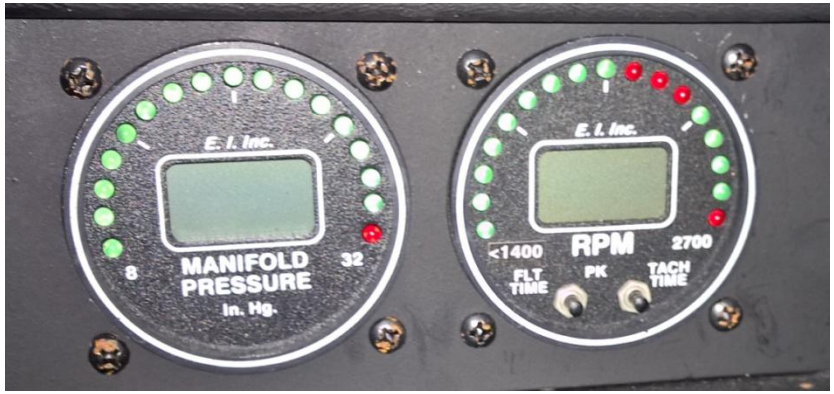
The engine and prop provide very good climb and cruise performance.

Airframe	Cylinders	Fuel Injected?	Horsepower	Constant Speed Prop?
Arrow	4	Yes	200	Yes
Warrior	4	No	160	No
T-41	6	Yes	210	No
C-172	4	No	160	No

The downside is that managing the engine, prop, and mixture is somewhat labor-intensive.

ENGINE/PROP - INSTRUMENTS

The primary Manifold Absolute Pressure (MAP) Gauge and the Tachometer are on the right side of the instrument panel.



- The red lights are not set for this engine/prop combination.
- Follow the placard which restricts RPM between 1950 and 2350 when below 15” MAP.

The Exhaust Gas Temperature (EGT) gauge is at the bottom of the instrument panel just to the left of the circuit breakers.

- Use to set peak EGT when leaning for cruise.

ENGINE/PROP - STARTING

The following starting procedure, mostly taken from the Lycoming Operator's Manual, provides more reliable starts than the procedure in the airplane POH.

1. **Master SW – On**
2. **Fuel pump – On (having it on 30-60 seconds early is good if the engine is warm)**
3. **Throttle – Open (lever full forward)**
4. **Mixture – Full rich 3 – 5 seconds (fuel flow indication present).** Prime less depending on how warm the engine is. Don't prime at all if the engine was just shut down. Prime increasingly more between 15-45 minutes after shutdown.
5. **Throttle and Mixture – Retard**
6. **Fuel pump – Off**
7. **Throttle – 1/4 open (not inches like the POH--1/4 of the total travel)**

Do steps 8 and 9 simultaneously.

8. **Starter – Engage**
9. **Mixture – Wait about 2 seconds, then advance slowly (don't wait until it fires).** If the engine is warm, wait until it fires.
10. **After the engine starts:**
11. **Throttle – 1350 – 1400 RPM**
12. **If the engine fails to start, re-prime and try again.**
13. **If it fails to start again, use the flooded start procedure:**
    1. Don't prime
    2. Open the throttle completely (i.e., lever completely forward)
    3. Mixture - Idle cutoff
    4. Engage the starter until it fires (10 seconds max) with your left hand
    5. Simultaneously retard the throttle (left hand) and advance the mixture (right hand)
14. **If it doesn't start again, let the starter cool for 5 minutes and try the normal start sequence again starting at Step 1.**

ENGINE/PROP – OPS LIMITS

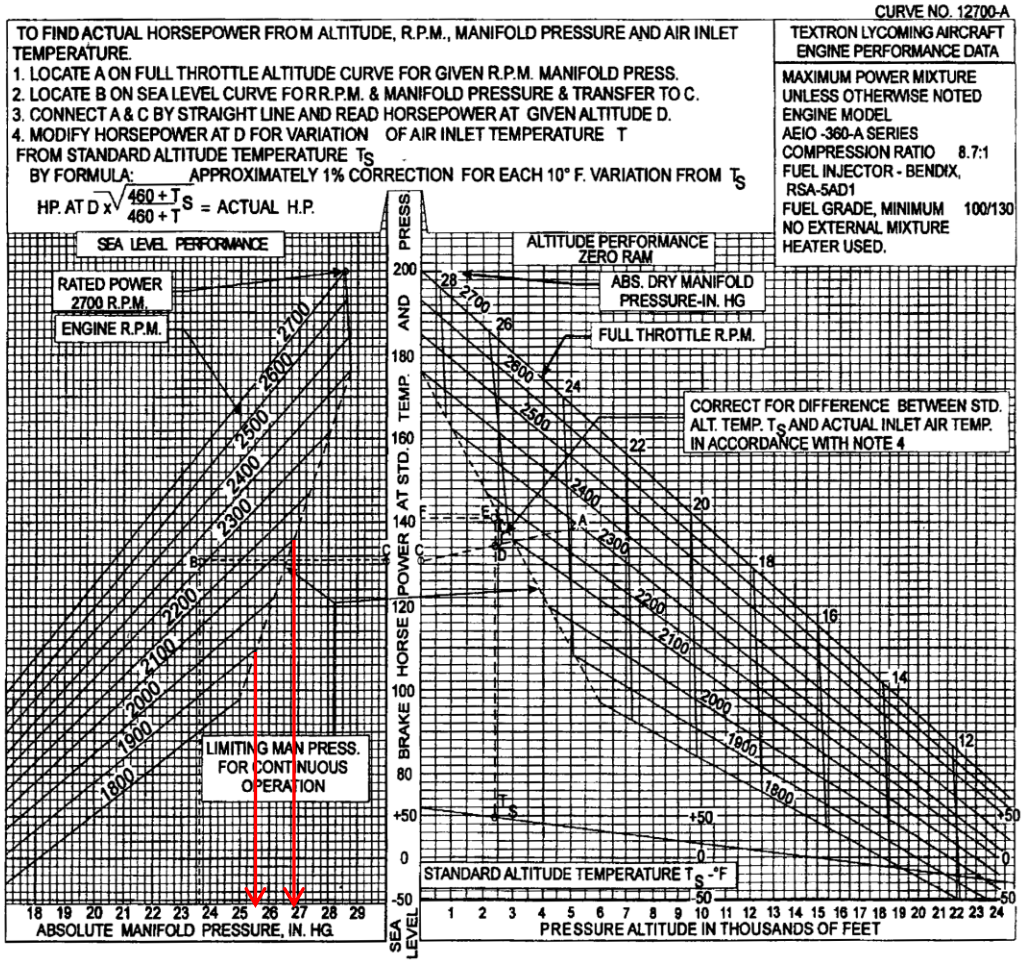


Figure 3-21. Sea Level and Altitude Performance - IO-360-A, -C, -D, -J, -K; AIO-360 Series

27” max MAP @ 2100 RPM

25” max MAP @ 1900 RPM

There is NO 25 squared rule.

This is NO requirement to retard MAP or RPM after takeoff.

THE ENGINE PLACARD RESTRICTION

Restriction: Avoid prolonged operation between 1950 and 2350 below 15” MAP.

Please avoid even short operating times in this region—the vibration can’t be good for our new engine and re-built prop.

I recommend flying at 1900 RPM during descents and in the instrument and visual patterns.

- Do you have to? No, but it makes it much harder to avoid this region and frankly watching RPM is an unnecessary distraction.

Is this annoying? Yes, but think of it as the price we pay for “inexpensive” performance.

I encourage you to leave the RPM at 1900 until you are established on final (3 degrees), fully configured with gear and flaps. Then at your last check of the gear on ½ mile final, move the prop lever full forward.

- This works in level flight at slower speeds in the pattern and during descents. You can set up to 25” MAP.
- If you need to climb, bring the levers forward—mixture, prop, and then throttle.

TAKEOFFS

Because of its short wing, I recommend using 25 degrees of flaps for takeoff; retracting once climbing at Vx and trimmed (approx. 200').

This usually means retracting flaps prior to raising the gear since Vx performance is best achieved with flaps retracted.

Because the original propeller was replaced by a three-bladed prop, aircraft performance is different—speeds are slower.

All speeds are in miles per hour (MPH).

Speed	Gear Down	Gear Up	Recommended
Vx	85	96	80/90
Vy	95	100	90-95 gear up
Cruise Climb		110	100 – 105 (slower when higher)

CRUISE

Engine Settings:

- For about 65% power, try 24” MAP, or full open throttle if at a higher cruising altitude and 24” MAP is not possible.
- Set 2100 – 2200 RPM. Find a speed that allows the engine to run smoothly. This will be slightly affected by the mixture setting.
- Set peak EGT with the mixture lever.
- Once the mixture is set, you may want to re-adjust both the throttle and prop lever.

Rudder Trim:

- With autopilot on, use rudder trim to center the ball.
- With autopilot off, use rudder trim to counter roll tendency in either direction.

Don’t forget to switch fuel tanks! The GNS-530 will remind you.

To find outside air temperature, press the blue button on the gauge on the far left of the instrument panel.

CRUISE (CONTINUED)

Autopilot:

- It holds heading with the “captain’s bars” or “heading bug” on the Directional Gyro.
  - Select “A/P ON” & “HDG ON”
  - Position the rotary mode knob to “HDG”
- To have the autopilot follow a GPS course:
  - Select “A/P ON” & “HDG ON”
  - Position the rotary knob to “NAV”
  - Ensure the Nav selector switch (below rotary knob) is on “NAV 1”.
  - Set the heading bug to the desired track (DTK) shown on the upper left of the GNS-530. See slide 20, where DTK is 133.
  - You must manually move the heading bug at every waypoint as the DTK changes.
  - Example in the top picture
- To have it follow an ILS, LNAV, or LPV course:
  - Fly to get on course.
  - Position the rotary knob to “LOC NORM”
  - Example in the bottom picture.
- There is no altitude hold or ability to follow a glidepath.

- Use it! It makes single-pilot IFR much easier.

LANDINGS

Landing the Arrow well is not easy. What do I mean by “well”?

- The nose doesn’t touch before you consciously lower it.
- You can easily turn off at 2000’ with light to moderate braking.

Challenges:

- heavier gross weight
- stiff landing gear struts
- picking a good approach speed
- center of gravity possibly being forward
- somewhat small stabilator (it’s sensitive to trim setting)

Effective Techniques

- Use the 50 pound ballast in the luggage compartment for CGs that are farther forward.
- Use 40 degrees of flaps even in moderate cross winds.
- Fly 75-80 MPH on final depending on gross weight—not 90 MPH like the POH says.
    - This will be slightly behind the power curve; numerous small power corrections are required.
- Once within ¼ mile on final, shift your aimpoint back to at or just prior to the threshold.
- Smoothly roundout with the stabilized, final-approach power setting, then flare and touchdown with a few hundred RPM above idle.
- Power to idle at touchdown. Gently aerobrake.

GARMIN GNS-530W

The Arrow's GNS-530W enables VHF communications, VOR and ILS navigation, and WAAS-enabled, GPS area navigation (RNAV).

- The Wide Area Augmentation System (WAAS) enables Localizer Performance with Vertical Navigation (LPV) approaches down to a possible 200' AGL.

Training Resources

The PRNFC website has postings for both the GNS-530 Pilot's Guide and Quick Reference Guide. The Pilot's Guide is printed in a binder in the Flight Planning Room.

You can also get the software trainer at: https://www8.garmin.com/support/download_details.jsp?id=3531

GARMIN GNS-530W

The Arrow's GNS-530W provides many safety and convenience features.

The Nearest Airport Page is great for emergencies.

GARMIN GNS-530W

The database contains easy to access frequencies for arrivals at cross-country airports.

GARMIN GNS-530W

The terrain page provides excellent situational awareness. Checkout the approach into Runway 6 at Roanoke.

GARMIN GNS-530W

The Vertical Navigation (VNAV) Page can make enroute descents easy. To setup the VNAV profile, select enter as you switch between fields.

GARMIN GNS-530W

A pop-up message can be displayed when approaching the Top of Descent point. This example shows a descent from 12,000’ into GYPTS for an RNAV to 32 at KNHK.

INSTRUMENT APPROACHES

I recommend three speed regions:

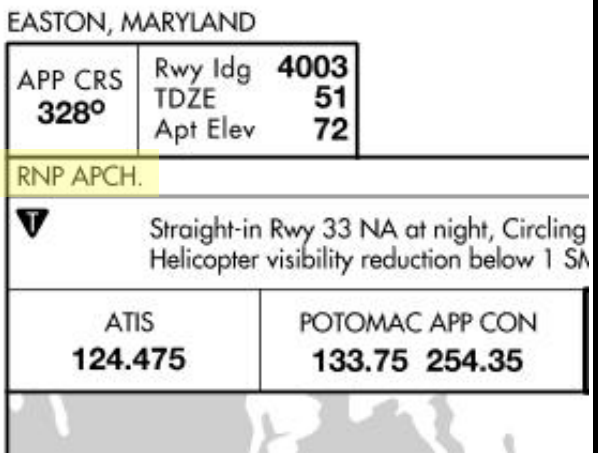
1. Descent
    - 20” MAP and 1900 RPM keeps you out of the placard range.
    - Trim for 500 FPM descent.
    - Will provide 120 – 130 MPH.
2. Instrument Approach Speed
    - 100-110 MPH—it’s a nice compromise between good forward speed, comfort in turbulence, and time to setup on approach.
    - Slow with 15” MAP. If that’s not enough to descend:
        - Trim for a higher speed in smooth air—parasitic drag will get you down! Then, level off to slow down.
        - Or, slow to below 150 MPH and lower the landing gear. You might want to raise it again if you still have a long way to drive to the Final Approach Fix (FAF).
3. Final Approach Speed: 75-80 MPH (depending on weight)

Lower gear and 10 degrees flaps at glide path interception or when starting down at the FAF.

Between 1500’ and 1000’ AGL (depending on proficiency) start to slow to final approach speed and slowly extend flaps to 40 degrees.

FLIGHT PLANNING

- **When filling out the International Flight Plan (FAA Form 7233-4)**
  - Type aircraft is P28R
  - Equipment is “SGR/C” meaning VHF radio, VOR, ILS, GNSS, RNAV, and Mode C IFF.
  - In “18. Other Information” enter “NAV/SBAS PBN/D2S1”
    - NAV/SBAS (Navigation with Satellite-Based Augmentation System, WAAS in the US) means it can fly an LPV approach.
    - Under Precision Based Navigation (PBN)
      - D2 = RNAV 1 GNSS. This means the system is capable of staying within 1 NM 95% of time.
      - S1 = RNP APCH (Required Navigation Precision Approach). This means the GNS-530 has the required performance monitoring and reporting for RNP approaches. See the notation in the picture. Approaches with this notation are authorized.
      - RNP-1 or higher allowed, but not lower.



NEED PRACTICE?

Try X-Plane and the Reality-XP GNS-530W Simulator. This also shows a Carenado Piper Saratoga.

QUESTIONS?