What is Pattern Work?

Version 1.0

Effective 08 December 2022

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Section 1

Acknowledgment

This primer is adapted from the United Virtual Airlines (UVA) Flight Classes self-study program, first introduced in 2007.

Comments and suggestions are welcome.

Description

A practice pattern, or circuit for our European friends, is a basic stepping stone for every pilot.

It allows for rapid repetition of the key skills of take-off and landing, which otherwise are limited to just once for each general flight. Although common practice with small general aviation aircraft, it is generally much too costly for fuel or Level D simulator time to actually fly in commercial settings. But, it is a ready option in a personal simulator.

Objectives

- Understanding why it is critical
- Being familiarized with its general construct
- How to actually fly it

Regulatory Precedence

All UVA standard operating guidelines are outlined in the UVA FOM, and in all cases the FOM will take precedence.

The material in this circular is advisory.

Section 2

Changes

None – initial release.

Section 3

Why the Pattern?

Fly a pattern well, and you will have taken a big step to becoming a better pilot. Whenever you hop into a new plane, off you need to go for Pattern Practice! Even when you have been flying for a while, there is nothing that sharpens the skills more than pattern practice. In fifteen minutes or so, you will have executed an approach, a takeoff and a landing, and are free to immediately continue the pattern by doing a touch & go or go-around, for more.

Every time you execute an approach, landing and takeoff, you are flying parts, or all of a *pattern*. If you can fly a pattern well, then you will be able to fly the approach, land, and takeoff well.

Now think about this – in a two hour flight, you will only get one crack at the approach, landing and takeoff. Compare that to pattern practice for two hours, you will have accomplished it eight times! That is why pattern practice adds up to quick skills advancement. There is no single better way to fortify your skills for a checkride, than to include pattern practice as one of the components.

ATC will generally not make reference to a "pattern" when they are vectoring you IFR, but no matter what the approach technique, you will be able to overlay this concept on any approach you will ever carry out. Once you have the concept of a pattern etched in your mind, you will find your approaches and landings are much more controlled, organized and successful.

Pattern

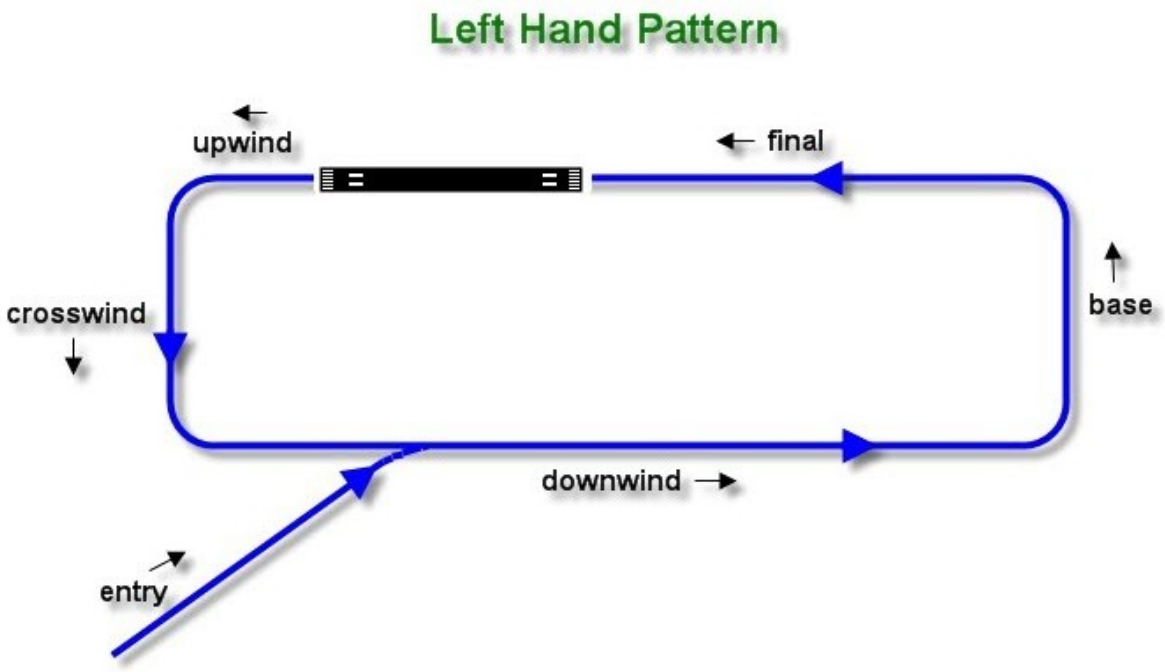
A pattern can be left hand, that is it consists of left hand turns at each corner, or right hand. A left hand turn pattern gives the pilot a better view of the runway as he circles and approaches. As such, left hand patterns are the standard, unless dictated otherwise by terrain or other external issues.

The parts or "legs" of a pattern are the upwind, crosswind, downwind, base, and finally – the final leg. When you takeoff (or go-around) you are flying the upwind leg. As you approach the runway to land, you will be flying the final leg.

You can imagine a pattern with a 1nm final, for a small aircraft on a tight VFR approach. You can also imagine a pattern with a 20nm downwind, and a 20nm final leg, like for an airliner at a congested airport. A large rectangular conga-line in the sky. Think of all of these as patterns. You can stretch the rectangle this way or that to fit.

There are many ways to exit and enter a pattern, you will learn these as you advance your flying career. Flying airliners, you will normally exit the pattern with a straight out upwind flight, or occasionally a significant left or right turn, immediately on wheels up.

Whether they make reference to it or not, ATC will in effect vector you to enter a pattern, perhaps on the downwind, or onto the base leg, or even a straight in approach directly onto the final leg. It depends on your direction of flight, and the traffic situation at the airport.



Let's Dig In

Let us now say that you are on approach to an airport. It doesn't matter where you enter the pattern, or how you get to a certain part of a leg, the technique is standard. Meaning, that if you are flying correctly, you will be doing pretty much the same thing with your aircraft in terms of speed, flaps and gear deployment at a given point in the pattern. The same goes for the takeoff.

Now, of course there can be variations in altitude and to some extent speed, depending on the needs of ATC and the required departure profile, but the basics are constant. Once those concepts are cemented in your mind, they will become almost automatic. No matter what you need to accomplish, just take that pattern and rubber band it over what you need to do, and there you go, you know what to do.

The Technique

We explain the proper approach, takeoff and landing techniques elsewhere (Departure, ILS Approach, Visual Approach), but let us review this from the specific perspective of each leg of a pattern. Of course sometimes for operational reasons you may need to vary the technique.

Takeoff – Upwind Leg

You are cleared for takeoff, you are on the runway, and are now rolling. As you rotate at Vr speed, you liftoff and start your climb on the upwind leg. You are holding your airspeed referenced to V2 by varying

your pitch, your engines are at take off thrust, and your flaps are at takeoff setting. Your gear will be retracted once you achieve positive rate on climb. Note that you do not set for a specific vertical speed (VS), you take whatever you get.

At acceleration height (800 ft AGL – UVA SOP), you pitch the nose down, to accelerate and clean up the flaps as you accelerate past each flap minimum speed.

Takeoff – Crosswind Leg

If you have an "immediate" turn on takeoff, you can execute this at 400ft AGL, or very occasionally sooner where a SID calls for it. It will typically not be exactly 90° left or right, but remember the pattern in our head is elastic, it will fit over any path we need to fly.

Landing – Downwind Leg

As you approach abeam the airfield, you may start to slow down to 210 knts. You may need to extend one notch of flaps. Your gear is stowed.

Landing – Base Leg

As you turn base, you need to slow further (e.g. 180knts) and further extend flaps. Your gear remains stowed. Typically you will be at 2000ft to 3000ft above field elevation (AFE), but that is up to ATC.

Landing – Final Leg

Required speeds and flap settings will vary with aircraft and circumstances. Below are some numbers to give some general guidance.

Let us say that you were turned to a 12nm base leg, meaning that the runway threshold is 12nm distant from the base leg. As you reach the end of the base leg, you turn (or you may be vectored) to intercept the extended runway line either by instrument or visual guidance. Your speed remains 180 knts, and you have extended a bit of flap already on the base leg.

You now watch the glide slope. When it comes “alive”, meaning that the magenta triangle becomes unghosted and starts moving downward, drop your gear, slow to 160 knts and extend flaps as required.

As a variation of this, you may find that you were vectored to a very distant base leg, were quite high and intercepted the glideslope well away from the airport. In this case, don't drop your gear and slow up that early. You could wait until you are 8nm to 9nm from the runway threshold to drop gear, extend flaps and slow down to 160knts.

As you approach the final approach fix (FAF), and as the glideslope indicator starts to reach center, you need to slow to your final wind corrected approach speed (Vtgt), and deploy full landing flaps. You must cross the FAF at the correct height as noted on the approach plates.

Then you establish a stable final approach, and land!

The option

When doing practice patterns you may hear the clearance "Cleared for the option".

That means that you are free to choose what you will do. You may "full stop land", meaning land and clear the runway (don't STOP on the runway), "Touch and Go" – be sure the runway is long enough, or "Go-Around". The latter two options will let you continue to practice. And practicing go-arounds is important in its own regard, as sometimes you will need to execute a last minute go-around due to runway or weather issues.

How to Practice

Well, first you need to pick an aircraft, pick an airport, and perhaps set some weather. Alternately you can just go with what is actually there, real-time. Often it is a good idea to pick an airport with lots of flat terrain surrounding it, and a long runway, gives you more room to play. Or you can pick airports with terrain as a specific challenge.

There is a solid "Pattern Practice Exercise" guide in the Pilot Library that outlines one example set of exercises.

Where

You can practice offline, or online. If you wish to do patterns on VATSIM, be sure to pick a quiet airport, the Tower or Approach controller will probably appreciate the traffic! Do not expect to be allowed to do pattern practice in a busy Terminal Airspace, especially during a major event.

How

As an example pattern, you can takeoff, fly upwind to acceleration height (800ft AGL), then turn crosswind for about two minutes while climbing to 3000 ft AGL, then turn downwind. As you approach abeam the airfield on the downwind, start a descent to 2000ft AGL. Turn for a 12nm base, intercept the extended runway line and then descend from 2000 ft AGL and land. You can do a touch and go, or even practice your go-arounds, to keep it going.

Normally in the pattern you would stay at the pattern altitude, which is typically 1000ft AFE for pistons and 1500ft AFE for turbines. But this, for example, will give you extra practice in descent and a climbing turn. Mix it up a bit too, changing the altitudes and the lengths of the various legs, flying a right hand pattern as well as a left hand pattern.

The Autopilot?

You can start out using the autopilot, but observe carefully what the plane is doing. Then turn the autopilot off and fly by hand assisted only by the Flight Director. Try to stay within 300 ft of your desired altitude at first, and then within 100ft, or even 50ft like the pros. Set similar tolerances on airspeeds and headings.

Now, here is a challenge that will really get you in tune with the plane. Once you have a good handle on the engine power required for the various segments, then turn off the A/T too, and fly it all yourself, “one hand on the yoke/stick and one on the throttle”.

Concentrate on your hand-flying in the pattern, but don't ignore your autopilot approaches either, George needs practice too. If you have full autoland capability, then practice those as well.

Real IFR Practice

Now it's time for the foggles, or the hood! You need these in fair weather conditions in the real world to simulate poor visibility, to allow for practice.

But, in a simulator we can select and set our own low visibility conditions, so do not need a physical device. Just slide the visibility to 2nm, then 1nm, but no less than 1/2nm if you are not going to do a full autoland.

You will be surprised at two things, how badly you do the first time through, and how much you improve after even just a few of such low-visibility hand flown approaches. It gets you to focus on, and really use the instruments for guidance.

Change it up!

Always try to vary what you do, remember to keep stretching that rubber band. Try different leg lengths, different altitudes, different weather – winds and visibility, different directions, different types of approaches, different aircraft, you name it. But also remember, never vary the basic components to the flying, they must remain constant, and will become second nature. They will be there when you need them!

And, most importantly, Have Fun, and watch your piloting skills improve!