

Understanding the Mythical “Teardrop” Traffic Pattern Procedure

A Deadly Recipe for Midair Collisions



by Jim Savage

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About the cover picture:

On August 18, 2022, a midair collision occurred in the traffic pattern at the Watsonville, CA airport. The three occupants of the two airplanes died. Although it was not caused by a "teardrop" pattern entry, it shows how deadly a midair collision can be.

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Preface

On January 29, 1986, the Space Shuttle Challenger broke apart 73 seconds into its flight. While it was determined the actual mechanical issue that caused the disaster was a pair of O-Rings that failed due to cold weather, it was eventually learned engineers had warned that test data from as early as 1977 indicated a potentially catastrophic flaw in the O-Rings. Those warnings were ignored and the problem was never addressed or corrected.

A little over two years ago, I knew nothing about the subject of “teardrop” traffic pattern entries at non-towered airports. That changed in the Spring of 2021 when I nearly collided with a Cirrus that was making a high speed, descending turn into the downwind leg of the traffic pattern. I subsequently learned the Cirrus pilot was performing his version of a “teardrop” entry.

Much has been learned by me about “teardrop” entries over the past two years. Regrettably, I have been unsuccessful in convincing the right people we are facing a growing problem that will inevitably lead to a midair collision. Like the Space Shuttle situation, the underlying problem can easily be corrected. Unfortunately, the problem is rapidly expanding like a deadly cancer and no one seems to care.

My objective in assembling this book is to share all that I have learned with people who have the ability to make the necessary clarifications to FAA reference documents before an accident occurs, not after. It is intended to provide a complete picture of how and why we arrived at our current high-risk situation and ends with a practical recommendation to return us to a much safer traffic pattern environment at non-towered airports.

The remainder of this book is quite detailed and is not something that can be read casually. If you do nothing else, please look at the section titled "The Big Picture" for an overall perspective on the root cause of today's concerns.

A Pilot's Perspective of the "Teardrop" Traffic Pattern Procedure

Twenty years ago, if you had interviewed a large group of American pilots and asked them if they knew what a "teardrop" traffic pattern entry was, it is almost certain that everyone would have responded with a definite "NO". Today, if you ask any American pilot if he/she has ever heard of a "teardrop" traffic pattern entry, there is a very good chance you will get yes for a response. A follow-up question asking if they have ever done a "teardrop" entry will also bring a lot of yes responses. The third question asking exactly how the "teardrop" entry is performed is the one that brings the most interesting responses. They vary from a touch of outrage that anyone would ask such a stupid question, to ones like *you just do a teardrop, any idiot knows how to do that*. The most complete answer is normally along the lines of: cross over the airport at 500 feet above pattern altitude, after flying beyond the downwind leg of the traffic pattern, turn right and descend to enter the downwind leg at midfield.

There are many variations in the response to the "how to" question, but they all have a common theme of a descending turn that resembles, in their mind, a teardrop shape. The current responses shown above are not speculation, but represent actual comments I have received as I have discussed this issue with pilots over the past two years.

What is most interesting about the above is there have been no new Federal Aviation Administration (FAA) *regulations* issued over the past 20 years that would account for this dramatic change in understanding. It is also interesting that in the context of Traffic Pattern Procedures, the word "teardrop" does not currently exist in any FAA printed document or regulation.

FAA's Current and Historical Guidance

The FAA provides a wealth of useful information to pilots through a variety of non-regulatory publications. Although they don't carry the weight of actual regulations, they generally reflect "best practices" and are normally accepted by pilots as required procedures. For purposes of understanding the current "teardrop" traffic pattern procedure, the following three publications will be analyzed. 1) *Pilots Handbook of Aeronautical Knowledge*, 2) *Airplane Flying Handbook*, and 3) *Advisory Circular 90-66B, Non-Towered Airport Flight Operations*.

Airplane Flying Handbook – 2014 Edition

To provide a base line from a period of time when pilots had never heard of a "teardrop" traffic pattern entry, a review of *Airplane Flying Handbook* FAA-H-8083-3A published in 2014, is a good place to start. Chapter 7 of that handbook covers the subject of traffic patterns. Following are three relevant paragraphs from Chapter 7 that explain traffic pattern entry procedures.

When entering the traffic pattern at an airport without an operating control tower, inbound pilots are expected to observe other aircraft already in the pattern and to conform to the traffic pattern in use. If other aircraft are not in the pattern, then traffic indicators on the ground and wind indicators must be checked to determine which runway and traffic pattern direction should be used. Many airports have L shaped traffic pattern indicators displayed with a segmented circle adjacent to the runway. The short member of the L shows the direction in which the traffic pattern turns should be made when using the runway parallel to the long member. These indicators should be checked while at a distance well away from any pattern that might be in use, or while at a safe height well above the generally used pattern altitude. When the proper traffic pattern direction has been determined, the pilot should then proceed to a point well clear of the pattern before descending to the pattern altitude.

When approaching an airport for landing, the traffic pattern should be entered at a 45-degree angle to the downwind leg, headed toward a point abeam of the midpoint of the runway to be used for landing. Arriving airplanes should be at the proper traffic pattern altitude before entering the pattern, and should stay clear of the traffic flow until established on the entry leg. Entries into traffic patterns while descending create specific collision hazards and should always be avoided.

The entry leg should be of sufficient length to provide a clear view of the entire traffic pattern, and to allow the pilot adequate time for planning the intended path in the pattern and the landing approach.

Key points of the above excerpts from the 2014 *Airplane Flying Handbook* are as follows:

Flying over an airport should be at an altitude that is well above the generally used pattern altitude.

After overflying the airport, the pilot should proceed to a point well clear of the pattern before descending to the pattern altitude.

After reaching pattern altitude, the traffic pattern should be entered at a 45-degree angle to the downwind leg, headed toward a point abeam of the midpoint of the runway to be used for landing.

Arriving airplanes should be at the proper traffic pattern altitude before entering the pattern.

Entries into traffic patterns while descending create specific collision hazards and should always be avoided.

The 45-degree entry leg should be of sufficient length to provide a clear view of the entire traffic pattern, and to allow the pilot adequate time for planning the intended path in the pattern and the landing approach.

The preferred traffic pattern entry is the downwind entry.

The above points were not newly introduced in the 2014 *Airplane Flying Handbook*. Although I do not know exactly when they first appeared in FAA reference material, they were definitely included in *Airplane Flying Handbook* FAA-H-8083, published in 1998.

Observation – The written narrative in the *Airplane Flying Handbook* from both the 1999 and the 2014 editions, provides clear guidance on how to safely enter the downwind leg of the traffic pattern after overflying a non-towered airport. The process involves overflying the airport at a safe altitude above the traffic pattern, flying well clear of the traffic pattern and then descending to traffic pattern altitude. The completion of the overflying and descent procedure is followed by approaching the pattern on a course of 45-degrees to the downwind leg and joining the pattern at midfield. The final step is a normal downwind entry.

There were no confusing illustrations associated with the traffic pattern procedures in those earlier versions of the *Airplane Flying Handbook*.

Pilot's Handbook of Aeronautical Knowledge – 2016 Edition

The next FAA document for this review is *Pilot's Handbook of Aeronautical Knowledge*, published in 2016. This document is the likely origin of the “teardrop” traffic pattern notion that is currently spreading throughout the National Airspace System.

Following are selected narrative and illustrations from Chapter 14 - Airport Operations section of the above handbook pertaining to traffic pattern entries at non-towered airports.

Non-towered airport traffic patterns are always entered at pattern altitude. How you enter the pattern depends upon the direction of arrival. The preferred method for entering from the downwind side of the pattern is to approach the pattern on a course 45-degrees to the downwind leg and join the pattern at midfield.

There are several ways to enter the pattern if you are coming from the upwind leg side of the airport. One method of entry from the opposite side of the pattern is to announce your intentions and cross over midfield at least 500 feet above pattern altitude (normally 1,500 feet AGL.) However, if large or turbine aircraft operate at your airport, it is best to remain 2,000 feet AGL so you are not in conflict with their traffic pattern. When well clear of the pattern - approximately 2 miles - scan carefully for traffic, descend to pattern altitude, then turn right to enter at 45-degrees to the downwind leg at midfield.

An alternate method is to enter on a midfield crosswind at pattern altitude, carefully scan for traffic, announce your intentions, and then turn downwind. This technique should not be used if the pattern is busy. Always remember to give way to aircraft on the preferred 45-degree entry and to aircraft already established on downwind.

In either case, it is vital to announce your intentions, and remember to scan outside. Before joining the downwind leg, adjust your course or speed to blend into the traffic. Adjust power on the downwind leg, or sooner, to fit into the flow of traffic.

Key points and comments pertaining to the above excerpts from the 2016 *Pilot's Handbook of Aeronautical Knowledge* are as follows:

Non-towered airport traffic patterns are always entered at pattern altitude.

The overall preferred method for entering a traffic pattern, regardless of position or direction of flight, is a downwind entry.

The preferred method for entering from the downwind side of the pattern is to approach the pattern on a course 45-degrees to the downwind leg and join the pattern at midfield.

If entering the pattern from the upwind side, two methods of entry are suggested. These two options are referred to as the Preferred Method and the Alternate Method.

Preferred Method Procedure

Announce your intentions and cross over midfield at least 500 feet above pattern altitude (normally 1,500 feet AGL.)

When well clear of the pattern - approximately 2 miles - scan carefully for traffic, descend to pattern altitude. (If the downwind leg of the traffic pattern is one mile from the runway, then "well clear of the pattern" is approximately 3 miles from the runway).

The additional distance covered while descending to pattern altitude will vary. Depending on the speed of the airplane and the rate of descent, this will likely place the airplane four or more miles away from the airport.

Then turn right to enter the 45-degree entry leg that will enable you to enter the downwind leg at midfield.

The above steps are not a single maneuver but are a series of steps to accomplish two separate procedures. The first procedure is one of safely crossing over the airport and clearing the traffic pattern. The second is making a normal downwind traffic pattern entry.

Although the wording in the 2016 *Pilot's Handbook of Aeronautical Knowledge* is a bit different and more specific than what was contained in the 2014 *Airplane Flying Handbook*, the basic procedures for overflying an airport, flying well clear of the traffic pattern and executing the preferred downwind entry, are the same.

Alternate Method Procedure

Announce your intentions

Enter on a midfield crosswind at pattern altitude

Carefully scan for traffic

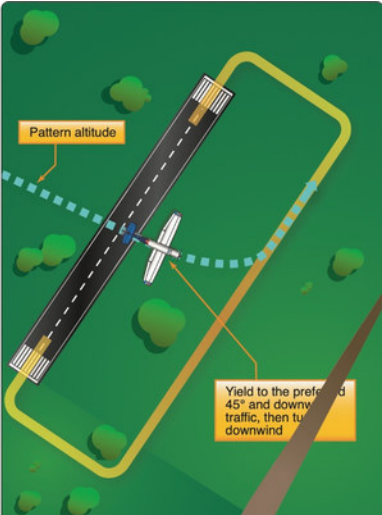
Then turn downwind

The above Alternate Method is very straightforward and well understood by most pilots.

The narrative contained in the 2016 *Pilot's Handbook of Aeronautical Knowledge* is easily understandable and both the content and format are consistent with what was published in the 2014 *Airplane Flying Handbook* and earlier FAA publications. However, the 2016 publication introduced a couple of new illustrations pertaining to the “Preferred” and “Alternate” procedure described above. These well-intentioned, but **grossly misleading** illustrations are the genesis of the mythical “teardrop” traffic pattern procedure that is currently spreading like a deadly cancer throughout the National Airspace System today. Following are those illustrations.



14-2 Preferred Entry



14-3 Alternate Entry

While intended to support the actual narrative presented in the 2016 *Pilot's Handbook of Aeronautical Knowledge*, the shortcomings of the above illustrations need to be clearly understood.

These illustrations are both colorful and cartoonish in appearance. While they can generally be described as a “not-to-scale” illustration, most would find that to be an overly generous characterization.

If we look at the runway size in both illustrations, we see the runway is 7 times as long as it is wide. Since it is intended to be a generic runway at a typical non-towered airport, for purposes of explanation, I will assume it is about 4000 feet long, or about $\frac{3}{4}$ of a mile long. With the length being 7 times longer than the width, the calculated width would be about 570 feet. A more reasonable number for an actual airport would be about 75 or perhaps even as much as 100 feet wide. The little airplane in the picture is also “not-to-scale” with a wingspan of about 850 feet, assuming a runway length of 4000 feet. At this point, none of this is a big deal.

Focusing first on illustration 14-3 for the Alternate Midfield Entry, the next item to look at is the position of the downwind leg. While there is no prescribed distance from the runway for a downwind leg of a traffic pattern, it is generally considered to be $\frac{3}{4}$ to 1 mile from the runway. Airplanes like a Piper Cub will probably fly a closer pattern and a Beech King Air will probably fly a wider downwind leg.

In the 14-3 illustration, the downwind leg, in relation to the runway length, is about $\frac{1}{3}$ mile from the runway, far closer than what exists at actual airports. If the downwind leg was based on the same scale for the length of the runway, much of it would be out of the picture. For the purpose of understanding the basic procedure of the Alternate Midfield Entry, do these gross inaccuracies on metrics make a difference? Probably not. With the simple procedure being: cross the runway midfield at pattern altitude and turn left onto the downwind leg, it is still easy to understand the maneuver.

Illustration 14-2 for the Preferred Entry – Midfield Crossing, is a far different situation. **If drawn to scale, 80 percent of the flight track would be out of the picture.** The actual procedure has the airplane flying 4 or more miles beyond the runway before turning back to enter the 45-degree entry to the downwind leg of the pattern. If we go back to our assumption of a 4000 foot runway, the turn to come back to the downwind leg would be at a point that is about five times the length of the runway. As drawn, the flight track is grossly distorted. Unfortunately, many pilots fail to see or understand that distortion. What they see in the picture is a descending turn that ends at the midpoint of the downwind leg. To many, it looks like a “teardrop” and is increasingly being referred to as a “teardrop” entry in position reports at non-towered airports.

Adding to the confusion, is the fact the illustrations for both the Preferred Entry and the Alternate Midfield Entry are always shown together. There is a natural tendency to assume these are comparable pictures. The runway length and width are identical in both illustrations, the airplane size is the same in both illustrations, the downwind leg placement is the same in both illustrations, therefore the scale of the flight track is presumed to be the same. If you turn to downwind for the Alternate Midfield Entry at 3/4 to 1 mile beyond the runway, the illustration for the Preferred Entry creates the impression you should begin a descending turn about two miles from the runway and not four or more miles from the runway as the detailed written narrative specifies.

In addition to the shortcomings already mentioned, there is a significant problem with the abbreviated labels and where those labels are placed within the illustrations. For example, in the illustration for the Preferred Entry, label 3 states “descend to pattern altitude then turn”.

While the actual procedure would have the airplane descend while traveling away from the airport, the label placement suggests it occurs when the airplane is approaching the airport. Without the benefit of the full detailed procedure contained in *Pilot's Handbook of Aeronautical Knowledge*, the not-to-scale illustrations provide insufficient information to fully understand and properly execute the procedure for the Preferred Entry.

Observation – The written narrative in the *Pilot's Handbook of Aeronautical Knowledge* provides clear guidance on how to safely enter the downwind leg of the traffic pattern when approaching from the upwind side of the airport. The process involves overflying the airport at a safe altitude above the traffic pattern, flying well clear of the traffic pattern and the descending to traffic pattern altitude. The completion of the crossing and descent procedure is followed by approaching the pattern on a course of 45-degrees to the downwind leg and joining the pattern at midfield. The final parts of the above process are a normal downwind entry.

The guidance provided in the illustration is inconsistent with the published narrative. It dangerously distorts the flight path that it is trying to depict. If viewed without reviewing and thoroughly understanding that narrative, it creates the impression the proper procedure is a descending turn directly into the downwind leg of the traffic pattern, a maneuver that many are now inappropriately characterizing as a “teardrop” entry.

Airplane Flying Handbook – 2021 Edition

The next FAA document for this review is *Airplane Flying Handbook*, published in 2021. Chapter 8, Airport Traffic Patterns, is similar in content to what is shown in Chapter 14 of the 2016 edition of *Pilot's Handbook of Aeronautical Knowledge*. Because the content is similar, but not identical in wording, the following items may seem a bit repetitious. They are being repeated, however, to show the exact wording of the most recent FAA reference publication.

Non-towered airports traffic patterns are always entered at pattern altitude. How a pilot enters the pattern depends upon the direction of arrival. The preferred method for entering from the downwind leg side of the pattern is to approach the pattern on a course 45-degrees to the downwind leg and join the pattern at midfield.

There are several ways to enter the pattern if the arrival occurs on the upwind leg side of the airport. One method of entry from the opposite side of the pattern is to announce intentions and cross over midfield at least 500 feet above pattern altitude (normally 1,500 feet AGL). However, if large or turbine aircraft operate at the airport, it is best to remain 2,000 feet AGL so as not to conflict with their traffic pattern. When well clear of the pattern - approximately 2 miles - the pilot should scan carefully for traffic, descend to pattern altitude, then turn right to enter at 45-degrees to the downwind leg at midfield. An alternate method is to enter on a midfield crosswind at pattern altitude, carefully scan for traffic, announce intentions, and then turn downwind. This technique should not be used if the pattern is busy.

Why is it advantageous to use the preferred 45-degree entry? If it is not possible to enter the pattern due to conflicting traffic, the pilot on a 45-degree entry can continue to turn away from the downwind, fly a safe distance away, and return for another attempt to join on the 45-degree entry - all while scanning for traffic.

Before joining the downwind leg, adjust course or speed to fit the traffic. Once fitting into the flow of traffic, adjust power on the downwind leg to avoid flying too fast or too slow.

Key points and comments pertaining to the above excerpts from the 2021 *Airplane Flying Handbook* are as follows:

Non-towered airport traffic patterns are always entered at pattern altitude.

The overall preferred method for entering a traffic pattern, regardless of position or direction of flight, is a downwind entry.

The preferred method for entering from the downwind side of the pattern is to approach the pattern on a course 45-degrees to the downwind leg and join the pattern at midfield.

If entering the pattern from the upwind side, two methods of entry are suggested.

A Preferred Method and an Alternate Method. It is advantageous to use the preferred 45-degree entry.

If it is not possible to enter the pattern due to conflicting traffic, the pilot on a 45-degree entry can continue to turn away from the downwind, fly a safe distance away, and return for another attempt to join on the 45-degree entry - all while scanning for traffic.

The illustrations for the two midfield crossing procedures in the 2021 handbook are the same as what was included in earlier FAA reference documents. The only minor change is they have been combined into a single image rather than two separate images.

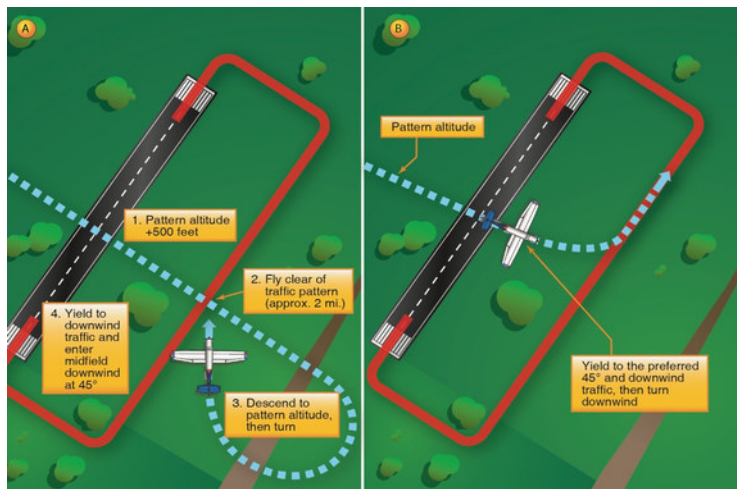


Figure 8-3. Preferred entry from upwind leg side of airport (A). Alternate midfield entry from upwind leg side of airport (B).

Rather than repeating comments about the troublesome aspects of the illustrations, please refer to the information already presented in the section pertaining to the 2016 edition of *Pilot's Handbook of Aeronautical Knowledge*.

Advisory Circular 90-66B, Non-Towered Airport Flight Operations (2018)

The final item for review is the Advisory Circular issued in 2018. It contains far less information than either the *Airplane Flying Handbook* or the *Pilot's Handbook of Aeronautical Knowledge*. This is a problem when it comes to understanding the preferred method to enter the traffic pattern when approaching the airport from the upwind side of the airport.

Following are selected items from the Traffic Pattern Entry section of the above Advisory Circular that pertain to traffic pattern entries at non-towered airports.

11.3 Traffic Pattern Entry. Arriving aircraft should be at traffic pattern altitude and allow for sufficient time to view the entire traffic pattern before entering. Entries into traffic patterns while descending may create collision hazards and should be avoided. Entry to the downwind leg should be at a 45-degree angle abeam the midpoint of the runway to be used for landing. The pilot may use discretion to choose an alternate type of entry, especially when intending to cross over midfield, based upon the traffic and communication at the time of arrival.

Note - Aircraft should always enter the pattern at pattern altitude, especially when flying over midfield and entering the downwind directly. A midfield crossing alternate pattern entry should not be used when the pattern is congested. Descending into the traffic pattern can be dangerous, as one aircraft could descend on top of another aircraft already in the pattern. All similar types of aircraft, including those entering on the 45-degree angle to downwind, should be at the same pattern altitude so that it is easier to visually acquire any traffic in the pattern.

Observation – The Advisory Circular provides a few pieces of general traffic pattern information that is the same or similar to what is included in both the *Pilot's Handbook of Aeronautical Knowledge* and the *Airplane Flying Handbook*. Noteworthy items include:

Arriving aircraft should be at traffic pattern altitude and allow for sufficient time to view the entire traffic pattern before entering.

Entries into traffic patterns while descending may create collision hazards and should be avoided.

Entry to the downwind leg should be at a 45-degree angle abeam the midpoint of the runway to be used for landing.

All similar types of aircraft, including those entering on the 45-degree angle to downwind, should be at the same pattern altitude so that it is easier to visually acquire any traffic in the pattern.

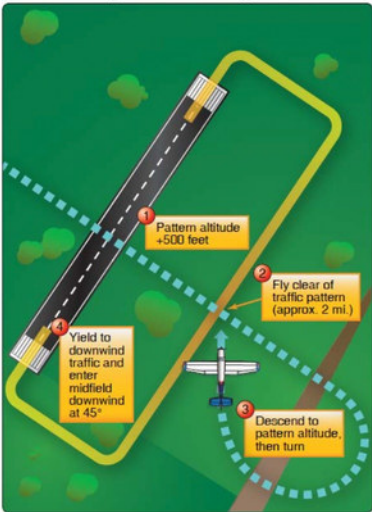
The most significant observation is that the Advisory Circular does not provide the detailed narrative regarding the specifics of how to properly execute the “Preferred Entry When Crossing Midfield” procedure.

Instead of including that essential information, the Advisory Circular simply includes the notation **(From PHAK)**. While that undoubtedly refers to the most recent edition of the *Pilot's Handbook of Aeronautical Knowledge*, that may not be obvious to all pilots reading the Advisory Circular. Even if one understands what **PHAK** is, the likelihood of having that book on hand while reading this particular Advisory Circular is remote.

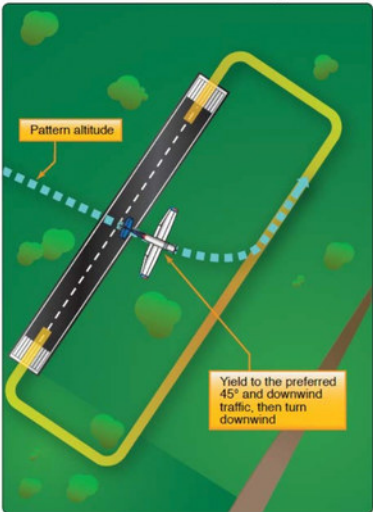
Absent specific guidance on how to properly execute the “Preferred Entry”, the only choice is the illustration, that looks nothing like the recommended procedure.

Figure 1. Preferred and Alternate Entry When Crossing Midfield (From the PHAK)

Preferred Entry When Crossing Over Midfield



Alternate Midfield Entry



The shortcomings of the above illustrations are identical to what was presented in the sections of this book covering the 2016 and 2021 handbooks. Additionally, the lack of reference information similar to what was included in those handbooks is not included in Advisory Circular 90-66B.

Essential Elements of Current FAA Regulations and Reference Documents Pertaining to Non-Towered Airport Operations

There is not now, nor has there ever been, an FAA sanctioned traffic pattern procedure for non-towered airports called a “teardrop” entry.

In the context of airport traffic patterns, the word “teardrop” does not currently appear in any FAA regulations or reference materials.

The overall preferred method for entering a traffic pattern, regardless of position or direction of flight, is the downwind entry.

Confusing language should never be used in a position report. Since “teardrop” is not a recognized traffic pattern word or procedure, it is, by definition, confusing language. In addition, “teardrop entry” is an IFR hold concept that has nothing to do with traffic patterns. As indicated in AC 90-66B, IFR terminology in a VFR environment is, by definition, confusing.

The traffic pattern should be entered at a 45-degree angle to the downwind leg, headed toward a point abeam of the midpoint of the runway to be used for landing.

Non-towered airport traffic patterns are always entered at pattern altitude.

The 45-degree entry leg should be of sufficient length to provide a clear view of the entire traffic pattern and to allow the pilot adequate time for planning the intended path in the pattern and the landing approach.

If it is not possible to enter the pattern due to conflicting traffic, the pilot on a 45-degree entry can continue to turn away from the downwind, fly a safe distance away and return for another attempt to join on the 45-degree entry - all while scanning for traffic.

When overflying a non-towered airport to view a windsock or tetrahedron or for repositioning the airplane from the upwind side of the airport to the downwind side for the purpose of entering the traffic pattern, the overflight should be at least 500 feet above pattern altitude, normally 1,500 feet AGL.

Additional guidance is provided when the purpose of the airport crossing is to enable the pilot to enter the 45-degree entry leg for a downwind entry. When well clear of the pattern – approximately 2 miles – scan carefully for traffic, descend to traffic pattern altitude, then turn right to enter the 45-degree entry leg that will enable you to make a normal downwind entry. The word then has been emphasized since it is often overlooked or read as the word and. The above language needs to be read very carefully. It should also be noted that the following language is from the written narrative of current editions of *Pilot's Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook*. Well clear of the pattern (approximately 2 miles) doesn't mean 2 miles beyond the runway. The downwind leg is part of the traffic pattern and depending of the aircraft being flown, is typically about 1 mile from the runway. Therefore, the descent begins approximately 3 miles beyond the runway or 2 miles beyond the downwind leg. The crossing altitude and the rate of descent will determine how much additional distance the airplane will cover before it reaches pattern altitude.

A 120 mph aircraft descending 500 feet, at a rate of 500 feet per minute, will cover an additional two miles before turning. A 90 mph aircraft making a descent of 500 feet, at a rapid rate of 1000 feet per minute, will travel an additional $\frac{3}{4}$ of a mile. The above calculations show there is not a specific distance that works for the wide variety of airplanes that might use this procedure. It does, however, show that the turn to intercept the 45-degree entry leg will likely be 4 or more miles beyond the runway.

Widespread Usage of the Mythical “Teardrop” Terminology and Procedure

Although the word “teardrop” in the context of traffic pattern procedures, doesn’t exist anywhere in current FAA literature, it is frequently heard in traffic pattern position reports at non-towered airports. Those reports contain phrases such as “teardropping into the pattern” at XXXX airport to, “entering the teardrop” for runway XX at XXXX airport. To most pilots, those words and phrases create more confusion than clarification. From a personal perspective, if I am in the vicinity of an airport and hear a position report that includes the word “teardrop”, I fly away from the area until that individual has either landed or moved away from the area.

Since there are no specifications for a “teardrop” entry or for “teardropping”, the ensuing procedures vary considerably from pilot to pilot. They generally have the common characteristic of a descending turn that ends at the midpoint of the downwind leg. They also incorporate practices that existing FAA reference documents say we should avoid such as: (1) using unclear (made up) terminology, (2) entering the traffic pattern while descending, (3) continuing turning until the point of entering the downwind leg at midfield (i.e. not flying a 45-degree entry leg), (4) flying a 45-degree entry leg that is of insufficient length to provide a clear view of the entire traffic pattern, and (5) beginning a descent to pattern altitude prior to being well clear of the traffic pattern.

The “teardrop” entry is particularly concerning when the airplane executing the descending right turn is a low wing airplane, thus blocking the pilot’s view of any other airplanes in the pattern.

Before exploring the magnitude of the current “teardrop” phenomena, a comment about the “Preferred” and the “Alternate” midfield crossing procedures is in order. The “Preferred” has been deemed by the FAA to be the safer of the two methods at busy airports. If the procedures specified in both the *Pilot’s Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook* are flown and the airport crossing segment is followed by a normal downwind entry procedure, that is definitely a safer of the two procedures. However, when performed as a “teardrop” to emulate the flight track portrayed in not-to-scale illustrations of those handbooks (and AC 90-66B), the descending turn into the downwind leg, with reduced vision of any other traffic in the pattern, changes a safe procedure into a recipe for a midair collision.

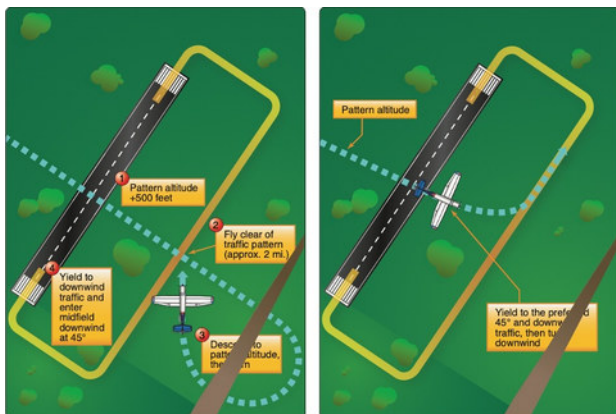
To better understand the magnitude of the current “teardrop” phenomena, following are representative examples of what is actually happening today. While I have selected three examples, there were many dozens to choose from based on a simple Google search. A similar YouTube search will yield many results of videos that are demonstrations of how to fly the “teardrop” entry. Most involve an individual’s interpretation of a descending turn into the downwind leg of the traffic pattern. The Genie is definitely out of the bottle!

FLY8MA.com Flight Training

This is from a YouTube online search and is a ground school combination video and screen shot material. The following is self-explanatory. The last sentence says – **“After crossing over midfield and observing the traffic from above, you then make a descending right turn to form a “teardrop” entry to the pattern, joining the left downwind on a 45-degree angle and at pattern altitude”**. There is no doubt this instructor believes the not-to-scale flight track is what the maneuver is supposed to look like.

How to enter the Traffic Pattern

There are two approved methods of entering the traffic pattern at a non-towered airport.



The option on the left shows how you would fly at an altitude 500' above the posted pattern altitude (pattern altitudes are typically posted between 600'-1000' above field elevation) to cross over “midfield” giving you the opportunity to both look down at the windsock and see what is going on down there on the ground in terms of wind and traffic, and also it should keep you 500' above all other traffic in the pattern in case

someone isn't talking on the radio (remember: radios are not required to be installed in airplanes when flying in Class G or E airspace (non-towered airports)). After crossing over midfield and observing the traffic from above, you then make a descending right turn to form a "teardrop" entry to the pattern, joining the left downwind on a 45-degree angle and at pattern altitude.

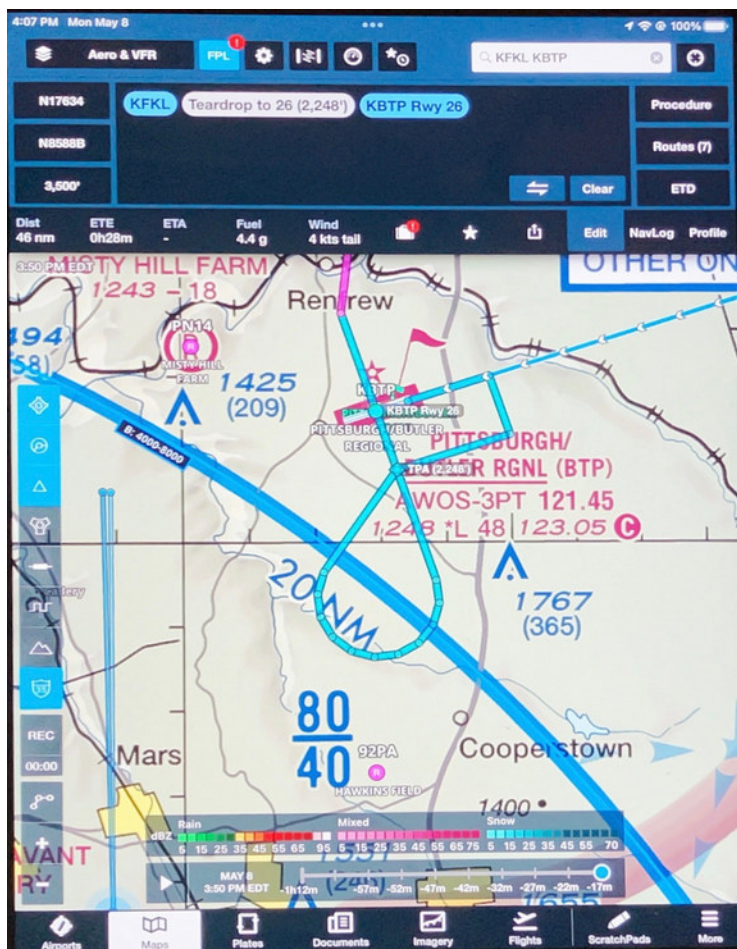
Analysis of FLY8MA.com Flight Training Procedure

This procedure fails to comply with current FAA guidance in just about every way possible. Simply stated, the procedure being presented is based on a cartoonish not-to-scale illustration and the instructor is telling the student to "fly the picture". While the FAA clearly states that a pattern should always be entered at pattern altitude, this individual is telling the student to make a descending right turn into the pattern. There is no 45-degree entry leg and the instructor doesn't consider the normal 45-degree entry leg to be part of the traffic pattern.

What is being presented is both dangerous and irresponsible.

ForeFlight.com

ForeFlight is a popular aviation application that is used by many pilots. One of the interesting features of ForeFlight is the ability to select a "teardrop" traffic pattern procedure. Following is an iPad screen shot of the "teardrop" entry for KBTP in Butler, PA.



Analysis of ForeFlight Procedure

The actual procedure appears to be a cross between the detailed procedures described in both the *Pilot's Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook* reference materials and illustrations contained in those books. Judging from the appearance, it appears the turn is initiated before the descent to pattern altitude, which would result in a descending turn. Nevertheless, it is interesting that ForeFlight has adopted terminology that does not currently exist in FAA reference documents. Like a number of other organizations and individuals, ForeFlight is treating this crossing procedure and subsequent downwind entry procedure as a single integrated maneuver and not a crossing maneuver, followed by a normal 45-degree downwind traffic pattern entry.

If the ForeFlight application used terminology other than “teardrop entry” and if the outbound leg would be extended a sufficient distance to comply with both the FAA definition of *well clear of the traffic pattern* and to complete the descent before turning to the 45-degree entry leg, all concerns about this offering would be eliminated.

EAA's Sport Aviation Magazine and a Follow-up FAA Team Sanctioned Seminar

In the May 2022 issue of *Sport Aviation*, Steve Krog, EAA's CFI contributor, had an article published titled *Entering the Traffic Pattern*. The article went into great detail describing what he said was FAA's recently developed "teardrop entry" procedure. By recent, he made reference to the 2018 *Advisory Circular 90-66B – Non-Towered Airport Flight Operations*. His expert opinion of how to properly execute the procedure was essentially a descending right turn into the downwind leg of the traffic pattern. To his credit, he shared that he personally did not like the procedure and considered it to be a dangerous maneuver. *Sport Aviation* has a subscription base of about 200,000 pilots.

Because of the success of Mr. Krog's article, EAA had a web-cast on August 17, 2022. Once again, Mr. Krog explained the procedure he referred to as a "Midpoint crosswind to teardrop entry." As occurred with his article, he explained the descending right turn into the downwind leg of the traffic pattern. And once again, he shared that he personally did not like the procedure and considered it to be a dangerous maneuver.

The seminar was approved by the local FSDO office for credit by pilots participating in the Wings program.

Analysis of EAA's / Mr. Krog's Article and Seminar

The information being presented in both the article and seminar is based on the not-to-scale illustration in *Advisory Circular 90-66B* that was published in 2018 and ignores the detailed procedures associated with the midfield crossing procedure. It should be noted that the AC does not actually include the detailed procedures, they simply make reference to the *Pilot's Handbook of Aeronautical Knowledge* that contains those procedures. Mr. Krog appears to be of the belief that *AC 90-66B* was a "change" that introduced the "teardrop" entry. Of interest is the fact the Mr. Krog recognizes the "teardrop entry" as a dangerous maneuver.

What have we learned?

After reviewing and analyzing historical and current FAA publications, gathering and analyzing information about current practices and beliefs, looking at training curriculum used by different flight and ground schools, and talking with current active pilots, a lot has been learned. In no particular order, here is a listing of what is now known about “teardrop” traffic pattern procedures.

Over the past 20+ years, there have been no regulatory changes pertaining to traffic pattern procedures at non-towered airports.

In 2016, the FAA made some changes to the section of the 2016 version of *Pilot's Handbook of Aeronautical Knowledge* (**PHAK**) that pertains to Airport Operations at non-towered airports. None of the fundamental traffic pattern principles were changed from earlier FAA reference books.

The revised book provided additional clarity around the best procedure for overflying an airport to then make a normal 45-degree entry to the midpoint of the downwind leg of the traffic pattern. An alternate traffic pattern entry procedure was also included in the revised book.

Along with the additional clarity provided in narrative form for the traffic pattern entry procedures, the **PHAK** added two new colorful “not-to-scale” illustrations. Although not realized at the time of publication, one of those illustrations would eventually become problematic.

While cartoonish in appearance, the not-to-scale drawing for the alternate midfield entry represented a reasonable portrayal of the actual procedure, as detailed in the written narrative of the **PHAK**.

The illustration for the preferred midfield crossing was drawn in a similar manner, but the scale that was necessary for the flight track to fit into the overall dimensions of the illustration was incongruent with the actual written procedures.

While there are notations on the misleading illustration for the preferred midfield crossing that are intended to provide clarification, the brevity and placement of those notations fails in providing the necessary clarity.

From the time the 2016 **PHAK** was published until the issuance of *Advisory Circular 90-66B, Non-Towered Airport Flight Operations* in 2018, the two midfield crossing procedures and the related illustrations drew little notice from pilots. After *AC 90-66B* was issued everything changed, and not for the better.

Unlike the 2016 **PHAK** that contained both the detailed specifications for the Preferred and Alternate midfield crossing procedures, the newly issued Advisory Circular only contained the not-to-scale illustrations. As mentioned above, the illustration for the alternate midfield entry represented a reasonable portrayal of the actual procedure while the illustration for the preferred midfield crossing bore no resemblance to the actual written procedures.

In the absence of clear written procedures, pilots looked at the illustration for the preferred midfield crossing and saw a “teardrop.” With that revelation, a new descending turn procedure that commenced soon after crossing the downwind leg of the traffic pattern and ended at the midpoint of the downwind leg, was conceived. And for a name, what could be more appropriate than “teardrop entry.” Presto, the myth had originated!

The fact the word "teardrop" does not exist in the FAA literature pertaining to airport traffic patterns and that many of the pilots trained before 2016 have no idea what is intended when they hear another pilot report they are "teardropping" or are making a "teardrop" entry, doesn't seem to bother the pilots who are flying these procedures and using that terminology.

It is now 2023. We have tens of thousands of pilots trained over the past six years that are absolutely convinced the proper way to enter the downwind leg of the traffic pattern when approaching the airport from the upwind side of the airport is to perform a "teardrop" entry. The fact that they are essentially emulating a cartoon and are disregarding many, if not most of the safety concepts associated with traffic pattern operations that have been around for many years, seems to be of little or no concern to anyone. We have flight schools, independent instructors, YouTube videos and even flight planning applications like ForeFlight that have embraced the notion of a descending turn into the downwind leg of the traffic pattern as a safe and rational means of entering a traffic pattern. The use of the word "teardrop" that doesn't exist in FAA literature applicable to traffic patterns is as natural to them as downwind, base or final.

It hasn't happened yet, but a midair collision caused by a "teardrop" entry is inevitable. I have personally experienced a "near miss" caused by a Cirrus pilot performing a high speed "teardrop" entry. To this day, that pilot doesn't know he almost died in the Spring of 2021 while performing that maneuver.

Recommended Solution to the Mythical “Teardrop” Traffic Pattern Problem

Immediately update *Advisory Circular 90-66B*.

Boldly state in that document – *There is not now, nor has there ever been an FAA traffic pattern procedure called the “Teardrop Entry.”*

Include the detailed steps for overflying a non-towered airport and then executing a normal 45-degree downwind entry. The language already exists in both the *Pilot’s Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook*. These steps should be unambiguous, leaving no room for individual interpretation.

Remove or completely revise the confusing not-to-scale drawings that are in the current version of AC 90-66B. If a new illustration is to be used, it is critical that any depicted flight track be representative of what the actual flight track would look like if the detailed steps were flown correctly.

Where possible, have organizations like AOPA and EAA publicize the revised aspects of the updated Advisory Circular.

Where possible, have training organizations like Boldmethod, Gleim and Sporty’s update their training products to assure consistency with the updated guidance.

Where possible, notify applications like ForeFlight and Garmin Pilot of the new guidance.

It is my view that what is now referred to as the “Preferred Entry When Crossing Over Midfield” in the existing illustrations, is really a two-step process and not a single overall maneuver. I consider the first step to be a series of actions to be taken to overfly the airport, fly well clear of the airport and descend to pattern altitude. The second step would be entering and flying a routine downwind traffic pattern entry. If the FAA considers this crossing and traffic pattern entry to be a single maneuver, then an appropriate name needs to be given to that maneuver.

Longer term, as the *Pilot’s Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook* go through their routine updates, they should be revised to be consistent with the latest Advisory Circulars.

Observation – From the perspective of an outsider, the above administrative changes don’t appear to be expensive or challenging. All it needs is for the right person within the bureaucracy of the FAA to fix it.

One Final Thought

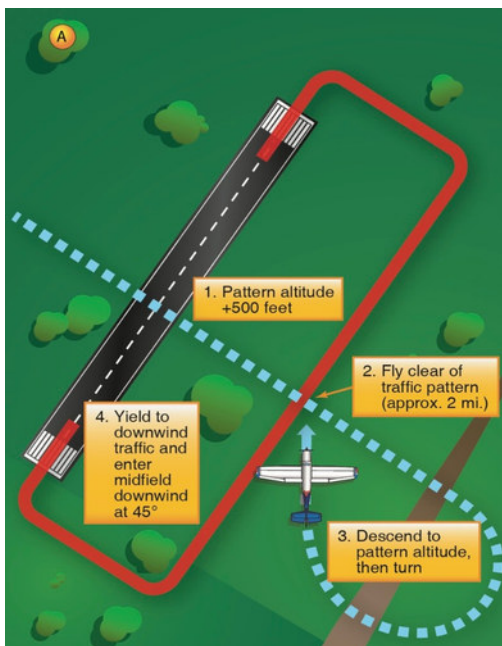
Throughout this book, I have commented on the grossly misleading aspect of the illustrations used in the 2016 and 2021 handbooks, and more importantly in the 2018 Advisory Circular that does not include the clarifying narrative pertaining to the two crossover procedures. The following pages titled **The Big Picture** make it crystal clear why the existing illustrations should never have been published in their current form and why they need to either be immediately removed or significantly modified to reflect the actual nature of the crossing procedures.

We have a clear choice. We can do something now and prevent a "teardrop entry" from ever causing a midair collision. Or we can do nothing, wait for the inevitable and let the National Transportation Safety Board (NTSB) deal with the issue.

The Big Picture – Current Illustration

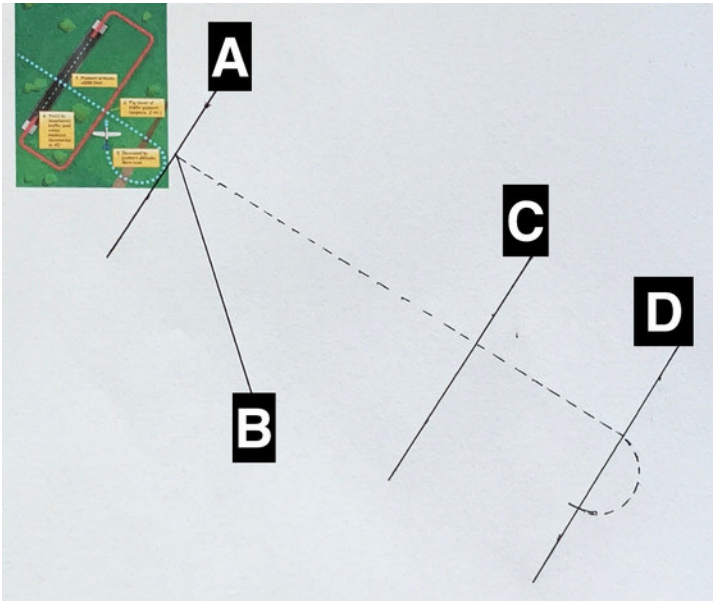
The following picture is ***the root cause of today's confusion*** and the greatly increased level of dangerous traffic pattern procedures now happening at non-towered airports throughout the USA. It was first introduced in 2015 and is now shown in current versions of both the *Pilot's Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook*. Those handbooks also contain detailed guidance on how to safely perform the depicted crossing procedure. The picture is also contained in the 2018 *Advisory Circular 90-66B*, but without the detailed guidance.

For many flight schools, independent flight instructors and pilots, this illustration shows a teardrop shaped flight path and they are now teaching and flying the maneuver to conform to that depicted flight path. The flight path in the illustration bears no resemblance whatsoever to the detailed guidance provided in other FAA reference material.



The Big Picture – Scaled to Runway Length (based on a 4000 feet runway length)

The following picture has been modified to show what the flight track would look like if the written procedures contained in of both the *Pilot's Handbook of Aeronautical Knowledge* and *Airplane Flying Handbook* were followed and if the flight track was drawn on a scale comparable to the original illustration's runway size.



The first solid line beyond the green box of the original illustration is labeled A and represents the correct position of the downwind leg, in relation to the runway. The line labeled B is the 45-degree entry leg. It should be entered at a point that provides a clear view of the entire traffic pattern. Label C is 2 miles beyond the downwind leg of the traffic pattern and marks the point where the descent should commence. Label D is an approximation of where the descent will conclude and is about 3 miles beyond the downwind leg. This is where the “turn to the 45-degree entry leg” begins.

Conclusion

Prior to 2016, written guidance provided by the FAA regarding how to safely overfly an airport and enter the traffic pattern was well understood by American pilots. That began to change in 2016 with the updating of *Pilot's Handbook of Aeronautical Knowledge* (PHAK) that provided additional clarifying details and introduced new illustrations related to that guidance. The clarifying details were a welcome improvement, but the new illustrations presented a grossly distorted perspective of the required flight path.

In 2018, the FAA issued Advisory Circular 90-66B that contained the same distorted illustrations as the 2016 PHAK, but without the necessary clarifying details. The absence of those details has given rise to the mythical "teardrop" traffic pattern entry. The result is a rapidly expanding level of misunderstanding amongst American pilots. We have moved from an incredibly safe airport crossing procedure to something that is a deadly recipe for a midair collision.

The good news is that fixing the problem is as simple as either revising or eliminating the distorted illustration that is currently being used as the basis for the airport crossing procedure.

The time to do that is now!

Bibliography/Reference Documents

Airplane Flying Handbook - 1999

Airplane Flying Handbook - 2014

Pilot's Handbook of Aeronautical Knowledge - 2016

Advisory Circular 90-66B - 2018

Airplane Flying Handbook - 2021

FLY8MA.com

ForeFlight.com

Sport Aviation - May 2022

EAA Web-cast - August 17, 2022

Final Comments From The Author

If you have taken the time to read this entire book, you have my sincere gratitude.

If you have not only read the book, but now have an understanding of the problem that has been created with the grossly misleading FAA illustrations, my communications objectives have been met. You will no longer be able to look at those illustrations, or listen to someone announcing a "teardrop" pattern entry, without cringing.

If you have read the book, understand the problem and are in a position to help bring about the necessary changes, we are much closer to where we ultimately need to be. The next steps are up to you.

Blue skies and safe flying.

Jim Savage

END

Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terribly unforgiving of carelessness, incapacity, or neglect.

Anonymous