DC Designs PT-17 Stearman

Operations Manual

Welcome to the *DC Designs* PT-17 Stearman. This manual will guide you through the operation of this aircraft, and ensure that you enjoy flying the airplane and also arrive at your destination with your pride intact and your moustache pristine. This is no glass-screen, flashing lights, tin-can tube-liner: this is the *real* deal. No nav-aids, no GPS, no nuthin'. All you need to do is read this manual, grab your map and your stopwatch, and go look at this wonderful world of ours.

CONTENTS

General Performance Table

- Crew = 2
- Length = 24ft 9 inches
- Wingspan = 32ft 2 inches
- Height = 9ft 8 inches
- Wing area = 298 sq ft
- Empty weight = 1,931 lbs
- Max take-off weight = 2,635 lbs
- Fuel capacity = 46 US Gallons
- Engine = Continental R-670 7-cylinder air cooled radial piston delivering 220 horsepower to a 2-blade fixed-pitch propeller
- Maximum airspeed = 108 knots
- Cruise speed = 83 knots
- Service ceiling = 13,200 ft
- Time to 10,000ft = 17 minutes
- Wing loading = 9.9 lb / sq ft
- Stall speed with 50% fuel and oil = 48 knots

The *DC Designs* Stearman represents the original configuration aircraft. The PT-17 Stearman is not cleared for night flying or sustained IFR conditions, as it does not have any de-ice equipment other than carburettor heating, nor any IFR instruments. It is, however, cleared for general aerobatics and spins.

Aircraft familiarisation

"If it looks right, it'll fly right."

There is no denying that the PT-17 Stearman looks the part. Built for the United States Air Force as a trainer, the Stearman sold close to ten thousand airframes and was exported around the world to become one of the best-known aircraft of its day. Today, it is one of the most popular general-aviation warbirds in existence, owned by enthusiasts the world over.

Like any good trainer, the Stearman is easy to fly, but hard to fly *accurately*. Her light weight, combined with the seven-cylinder radial engine, mean that a pilot must be mindful of the throttle throughout all phases of flight, and touchdowns require deft stick and rudder work. It is said that if you can fly a Stearman on climb-out and keep control of her drift, you can fly anything.

Powerplant

The PT-17 Stearman is powered by a single Continental R-670, 7-cylinder radial engine. The powerplant delivers around 200 BHP (at 2075 RPM, at sea-level) to a twin-bladed, fixed-pitch steel propeller of 8ft 6" diameter.

Maximum airspeed in level flight with this engine is around 108 knots indicated. The never-exceed speed for the aircraft is 160 knots. Maintain a careful eye on temperatures and pressures throughout all aspects of flight – usually the first sign of engine trouble will be an increase in oil temperature or pressure, or both.

Main Panel Layout (Pilot)

1. Control lock lever
2. Mixture lever
3. Throttle lever
4. Fuel Tank valve
5. Magneto lever
6. Battery switch
7. Avionics switch
8. Altimeter
9. Airspeed indicator
10. Whiskey compass
11. Turn and slip indicator
12. Engine temp and oil pressure
13. Clock
14. Engine RPM
15. Vertical speed indicator
16. Lights switches
17. Engine primer
18. Engine starter switch
19. Radio and transponder unit
20. Carburettor heat lever
21. Parking brake lever

As you can see, you have plenty to keep you occupied in the cockpit. The layout in the front (student / passenger) cockpit is identical to the main panel, but does not have a carburettor heat lever.

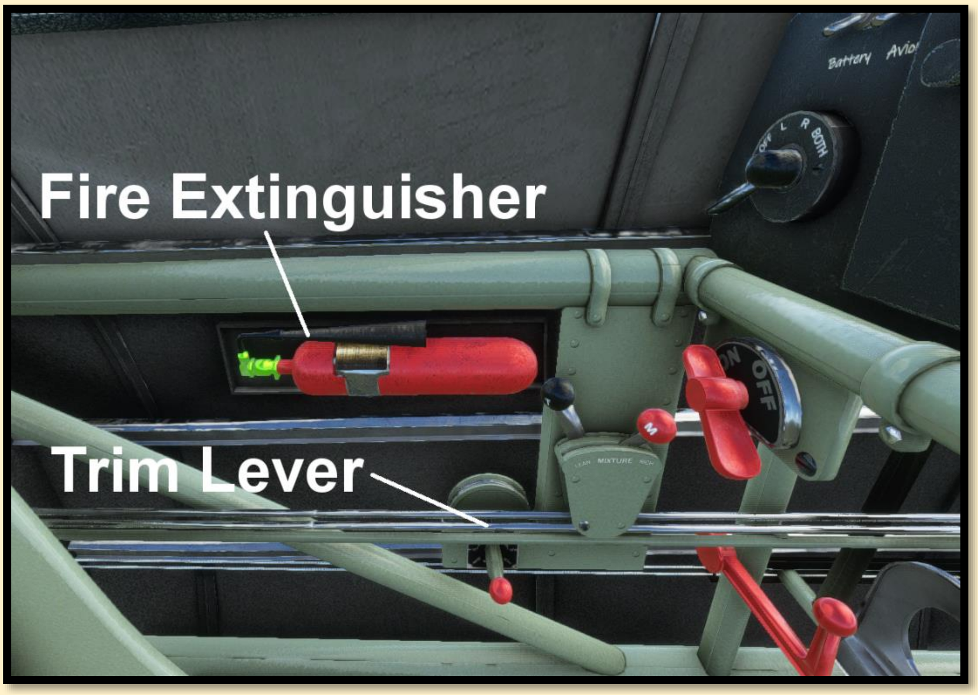
<u>This aircraft can be flown solo from the REAR seat only. Do not attempt solo operation from the student's seat.</u>

On the radio set there is a small button which controls the kind of crew that you want aboard your Stearman. The button toggles between a modern civilian crew, and a World War Two student and instructor crew.

In addition to the crew-type toggle, you can also control the presence of the student / passenger in the front seat by using the in-sim drop down menu. Select the Payload section, and where it says Co-Pilot, add any weight above

100lbs to make the occupant of the front seat appear. The code behind the system will automatically detect whether vintage or modern crew are selected, and display the correct character.

A young lady shows her student how the Stearman should be flown.



To the left of both pilot and student can be found the elevator trim levers, located in both front and rear cockpits. This rotates toward the user for elevator trim up, and away from the user for elevator trim down. It can provide fifteen degrees of elevator trim either way.

A fire extinguisher is available should the unthinkable occur and a fire break out either in the cockpit or the engine bay.

To the right of the pilot there is a small flight storage case, and just above it is the carburettor heat handle. Pull this toward you to apply heat to the engine carburettor during icing conditions. It should be noted that icing does not just occur in winter or inside clouds: it can occur on a summer's day if the humidity is high and the ambient temperature sufficiently low. Air temperature decreases by an average of 2 degrees per thousand feet of altitude, so be aware of your flight conditions at all times. If you notice a gradual loss of engine power and there are no other mitigating factors, apply carburettor heat to clear ice from the fuel flow.

Above the front seat, protruding from the underside of the upper wing, is the fuel gauge. In the image above, the fuel gauge is showing that the tank is approximately half-full. The lower the black plunger sinks within the tube, the less fuel there is in the tanks. There are three red markers, each representing quarter-full, half-full and three-quarters full. An "E" at the bottom marks the empty position.

The Stearman’s single upper-wing fuel tank is gravity fed and contains a maximum of 46 US gallons of fuel. For most operations, this is sufficient for around two hours of flight, giving the aircraft a range of around 160-200 nautical miles depending on altitude and fuel mixture settings.

You can obtain more accurate estimates of endurance using the charts on the following pages.

Flight Operations

A World War Two pilot at the controls once again.

The PT-17 Stearman is relatively simply to operate, with forgiving ground handling and flight characteristics. However, it is also easy to make mistakes, especially when flying a tail-dragger. Be ready to perform the “rudder dance” on take-off and landing.

The aircraft has a Check List that can be followed using the in-sim drop-down menu. Just select “Checklist” from the far left of the menu and follow the start-up procedure from there. It will guide you on how to prepare the aircraft for flight, engine start, taxi, take-off, cruise and landing.

See overleaf for a more detailed description of engine parameters and flight characteristics.

Contintental R-670 Engine characteristics

FUEL: 73 Octane Spec AN-VV-F-761

OIL: Spec AN-VV-O-446 Grade

OIL TEMP: 40 Degrees C – 90 Degrees C

OIL PRESSURE (pounds):

Rated Speed = 90

Desired = 70-90

Minimum Cruising = 60

Idling = 15

OVERSPEED: 2280 RPM during dives.

MIXTURE: Should be maintained in full “rich” position during take-off, climb at or near maximum power, and during high-speed flight below 3,000ft. For all operations at or below 70% normal rated power, where low specific fuel consumption is of importance, the mixture may be leaned sufficiently to give a drop of 20 RPM in engine speed. For landing, the mixture must be in the full “rich” position.

CARBURETTOR AIR CONTROL: Hot or cold air can be fed into the carburettor when the temperature is low and the humidity is relatively high. There is no available carburettor temperature gauge, so always apply “full hot” lever when icing conditions are suspected.

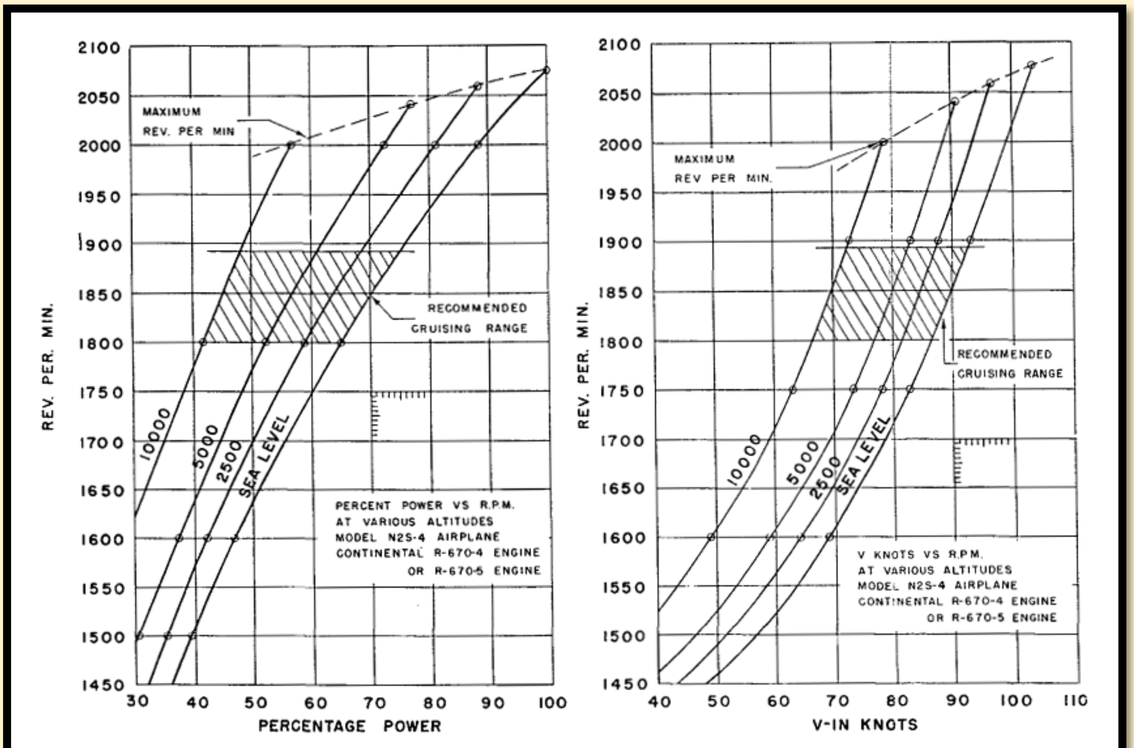


FIG. 10 POWER CONTROL CHARTS

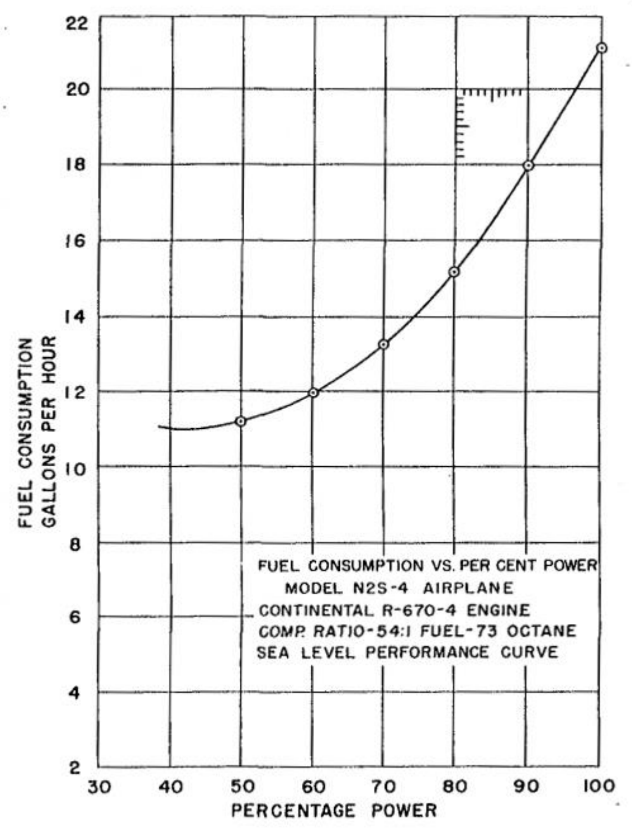


FIG. 11 FUEL CONSUMPTION CHART

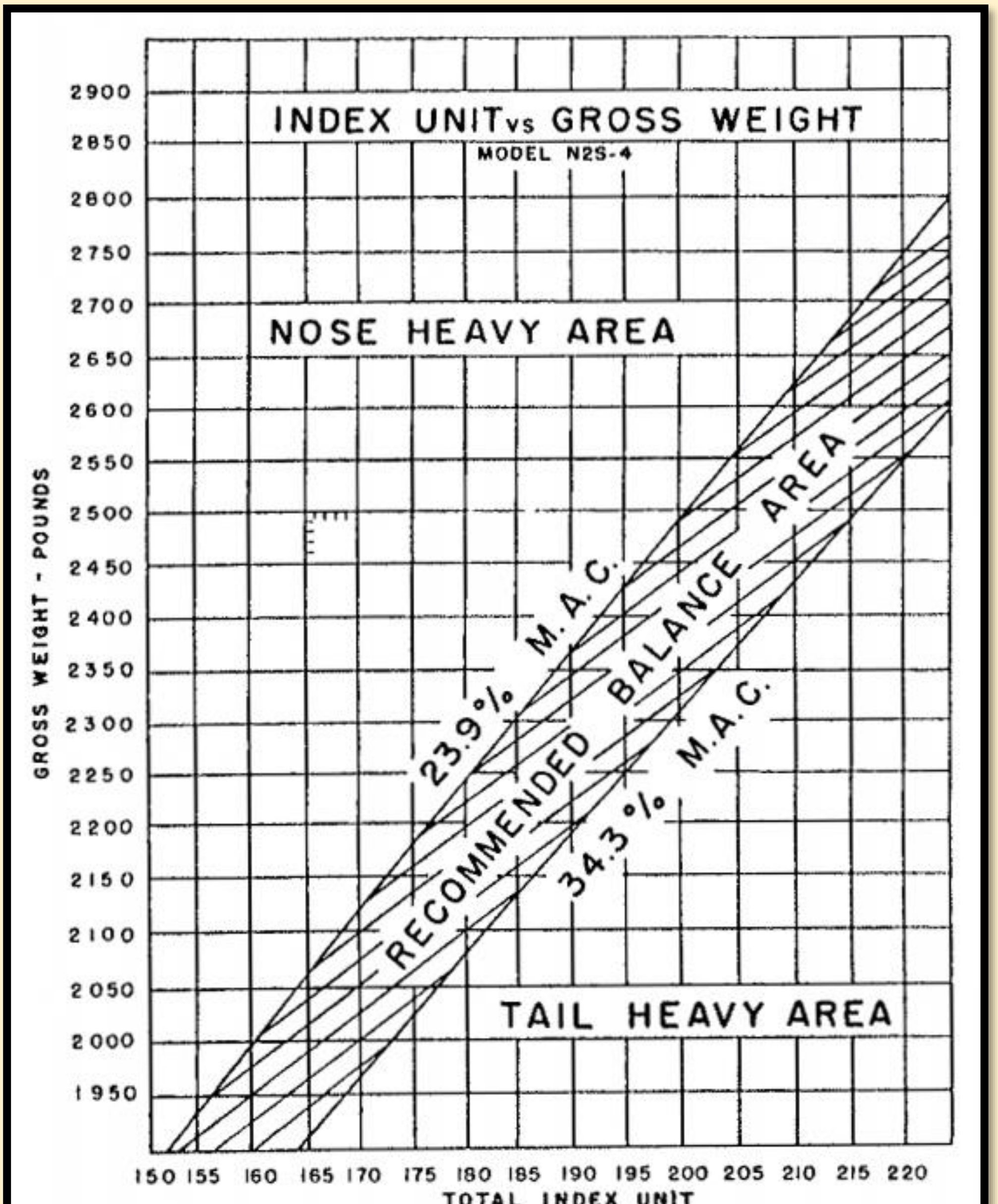


FIG. 16

The Stearman's Centre of Gravity can be calculated via this chart. As Microsoft Flight Simulator does allow for the manual alteration of CoG M.A.C, this chart may be of consideration for flights where the aircraft load-out may bring the balance close to the acceptable limits for flight.

Manoeuvres

The PT-17 Stearman is fully aerobatic, and such manoeuvres are encouraged to sharpen a pilot's skills.

Cleared manoeuvres for the Stearman are: Loop, Snap Roll, Chandelle, Immelman Turn, Inverted Spin, Wing Over, Vertical Turn, Prolonged Spin and Aileron Roll (at speeds less than 125 knots).

The airframe is rated to +6 and -3 Gs, at a weight of 2,671 pounds – these figures should never be exceeded.

Entry speeds for manoeuvres like loops should be in excess of 100 knots, with the pilot applying increasing back-pressure on the stick to maintain a brisk pitch-up into the vertical. Check wings level in the climb before looking for the horizon as you come over the top. As the nose moves through the inverted, draw back the throttles and maintain full back-stick until the airspeed builds once again.

The next section is for newcomers to flight simulation, who may wish to learn some basic techniques used in Visual Flight Rules navigation.

Visual Flight Rules Navigation

The Stearman does not contain any navigational equipment, and is not equipped for IFR (Instrument Flight Rules) flight. A radio and transponder are available for communication and identification purposes respectively, but this is a World War-Two-era aircraft, and back in those days, pilots found their way around with a map, a compass and a stopwatch.

"What? Where's the GPS? How can I tell where I am? What sorcery is this that you speak of?"

Part of the joy of true flight is finding your way around without any recourse to navigational computers. While IFR navigation via radio beacons can also be a rewarding venture, the true "*oil around the goggles*" pilot uses age-old means of finding their way home, even dead-reckoning on occasion if necessary.

To really find your way around, you'll need first to have a departure and a destination in mind. This may sound obvious, but knowing where you want to go and not just ambling aimlessly around is essential – you're in MSFS now, and if you're flying like a true pro and have real-world weather on (within reasonable limits) then you're going to need real-world techniques to find your way around if that weather closes in…

In general, the best way to plot a simple route is as follows:

1) Measure the distance between departure and destination airfields in nautical miles (1.15 nautical miles per statute mile)
2) Divide that distance by the Stearman's cruise speed (80 knots)
3) Set your departure time
4) Calculate your arrival time (speed over distance)
5) Reference the magnetic heading required to reach your destination
6) Ideally, plot the route on a simple map.
7) If possible, note prominent geographical features along the route such as towns, rivers, lakes, highways, railway lines etc, and mark them.

So, if the distance between our airfields is 120 nautical miles, then our flight time at 80 knots will be approximately one hour thirty minutes. If we're leaving at 1pm in the afternoon, we can expect to arrive overhead our destination at 2.30pm.

Now, we need to note local wind direction and speed. A headwind will slow us down, a tail wind will speed us up, and a crosswind will push us off track. We can calculate those into the route plan, but for the most part we can use a "rule of thumb" general calculation. If there is a 10-knot headwind to our destination, then at our cruise speed of 80 knots indicated, our speed over the ground below (ground speed) will be only 70 knots. That will increase our overall flight time by a few minutes, and should not adversely affect things. A 10-knot tail wind would of course reduce our flight time by the same amount.

With this in mind, it is possible to plot the 120-mile course, looking for different ground features at regular intervals, so that you can navigate from one to the next without losing track of where you are. Measuring the distance between these features can also provide you with an ETA to each one, marking time along the route. A final routine task for real pilots flying VFR is to mark a “fuel ladder”, checking that they have enough fuel to reach the next point on the route and, of course, their destination.

Using these methods, a pilot can navigate from point A to point B/C/D and onward without ever losing track of where they are… unless the weather sets in.

Dodging weather is part and parcel of VFR flying. The Stearman cannot really fly into IFR conditions – it can be done, but you can bet that the pilot concerned won’t want to stay there long. So, if you’re on your route and you realise there is a well-formed cumulonimbus with extensive rain curtains looming ahead of you, then you’ve got some work to do.

The good news is that in all but the most terrible circumstances, weather can be avoided via the highly technical route of “*going around it*”. In real life, pilots make detailed observations of weather conditions prior to flying, and make judgement calls on whether it’s safe or not to fly at all.

A Stearman pilot valiantly avoids a rain shower to keep his moustache pristine.

If you should find yourself facing a wall of weather, plot a route around it in the same way that you planned the original flight. Locate a suitable target to one side of the storm, such as a town, and turn towards it. Note your new heading, and how much it differs to your previous heading (let’s say you turn right by 20 degrees). Once overhead your target turn back onto your original heading.

Once past the storm, steer the opposite diversion heading (turn left by 20 degrees) back toward your original route until overhead the first visual marker on your map after the storm’s position. Don’t forget to estimate the extra fuel used during the diversion. Finally, once overhead that marker, you can then turn onto your original heading with the storm now safely behind you.

Sometimes, if you’re lucky, a route will largely follow that of major highways or railways, allowing you to keep an easy track of where you are and where you’re going. It’s not unknown for pilots to keep a pair of small collapsible binoculars in the cockpit with them, the better to read the road signs below to maintain their course.

This is all perfectly acceptable behaviour, and for this reason in real life, when flying VFR and following ground features such as roads, pilots always keep those features off the left wing. That way, if somebody else is doing the same thing but in the opposite direction, there is a much-reduced risk of a collision.

“But, can’t I just point in the right direction to my destination and go?”

You could, but the weather plays havoc with all aircraft, especially aircraft that are small and light. Look up at any light aircraft as it passes overhead, especially if there is a breeze of any kind. Chances are, the aircraft will be flying in one direction, but the nose will be pointing slightly to the left or right of that heading – into the wind. This is called “crabbing” and is most noticeable when aircraft are coming in to land in a crosswind. They’re using the power of the engine to counter the wind and maintain a straight track.

Using regular ground feature markers such as towns allows the pilot to navigate from one feature to the next and not be drifted off track by crosswinds. For this reason, it’s often best to fly above 2,000ft if you’re on an unfamiliar route, as you’ll be able to see further toward your next waypoint, and to make those flight plans count. This is especially important when flying “*sun-up*”.

The view from an aircraft can be hugely different depending on the time of year and the direction of flight. In summer, in the middle of a clear day, you can see for miles in all directions with great clarity. But in winter, with a low sun and perhaps some haze and cloud, the visibility "*down sun*" (with the sun behind you) might be 20 nautical miles. Turn the airplane around so that you're flying "*sun up*", and that visibility might drop to 5 nautical miles, and the clarity will likewise reduce. Ground features become obscured and vague. If you're flying with 15 miles between markers and there's a brisk crosswind, suddenly you're at risk of drifting off course sufficiently that you miss the next marker. If that happens, you need to know what to do about it.

"Catch my drift?"

Another nautical term that made it into aviation, catching one's drift refers to the helmsman (or pilot) identifying crosswind drift and neutralising it, in this case by crabbing into the wind. If you're flying toward your next marker, a town that you can see ahead, and you're constantly turning left to keep pointing at it, then you're in a crosswind and you need to counter the drift. Turn five degrees into the crosswind (deliberately making your compass heading incorrect) and wait to see if it's enough to counter the drift. You'll be flying slightly sideways, but if it counters that drift, you're tracking accurately toward your marker.

You can use any suitable ground marker while flying to check for drift, such as a house or lake – you'll be surprised how obvious it becomes when you point toward the marker and see it gradually slip to one side or the other.

"But what if I'm already lost?"

No pilot is *ever* truly lost – we're only ever "temporarily uncertain of our position". If you have drifted off course, the first thing to do is to figure out how long you've been drifting for and how quickly.

If you passed your last marker six minutes ago, and you're flying at 80 knots in negligible winds, then you can calculate that your marker is about 8 nautical miles behind you (you cover 80 nautical miles in 60 minutes, so you'll cover 8 miles in 6 minutes).

Check the nose, pick a marker, keep an eye on the time and watch to see which way you've been drifting. If you're drifting to the right, then begin a left turn through a gentle 160 degrees (not a full 180). This will roughly point you back toward your last marker, while also countering the crosswind that drove you off-course in the first place. With the marker only a few miles behind you, you should pick it up within a few minutes.

All of these techniques are used by real pilots (although with somewhat more detail added) but as a starting point they can provide you with a means of flying with a purpose. There are many resources both on-line and in books that can be used to expand your knowledge of VFR navigation and allow you to visit airfields and locations (such as your own home) with considerable accuracy, ensuring that you're never again "temporarily uncertain of position" for long …

CREDITS

DC Designs PT-17 Stearman

Models and code	Dean Crawford
Flight dynamics	CodenameJack447, Dean Crawford
Textures	Dean Crawford
Sounds	Sim Acoustics (WWise)
Smoke	Touching Cloud

Just Flight

Project management	Dermot Stapleton
Manual	Dean Crawford
Installer	Just Flight / Microsoft

COPYRIGHT

SOFTWARE PIRACY

This software is copy protected.

Here at Just Flight we have invested significant time, effort and money in developing, manufacturing and publishing all of our flight simulation products. This includes rewarding the programmers and artists whose creativity contributes so much to the products we all enjoy.

A pirate, otherwise known as a thief, makes a profit from the sale of other people's hard work. In some cases he makes more profit than the publishers and developers make from the sale of an original title. Piracy is not just the domain of the casual domestic user in his or her back room, but is also a multi-million-pound business conducted by criminals often associated with the illegal drugs trade. Buying or downloading pirated copies of programs directly support these illegal operations.

Don't be fooled by a load of old tosh about file 'sharing'. The sites that host these 'shared' files cover their backsides with the excuse that they are simply a 'gateway' to the files. In fact, they actively encourage piracy and are often funded by advertising. Most of them are illegal money-laundering operations by another name.

The people who really suffer from game piracy are the artists, programmers and other committed game development staff. Piracy and theft directly affects people and their families. Loss of revenue to the games industry through piracy means many are losing their jobs due to cut-backs that have to be made to ensure developers and publishers survive. The logical outcome of this is that eventually the supply of flight simulation programs will dry up because developers think it is not worth the hassle.

It's not just copying software that is against the law. Owning copied software also constitutes a criminal offence, so anyone buying or downloading from these people is also at risk of arrest and prosecution.