Introduction To The Instrument Landing System

Skill Level: Basic

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Discover the Instrument Landing System (ILS). Once you understand the ILS you'll be able to shoot precision ILS approaches into any Flight Simulator airport regardless of the weather conditions.

The Instrument Landing System or (ILS) is a precision guidance system that a pilot uses to perform a precision approach and landing on a runway in Instrument Conditions (IMC). Other instruments such as the VOR and NDB provide guidance to a runway from within cloud but neither of those instruments provide the precision of the ILS.

In this lesson you'll learn all about the basics of the ILS approach. You'll get a basic understanding of the station that transmits the ILS information, the ILS receiver in your aircraft and a brief preview of the ILS approach chart. We're going to do a complete lesson on reading ILS approach charts in a subsequent lesson.

You'll fly an actual ILS approach yourself as I talk you through it. This is only intended to be an introductory lesson and we'll get into the real meaty stuff later on.

To help you further understand this lesson there is a file which you can download from the Computer Pilot internet site at *http://www.pcaviator.com.au/compilot.htm* called **CMI Rwy 32 ILS Approach**. It is a recorded FS95 video of the ILS approach you'll fly in this lesson.

Once you understand the Instrument Landing System, you will be able to perform ILS approaches at any flight simulator airport regardless of conditions except, of course, if the weather is below the minimum allowable cloud base for a safe ILS landing.

The Anatomy of the ILS

The ILS Transmitter

The easiest way to understand the ILS transmitter for the purpose of flight simulation is that it is a radio transmitter located next to a runway. It transmits a lateral and vertical navigation signal that projects out from the runway to effectively form a cone that the aircraft flies down on approach to the airport. The lateral (sideways) signal is the localiser and the vertical signal is the glideslope. The localiser signal helps the pilot maintain alignment with the runway centreline during the approach and the glideslope provides an accurate 3° slope for a safe descent to the runway while remaining clear of obstacles. The localiser sweeps ±35° each side of the runway centreline but the tolerance for the approach on the ILS radio in the aircraft is ±3° either side of the localiser.

Marker Beacons

Marker beacons are beacons that emit an audio signal and help a pilot determine his position in the ILS approach. The outer marker, indicated by the flashing blue light in your aircraft, emits a medium pitch beep that lasts for around 10 seconds at normal approach speed. It usually indicates the commencement of the ILS approach. The middle marker is indicated by the yellow light emits a higher frequency sound indicates the missed approach point (also known as decision height) or the point that if you cannot see the runway approach lighting then you must not land and should perform a missed approach procedure.

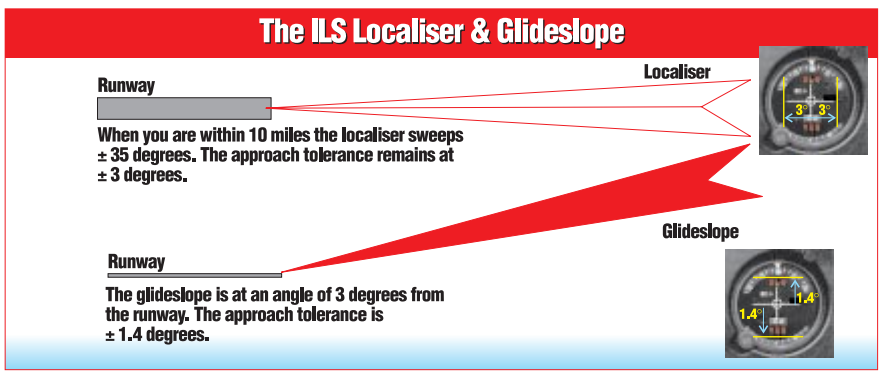
The ILS Radio

Your Nav 1 radio is usually always an ILS receiver as well as a VOR radio. It consists of a glideslope indicator needle and a localiser indicator needle. These two needles work like crosshairs when a pilot is performing an ILS approach. The localiser needle tells you where the runway is and the glideslope needle tells you where the correct height position is.

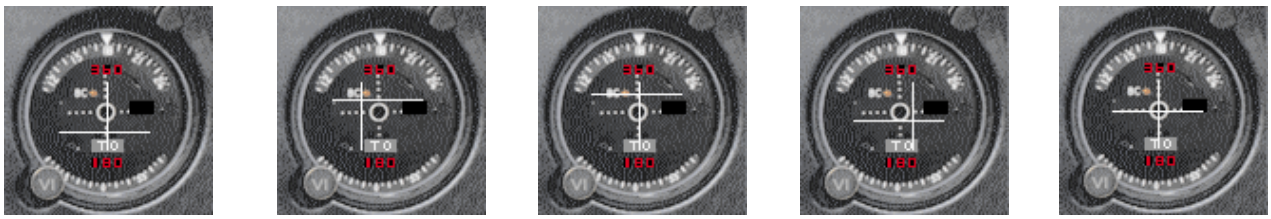
Occasionally you will see a flag on the ILS that says GS. This is a warning flag that indicates that your glideslope signal is currently unreliable.

The diagram on the top right hand page illustrates how the ILS receiver works. The basic principle to understand is that the aim is to centre the crosshairs over the

The components of the ILS. The localiser and the glideslope.



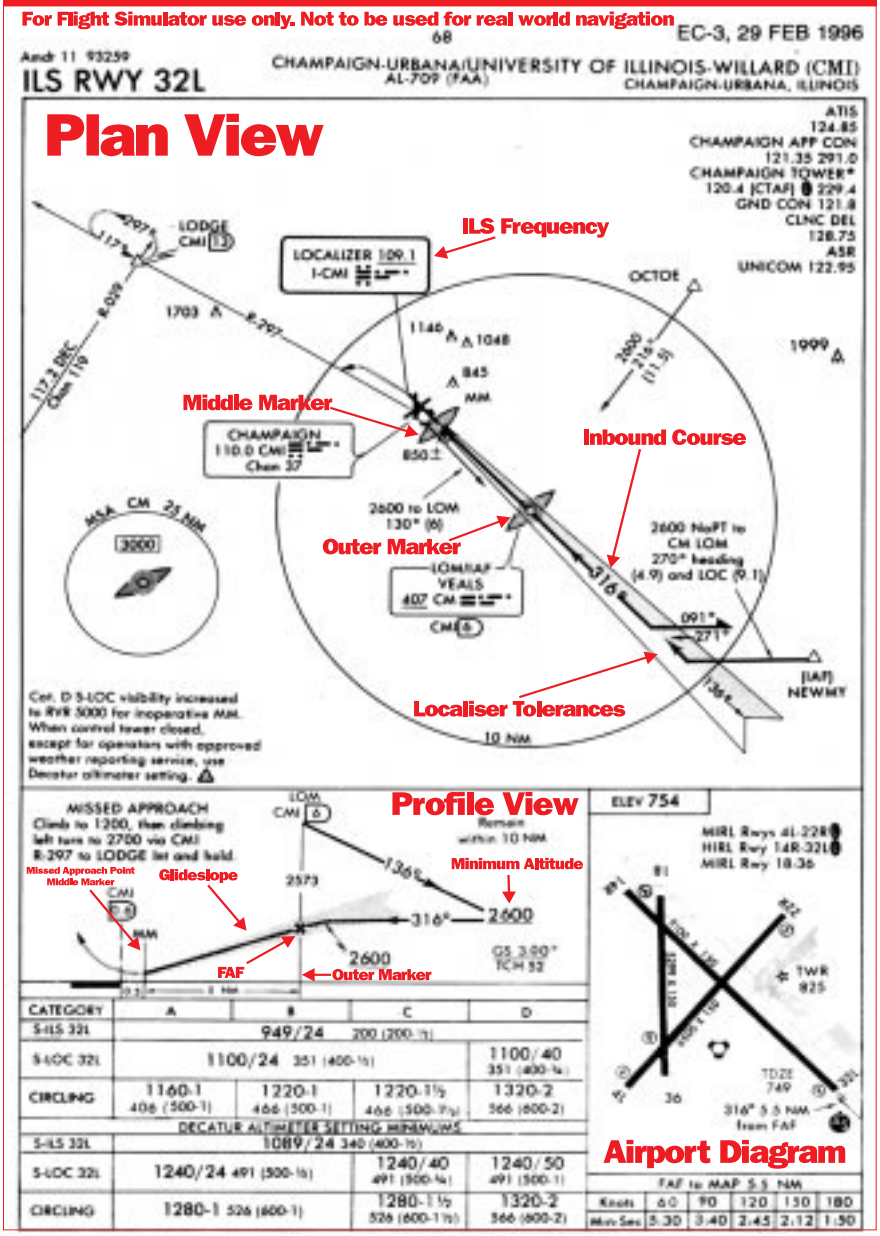
Interpreting The ILS



Above: The ILS receiver in the aircraft. The vertical needle is the localiser, the horizontal needle is the glideslope. The circle in the centre is your aircraft. The aim is to is to centre the needles in the circle as illustrated on the far right.

Below: The ILS Approach chart. Learn to read these and you can fly ILSs anywhere

ILS Approach Chart



centre dot on the ILS receiver and maintain this indication while flying down the ILS.

The difference between the localiser and the VOR

A VOR is a transmitter that emits an omnidirectional (in all directions) signal. *(Refer to our lesson on the VOR Vol 1 Issue 4).* The signal takes into account the OBS setting.

The localiser on the other hand emits one beam only. It doesn't matter what number you have on the OBS the localiser needle only displays a signal if your aircraft's position is within ±35 degrees of the localiser beam. It also doesn't matter which direction your aircraft is pointing. If your aircraft is within the ±35° of the localiser beam you'll receive a signal. It is always a good idea however to tune the OBS to the heading indicated on the approach chart purely as a reminder of the correct heading to fly during the ILS approach.

The ILS Approach Chart

Understanding how to read the ILS chart is an important key to flying ILS approaches. When you understand the basics of reading a chart you'll be able to apply that knowledge to fly ILS approaches into any flight simulator airport with a published ILS approach. For the flight simulator pilot learning to read ILS charts is fun and it's even more fun using what you know to fly the most challenging of ILS approaches. The purpose of the ILS chart is to provide the pilot with information required to fly an ILS approach into an airport under IFR conditions. It contains all of the pertinent information to get the pilot to a point known as the final approach fix where his approach begins plus all the information for the approach itself. It also contains instructions for the pilot in the event of a missed approach.

Let's take a look at an ILS approach chart for Champaign-Urbana University of Willard Airport (left). It's a familiar airport to all flight simulator enthusiasts and it is a simple ILS approach.

Refer to the diagram of the approach chart. It has a plan (top) view, profile view and an airport diagram. On this chart is all the information a pilot requires to fly the approach. The plan view provides a bird's eye view of the approach. On this view there is information such as radio frequencies, obstructions, location of marker beacons, the Initial Approach Fix and heading to fly for the ILS approach in the bold black line printed over the approach cone. In this case the heading for the approach is 316°.

The profile view shows the flight profile for the ILS. The underlined 2600 to the right of the approach path is the minimum altitude allowed before intercepting the glideslope. You must not descend below this altitude until you intercept the localiser. The bold **X** indicates the final approach fix and the commencement of the approach. This is where the Outer Marker is. After you reach this point you will have intercepted the glideslope and can commence the descent down the ILS. MM indicates the position of the Middle Marker. This indicates the missed approach point. If the pilot cannot see the runway approach lights at this point he must execute a missed approach.

The grid of numbers below the profile view shows various minimum cloud heights for the approach. The minimum for this approach is 949 AMSL or 200 feet AGL with a visibility of 2400 feet or 1/2 mile. If the weather is reporting below these parameters for the airport the pilot must divert to another airport. He would not even be permitted to attempt the ILS. Disregard the other numbers for now. We'll cover the entire ILS approach chart in a subsequent issue.

We've covered the absolute basics for now and we have enough knowledge to fly a very simple ILS approach without any fancy stuff for now.

Let's Go Flying!

We're going to start-up our flight in an ILS approach configuration at 2600 feet tracking the localiser into CMI Rwy 32L. We're going to intercept the glideslope and fly the ILS approach and land safely at CMI.

If you have internet access you can download the FS95 ***Flight*** from *http://www.pcaviator.com.au/compilot.htm*. The flight is titled **CMI Rwy 32 ILS Approach** and you can also download the accompanying video to watch me fly it as I've explained it.

Alternatively you can create a flight with the parameters in the next column.Our cloud base for this flight is 1100 AMSL so that gives you an additional 150 feet grace over the minima for this approach. You should do it comfortably.

Approach Configuration

Performing an instrument approach is similar to a normal approach and landing in that you set the aircraft up for approach, commence the approach and then monitor your approach, making appropriate adjustments to your power and pitch settings to maintain the glidepath/glideslope. Refer to our lesson on landings in this issue.

In a Cessna 182 a recommended approach setting is 95 knots, one stage of flap applied and a power setting of around 2000 RPM. Before you commence the approach your aircraft should be trimmed for straight and level in this configuration so that when you reach the final approach fix (FAF) that all you need to do is reduce power to maintain the glideslope.

We're in IFR conditions in an approach configuration for the ILS Runway 32L Champaign

Flight Parameters

Co-Ordinates
North: N039 deg 57' 14.7094"
West: W088 deg 09' 53.3548"
Altitude: 2600
Heading: 316 degrees

Weather
Cloud Base: 1100
Cloud Tops: 4000
Visibility: 1.5 miles
Wind: Nil

Breaking out of cloud and seeing the runway lights streaming right in front of you gives you a great feeling of satisfaction. You're clear to land.

Let's start the flight.

You're at 2600 feet, 2000 RPM, trimmed for straight and level at 95 knots, heading 316 degrees. It is critical that you maintain

exactly 316 degrees heading as only 1 or 2 degrees out can put you way off your correct path. Note that the glideslope indication is showing that you are below the glideslope. This is correct and should be ignored until you reach the FAF. Note also that as you continue that the glideslope begins moving down the instrument. As the needle approaches the centre of the instrument you'll hear the outer marker beacon sound and your blue outer marker light in your cockpit will flash. This signifies the commencement of your approach.
All you need to do when you reach the outer marker is:

1. Lower your landing gear
2. Reduce your power to 1800 RPM

Your aircraft will now begin a descent of around 500 feet per minute down the glideslope. At this stage, most of your focus should be on the ILS. You should still be monitoring your other instruments like any good IFR pilot would.
The aim is to keep the crosshairs centred over the centre of the ILS radio and as it drifts you should make the appropriate adjustments to stop it drifting and then to return it back to centre.

1. If the glideslope is moving up then you are descending too fast and need to apply power to stop your descent until you re-intercept and then re-adjust your power to maintain the glideslope

2. If it is moving down then you need to reduce power to increase your rate of descent until you re-intercept and then re-adjust your power to maintain the glideslope

3. If the localiser is to your right then you have drifted left. Make small heading adjustments with your rudder e.g. take up a heading of 320° to re-intercept and then when the needle is centred then resume a heading of 316 degrees

4. Do the same if the localiser is moving left. It means you have drifted right and need to correct and re-intercept with a small heading change e.g. 312 degrees. When the needle is centred then resume a heading of 316 degrees.

Don't chase the needles. Small, subtle corrections are the secret to tracking the ILS.

Continue on. You'll note as you get closer to the runway that the needles become more sensitive. Local ATIS at CMI is reporting cloud base at 1,100 so when you reach 1,100 AMSL then you should break out of cloud and see the runway become visible. Be ready for this as it really is a satisfying experience. So continue your approach and be prepared to break out at 1,100 feet. When you are visual continue the approach using the ILS. At 950 feet you will have reached your decision height and you will hear the middle marker beacon sounding.
You are visual so you can continue the approach visually. So now prepare for the landing. Apply flap as required, slow the aircraft down to 75 knots and perform a normal landing using all the visual cues you would normally use for a landing.

So you have just performed an ILS approach right down to touch-down!

In the next issue of Computer Pilot we will go through another lesson on the ILS and will cover it more comprehensively. There will be a complete discussion on the ILS approach chart and we'll go through a more comprehensive approach where you will approach the airport from an enroute leg, perform a procedure turn and shoot an ILS approach right down to minimums. It will be a very interesting educational lesson on the ILS approach.

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