INTERPRETING Instrument Approach PLATES

Skill Level: Advanced

By Brent McColl

It's the Salt Lake City winter of 1930, and a young pilot Elrey B. Jeppesen is climbing a smoke stack that menaces the approach path to his local airport. Armed with an Altimeter, he carefully measures the obstruction's elevation and records it in a 10-cent notebook. The Instrument Approach Chart is born, and will go on to become a billion dollar business for the young inventive pilot. Follow along as we learn the art of Interpreting Instrument Approach Plates.

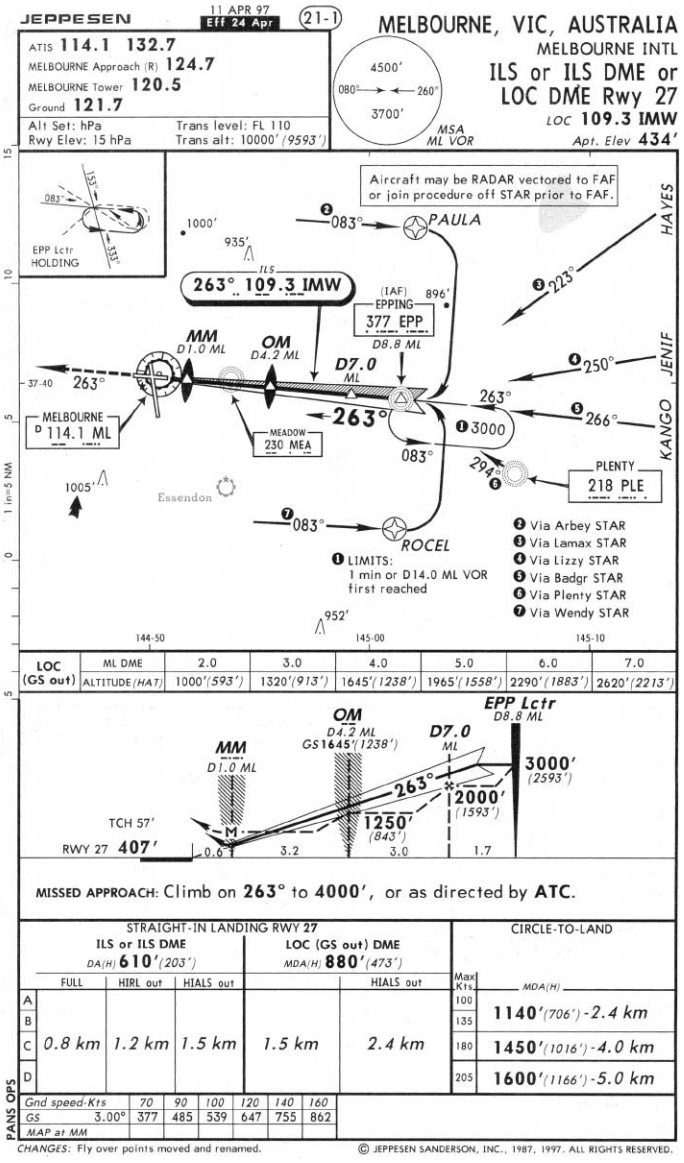
Elrey B. Jeppesen was born into the era where getting to your destination was sometimes as much an achievement as the miracle of flying itself. Jeppesen flew the mail for $50 a week and 14c a mile, risking life and limb to ensure the mail "gets through". The price of this determination was often the loss of life, as weather would force the ill-equipped aircraft lower and lower as it followed the major highways between airports. Jeppesen foresaw a day when aircraft could fly through this weather rather than under it. He began drawing diagrams of the terrain and obstacles in the vicinity of the airfields he flew to and from, allowing a pilot to safely take off and land armed with the knowledge of the location of high ground, chimneystacks and other objects to be avoided. Later in his career, Jeppesen became involved in the introduction of radio navigation, so completing the final piece in the creation of the Instrument Approach Procedure. Thanks to Elrey B. Jeppesen's original concepts, pilots world-wide, in everything from the smallest aircraft to the largest airliner, trust their life to the diagrams published by the company he founded.

Introduction

In this lesson, we are going to learn how to decipher the many symbols and lines that make up a typical approach plate. 'Approach Plates', 'Approach Charts', 'Instrument Approach Procedures', these names all refer to the small paper charts upon which are defined procedures that allow the pilot to descend from an en-route minimum altitude, down to relatively lower height in line with the runway, or at least, to a point within the vicinity of the airport from which a safe landing can be made.

We will not cover the many examples and types of approaches in this lesson; rather, we will select a simple, common approach and present it in detail. Other types of approaches will be covered in future articles, drawing on the symbology and procedure learnt in this lesson. For this lesson I have chosen an approach known to me, and one for which I have performed in both VMC and in IMC. It just happens to be in my hometown, so I think of it as a sort of homecoming, a final transition from sky bound to earth bound. It's also a fairly simple example of this type of approach, and as such, serves as a fairly light first step into the subject.

Let's begin by examining each section from the top down.



Melbourne Runway 27 ILS (Jeppesen SimCharts)

The plate we cover here is the Runway 27 ILS Approach for Melbourne's International Airport. The approach begins at 3000 feet, and guides the aircraft on a track of 263°, across the EPPING Locator, down to a minimum altitude of 610 feet, representing just 203 feet above the threshold of Runway 27.

Header Details

The header portion of the plate contains three main sections from left to right:

- **Relevant communication frequencies associated with the airport;**
- **Minimum Safe Altitude (MSA) specification; and**
- **Approach name in full and airport elevation.**

Index Number

In the centre at the very top of this section, is the Index Number, which is used to provide logical sequencing to the many approach charts for what could be many airports in a given city. Our plate is indexed (21-1), and can be interpreted as follows:

The first digit represents the airport number in the city specified. Melbourne is the second of three airports in the Melbourne area; hence its charts begin with '2'. The second digit is the type of approach (1 = ILS, 2 = GPS, 3 = VOR, etc). The digit following the dash is the filing order for charts of the same type. Melbourne Runway 16 ILS is numbered 21-2, being the second ILS for this airport.

Frequency Box

This is a handy reference of comm frequencies, beginning with the ATIS (Automatic Terminal Information Service) for Melbourne: 114.1 Mhz and 132.7 Mhz. The frequency for 'Approach', 'Tower' and 'Ground' ATC functions are also included in the logical sequence they would be used:

Approach (124.7)	during initial maneuvering to the commencement of the ILS;
Tower (120.5)	during the approach itself; and finally
Ground (121.7)	after landing and clearing the runway.

Below the frequency box there are some details of the altimeter settings for the airport, showing that Hectopascals (hPa) are used, and the barometric pressure corresponding to the airport elevation (QFE: generally only used in the UK). Also shown is the Level (FL110) above which altimeters should be set to 1013 hPa to read Flight Level. Below 10000' altimeters should be set to sea level pressure (QNH) to read altitude, which equates to 9593' above the threshold of our runway concerned.

Minimum Safe Altitude (MSA)

In the centre of this top section, the minimum safe altitude (MSA) is displayed. This circle represents the lowest altitude you may fly within 25 nm of the specified approach aid (ML VOR in this case). Some charts show one altitude, others like this one are divided into sectors. So, if we are arriving from the north between the sector 080° inbound through to 260° inbound, then we can safely descend to 4500 feet when within 25 nm. Arrivals from the south of that sector may descend to as low as 3700 feet when within 25 nm.

ILS or ILS DME or LOC DME Rwy 27

This is the full title of the approach, and is very important. It doesn't just say Rwy 27 **ILS**, rather it indicates each alternative approach as follows:

ILS	The full ILS procedure using the Localizer and Glideslope, Epping Locator and Marker Beacons;
ILS DME	As above but using the DME in lieu of the Marker Beacons;
LOC DME	As above but using just the Localizer without the Glideslope.

LOC *109.3 IMW*

Indicates the primary approach aid in the approach, and its frequency. In this case, it's the Localizer on 109.3 MHz.

Finally, the airport elevation is specified as 434 feet.

Plan View

The main focus of any approach plate is the plan view, providing a complete specification of the tracking requirements of the approach. This includes arrival and holding information, as well as the tracking for the approach itself and finally the missed approach. The plan view is oriented to True North, and has a distance scale down the left-hand side.

Holding Patterns

The Melbourne 16 ILS chart has only one holding pattern associated with it at EPP Locator. This is shown in situ as a left-hand racetrack pattern at Epping. The inbound and outbound course is indicated near each arrowhead (263° and 083° respectively), and the minimum altitude in the hold (3000). The 1 refers to a note, in this case to the lower-right side of the plan view that states:

> 1 LIMITS:
> 1 min or D14.0 ML VOR
> first reached

This note simply states that you must not fly outbound for longer than 1 minute or 14 miles from Melbourne VOR before turning inbound again. On some charts there can be more than one note, and these notes could say just about anything about any facet of the approach.

Still on the subject of Holding, if there are holding patterns specified on the chart, Australian charts have the entry sectors and maneuvering specified for each shown somewhere in the plan view. In our case, it's to the top-left of the plan view, showing the entry sectors into the Hold at EPP Locator. *For a refresher on Holding Pattern entries, refer to Computer Pilot Vol 3 Issue 1 on page 54.*

Track Specifications

There are four more common types of lines drawn on the plan view:

- A thick line represents the primary approach course (the 263° course in our example);
- A medium line represents arrival or transition routes to the commencement of the approach (the 083° course via PAULA for example);
- A thin line is used to represent Holding Patterns (Holding at EPP for example); and
- A medium dashed line represents the Missed Approach tracking (straight ahead on 263°in our case here).

So, looking at the plan view generally, you can see the airport is drawn in position, with ML VOR (114.1 Mhz) shown in its true geographic position to the right of our Runway 27. The ILS is shown as a white/grey hatched splay radiating out along the reciprocal approach course, with the Middle Marker (MM) and Outer Marker (OM) shown in their position along the inbound course. Distances from the DME facility are shown preceded with a 'D', such as the DME distance from ML DME to the OM (D4.2 ML) representing 4.2 nm. Finally, the frequency and ident (letters and morse code) for the ILS are shown as:

> 263° 109.3 IMW

Locator Beacons

Tucked in under the approach course is the MEADOW Locator (230 kHz) between the MM and the OM. With EPP Locator shown at D8.8 ML. Almost every ILS installation has a Locator established at the commencement of the approach. This enables a pilot to navigate to the commencement of the ILS manually, without guidance from ATC (although this is the more common entry method).

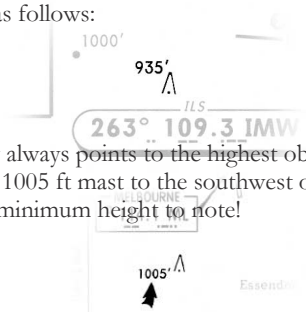
A third Locator Beacon is shown as part of the Plenty STAR (PLE 218 kHz). A STAR is an abbreviation for Standard Terminal Arrival Route, and is a published arrival clearance. We covered STARs in a recent issue of Computer Pilot.

Topographical Features

Spot heights and heights of objects (such as chimney stacks like those climbed by Captain Jeppesen) are depicted on the plan view. Spot heights are shown in feet AMSL (Above Mean Sea Level):

- 1000'

Indicating the highest altitude of the terrain in that immediate area. Aboveground obstructions are shown with a cocked hat and an altitude AMSL as follows:



A thick arrow always points to the highest obstacle on the chart. In this case it's the 1005 ft mast to the southwest of the airport. This is a handy absolute minimum height to note!

While it's not the intent of the chart to enable visual navigation, some limited, visual topographical features are shown where they may provide visual cues the Instrument Pilot. Supplemental features include water boundaries and coastlines, such as the reservoir shown to the top-right on the plan view, and key aeronautical features such as Essendon Airport just south of the approach track. These features are shown in light grey in the plan view.

LOC (GS out)	ML DME	2.0	3.0	4.0	5.0	6.0	7.0
	ALTITUDE (HAT)	1000' (593')	1320' (913')	1645' (1238')	1965' (1558')	2290' (1883')	2620' (2213')

DME/Altitude scale

We now move into the vertical navigation sections of the plate. Beginning with the DME/Altitude scale immediately below the Plan view. This scale is used to provide a supplemental Glideslope reference by correlating altitude with distance. If your Glideslope receiver fails - or the Glideslope on the ground is off for maintenance, as they often seem to be - then this scale assists you to perform a Localizer Approach (LOC DME) at a constant descent rate (In which case, a higher minimum is used and is published at the foot of the plate).

It's important to note that this scale is a guide only. Descent restrictions published on the profile diagram must be adhered to in any case.

Profile View

Completing the three-dimensional picture of the approach is the Profile diagram, showing the altitude minima at strategic distances or fixes along the approach track. The flight path is from right to left in this example, in order to logically flow in the direction of the plan view. Had the approach been to the East, then the profile view would be reversed, being flown from left to right on the page.

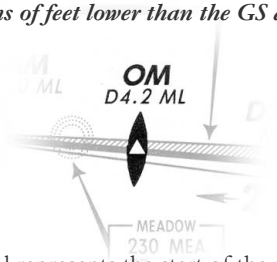
Let's study the profile view for a moment.

It all begins to the right with a minimum altitude of 3000 ft crossing EPP locator. Shown in braces is the height (2593') Above Ground Level (AGL). The procedure then has a level segment, until intercepting the Glideslope of the Runway 27 ILS.

Descent commences following the GS until crossing the OM at 4.2 DME ML. There is a supplemental descent path shown with the dashed line. This represents the Runway 27 LOC DME approach. If we did not have GS guidance, then we would be permitted to descend to 2000 ft after crossing EPP Locator, with further descent crossing the D7.0 ML position where we continue to 1250 ft until the OM, etc.

The Glideslope continues until it crosses the MM at D1.0 ML. The MM is 0.6 from the threshold of Runway 27. The runway is presented as a thick black stripe with the threshold elevation shown as 407 feet.

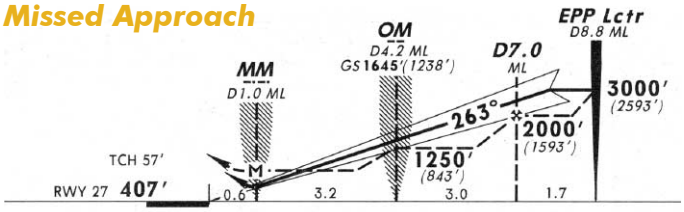
'TCH' is the abbreviation for Threshold Crossing Height - the height that the Glideslope crosses the very start of the runway. An aircraft 'on slope' with have its GS antenna cross the start of the runway 57 feet above its surface. While this is immaterial for our tiny Cessna 182, larger transport types need to take this into consideration where wheels can be tens of feet lower than the GS antenna on the aircraft.



The 'M' symbol represents the start of the missed Approach when performing the LOC DME approach. If you are not 'visual' by this point, you must go around in accordance with the Missed Approach procedure specified later on the chart. For aircraft following the full ILS, the Missed Approach begins when you reach the altitude minima specified (More on this later).

Distances between each fix are published at the base of the diagram. The distance from the OM to the MM is 3.2 nm for example.

Missed Approach



Missed Approach is to climb to 4000 feet while tracking 263° or as directed by ATC.

If you do not get below the cloud, or you are clear of cloud but the visibility is less than the minimum specified for the type of approach or operation you are performing, then you must follow these instructions immediately from the Missed Approach point (MAP) shown by the 'M' when doing the LOC DME, or from the Decision Altitude (DA) as published in the table at the base of the chart.

Landing and Circling Minima

The table near the lower part of the plate specifies the minimum altitudes and visibility minimus that must be adhered to for the type of approach, or other conditions.

Divided primarily between:

- **STRAIGHT-IN; and**
- **CIRCLE-TO-LAND**

depending on wether you are landing straight ahead on Runway 27, or using the ILS to get below cloud before maneuvering to land on another runway (Circle-To-Land).

Looking at the CIRCLE-TO-LAND minimums firstly, you can see that three different pairs of minimum altitude and visibility minima are specified. These correspond to the approach speed of the aircraft. We are Category A and this corresponds to the first minima (1140' and 2.4 km vis). The categories are labelled down the left-hand side of the Minima table, A through D. Category C aircraft (such as a Boeing 737) require a minimum of 1450' (1016' AGL) with 4.0 km visibility. Bombardier CRJ Regional Jet aircraft are Cat D, requiring the 1600'/5.0 minimums.

Then to the left of this, the table further divides the runway approach into ILS (with GS) and LOC (without GS). Finally, for each type there is a set of minima for operations with and without High Intensity Approach Lighting (HIAL) and High Intensity Runway Lighting (HIRL).

Footer

At the foot of the approach is a scale that assists you in determining your rate-of-descent to comply with the 3° GS. For example, if you were approaching at 120 knots, with a 20-knot headwind (120 - 20 = 100 knots groundspeed), you would aim for a rate of descent in the order of 539 ft/min.

Finally, any general notes are published in the box to the right.

Summary

We can all take our hats off to Elrey B. Jeppesen for his meticulous attention to detail, and for risking his life climbing those smoke stacks. His attention to detail lives on in these excellent publications. Our thanks go to Jeppesen for allowing us to reproduce these charts from Jeppesen SimCharts software. These charts are available on CD from PC Aviator, and if you are serious about practicing Instrument Approaches, why not order a set for your part of the world.

Until next flight…
Keep Flying ✈