

Creating ILS Approaches for FS2004 (with a few notes about flying them)

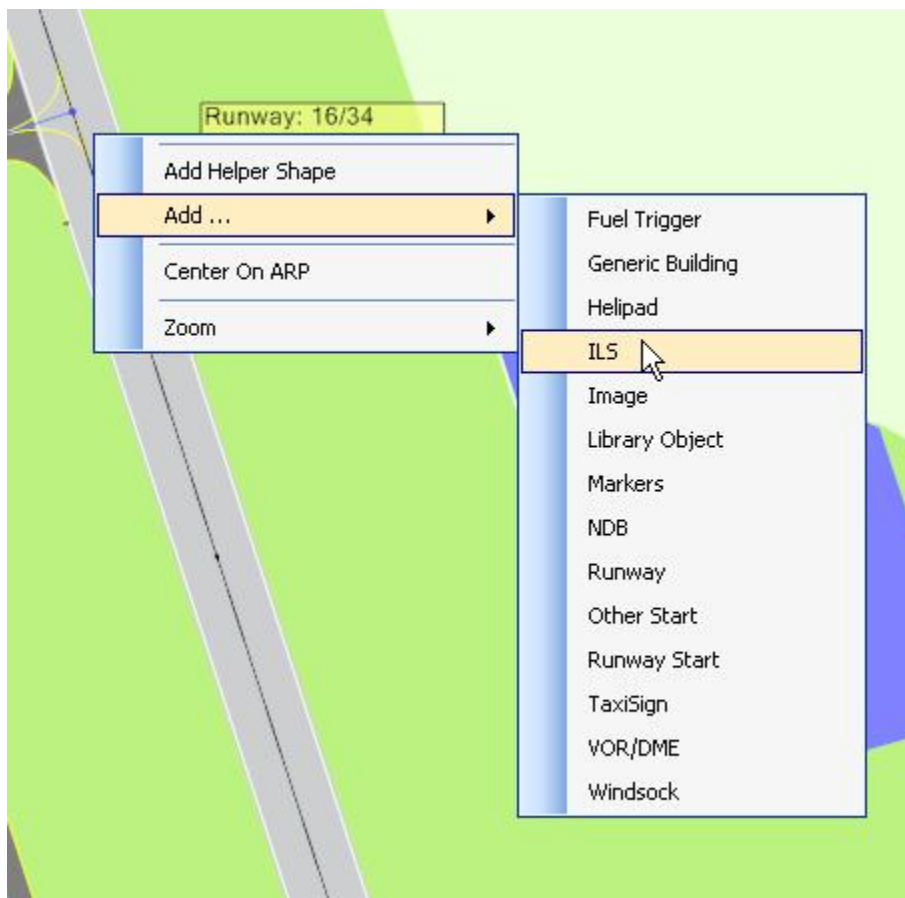
The reason I created this tutorial is that I had such a heck of time getting this to work! I searched around every forum I am aware of, and found very little on this subject, and much of what I did find was in the way of rather confused discussions and occasional hints, some of them more misleading than helpful (although some hints certainly were helpful). Anyway, I did finally get things working, and I thought I might as well try to spare others following the same path some of the troubles and headaches I went through.

The topic here is primarily *creating ILS approaches* – i.e. you’ve got a runway that doesn’t have an ILS, and you want to give it an ILS and have that ILS work as an approach that will be assigned and used correctly by the sim ATC. You might want to do this because there is a runway that didn’t have an ILS at one time but does now. The first time I did this was to add the ILS approach for Runway 26 at CYTZ, the Toronto City Centre Island Airport – this doesn’t exist in FS2004, as it didn’t used to exist in the real world; but it now gets constant use from Porter’s flights into CYTZ. Recently I returned to the fray, since I was doing a bunch of Southwest flights and wanted to fly into KECP, the new Beaches International Airport near Panama City in Florida, which Southwest connects with KBWI, KBNA and KMCO (and Delta/ASA connect with KATL). I found a couple of AFCAD files for KECP available for download, but neither of them included a working ILS approach (i.e. an approach that the built-in ATC in FS2004 would assign to you). Both had the I-PUK ILS for runway 16 correctly defined, so you could tune it into your Nav radio and fly the localizer and glideslope, but in neither case would ATC offer you the ILS approach as an option – all you could get was visual approaches to 16 and 34. The reason for this (and this is fairly well documented, so I was aware from the start that this was the issue) is that in order for ATC to use an ILS for landing the ILS **must** have a valid approach defined and associated with it – no approach, no ATC assignment. Of the two AFCAD files I downloaded for KECP one had no approaches defined at all, and the other had an approach defined for ILS 16, but it was rather mangled and didn’t work. Note that KECP (<http://iflybeaches.com/>) is a brand new airport – it opened May 23rd 2010. As such, it inherits no attributes from the default scenery in FS2004.

So... you want to define an approach to get your ILS working with ATC – how do you do it? At one time you pretty much had to edit BGL source code by hand and then compile it; and this was made more difficult by the fact that the standards that a working approach had to follow were not well defined (they certainly aren’t clearly spelled out in the FS2004 SDK). We do have things a bit easier now, with more tools available, but it still isn’t simple. The tool I have been using to edit approaches is ADE9x (<http://www.airportdesigneditor.co.uk/>). This is an excellent editor for both FS2004 and FSX airports, and includes a mode for working with approaches. References to ADE9x in this tutorial are taken using ADE9x v01.46.02 – I see that v01.50 is now available, but I haven’t tried that yet. Perhaps it helps with some of the issues discussed here. I may also have missed better ways of doing some of the things discussed here – if you know of a better way around some of these issues, please let me know.

Anyway – on with the meat of things. Let’s define an approach and get it working.

First you need to have an ILS assigned to the runway, if it isn’t already there. You can do this in ADE9x. Open the program in FS9 mode, and open the airport you want to work on (I’m not going to cover creating airports from scratch in this tutorial – there are various tutorial available for that). If the ILS you want is not there with the runway, you can add it by right-clicking and selecting the Add menu, and then ILS from the list of items to add:

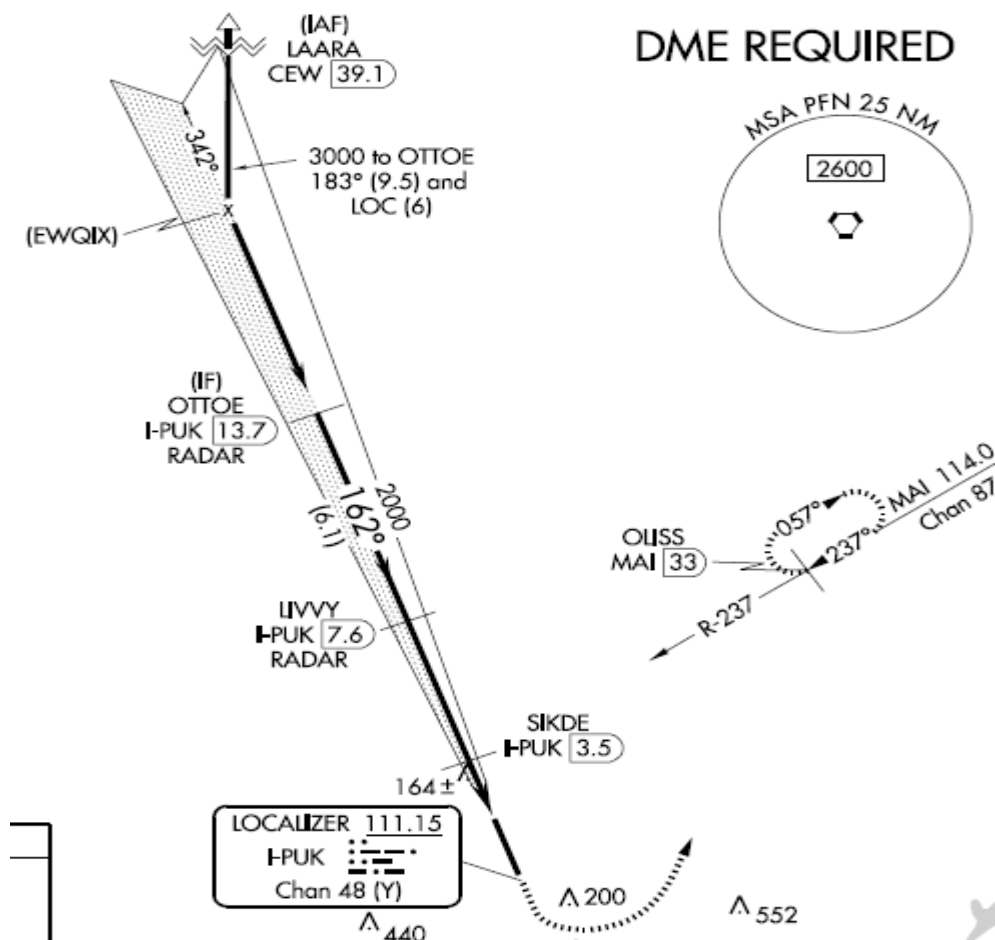


When you do this, you will get a pop-up to define the ILS:

 A screenshot of the 'Define ILS' dialog box. It has the following fields and controls:

- 'Runway' dropdown menu set to 'Rwy 03'.
- 'Ident' text box containing 'IABA'.
- 'Name' dropdown menu set to 'ILS/DME 03'.
- 'Frequency (MHz)' dropdown menu set to '110.15'.
- 'Range (Nm)' spinner box set to '27.0'.
- 'Has Glide Slope' checkbox checked.
- 'Has DME' checkbox checked.
- 'Enable Back Course' checkbox unchecked.
- 'Create ILS Approach' checkbox checked.
- 'Add' button at the bottom left.
- 'Cancel' button at the bottom right.

You will pick the runway the ILS should be associated with, define its Ident (the identifier that will show up for the ILS on your Nav equipment), its frequency, range, etc. Most of this is, hopefully, pretty self-explanatory if you have worked much with ILS landings. You can get these details from a plate for the real approach, if you have access to one (generally you can get most from <http://flightaware.com/>). Here's a piece of the plate for the I-PUK ILS on Runway 16 at KECF that I was trying to get to work:



You can see that this is an ILS with DME, that its Ident is I-PUK (just use IPUK in ADE9), that its frequency is 111.15 etc. Once the ILS has been added in ADE, you can edit its properties by right-clicking on it and selecting 'Edit object' from the pop-up menu. You will get a properties page which looks (partially) like this:

Airport	KECP	Runway	16
Name	ILS/DME 16		
Ident	IPUK	Freq	111.15
Range (Nm)	27.0	Mag Var	0.00
Beam Width	6.0	Enable Back Course	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Glide Slope		<input checked="" type="checkbox"/> DME	
Lat	N30 22.117093	Lat	N30 20.610221
Lon	W085 47.955206	Lon	W085 47.448859
Angle	3.0		
Location			
Latitude	N30 20.610221	Alt [Meters]	20.908
Longitude	W085 47.448859	Heading	162.000000
<input type="button" value="Set by Drag"/>			

Notice that you can set additional things on this properties page, such as the Beam Width and Glideslope angle.

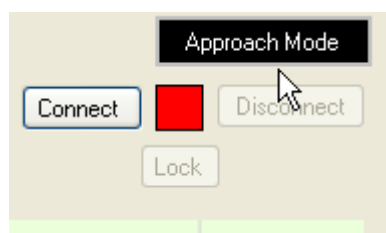
Once you have created your ILS, you will want to place it on the airport. Normally ILS equipment will be placed at the far end of the runway for which it is used – so, for example, at KECP, the ILS equipment for Runway 16 will



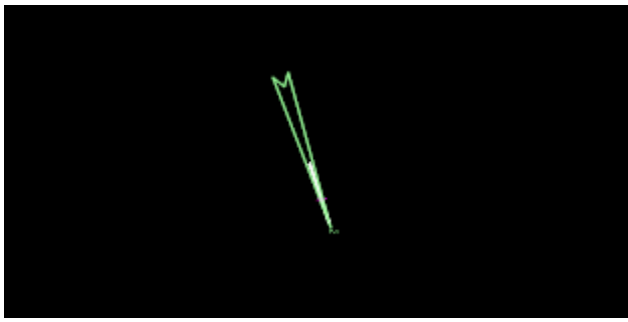
be at the far end of Runway 16, i.e. behind the start position for Runway 34 – see the cap from ADE9 at left. The green ‘fan’ is the ILS and the square box with the dot in it is the DME. This is typical placement for an ILS at the end of the runway. Sometimes it is not possible to place the ILS equipment at the end of the runway in real life – e.g. at CYTZ, which is on a small island with very little room, the ILS equipment is beside the runway, and the ILS approach course differs from the runway course by about 3 degrees, bringing landing aircraft in quite neatly to the start of the runway, but requiring a turn of 3 degrees to land.

Anyway... let’s presume that you’ve now got your ILS. If you compile your airport like this (‘Compile Airport’ from the File menu in ADE) and place the resulting BGL in a scenery folder where FS2004 can find it, you should be able to tune the ILS created in ADE in on your Nav1 radio, and use APP mode with your auto-pilot to fly the localizer and glideslope in to the runway (a bit more about flying ILS approaches further on in this doc). But you will not get offered an ILS approach by the FS2004 built-in ATC when you fly into the airport (not unless you were working on a previously existing airport, and the approach is defined in some other BGL in

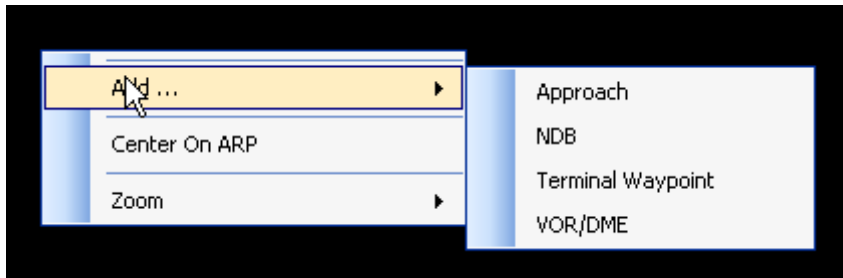
your scenery). Assuming we are talking about a brand new airport, or at least a brand new ILS on a runway that never had ILS before, then ATC will not offer you the option to land with ILS on the specific runway. For example, flying into KECP with either of the AFCAD files I downloaded, all I got offered was VISUAL 16 and VISUAL 34. This is normal. To get the ILS working with ATC we need to open the airport again in ADE (either open it from a saved ADE project file, or use ADE’s ‘Open Airport from Bgl’ option). Now we need to use ADE’s approach mode, which is accessed by pressing the button in the top right corner:



When you click this button, the familiar airport layout in ADE will disappear and be replaced by a whole new world. And at first a rather empty one. All you will see, if this is a new airport and no approach work has been done on it, is a black screen with the runway and ILS at the centre:



This is where you will create your approach and get it working. You could start straight in and add an approach – but any approach will need some waypoints, and it's probably best to start by adding these. You can do this by right-clicking anywhere and choosing Add... and then the type of point you want to add:

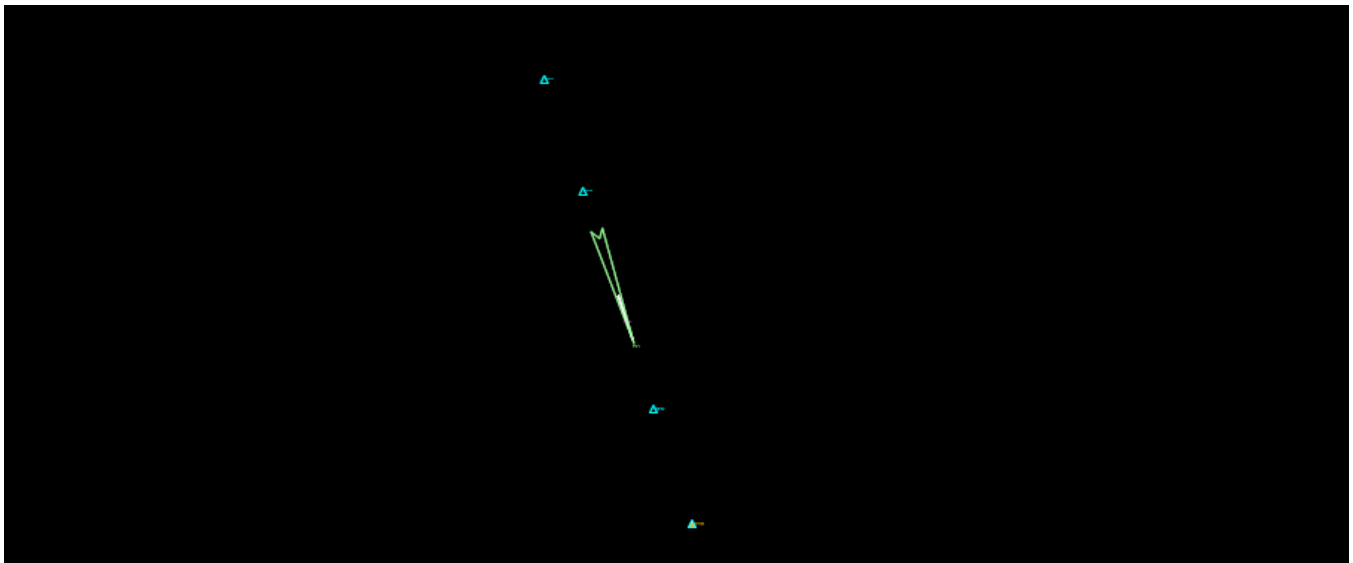


In general, I'd suggest that you just use Terminal Waypoints for your approach. If you are working from a real plate, you can add real waypoints. However it doesn't always work too well to put up approaches in FS exactly as they are in the real world. If you look at the section from the plate for the I-PUK approach at KECF on page 3 above, you will see that the furthest out fix for this approach is LAARA, which is followed by a 9.5 mile leg at 183°, turning onto the final approach heading of 162° and descending via OTTOE, LIVVY, and SIKDE. In FS, ATC will simply position you around 6-10 miles outbound from the initial fix for your approach, give you a heading 30° off the final approach heading to follow, and tell you to maintain your heading and altitude until you intercept the localizer. If the initial fix of the approach is too far from the runway, this will create problems, as ATC will vector you to intercept the localizer so far away from the airport that you won't even be able to detect the localizer signal. More on dealing with situations like this below. But for now... don't get too complicated in defining your ILS approach for ATC to use. If you do want to add more complicated manoeuvres prior to actually capturing the localizer, those can be added as Transitions. But for the main ILS approach itself, I'd suggest sticking to a couple of waypoints before the runway, with the furthest out waypoint not more than 12 miles

Ident	LIVVY
Type	FAF
Mag Var	-1.60
Region ID	K7

from the threshold. So, in the case of I-PUK, we can use OTTOE, which is 11.9 miles from the threshold as our initial fix, and LIVVY, 5.8 miles from the threshold, as an intermediate fix. You can add SIKDE as well if you want, but I'm not going to bother in this example. You will also need one or two waypoints for your missed approach legs. I'm not going to get too accurate with those – I will just put in a simple, generic missed approach. So... let's add some waypoints. At the left you will see that I am adding LIVVY as a fly over fix. Then I will add OTTOE as an IAF. Then I'll add another FAF, and a generic 'UNNAMED' waypoint for the missed

approach. So now my map in ADE looks like this:



Don't worry too much about where to put the waypoints – just right-click and add them in approximately the place you want them. We'll position them more exactly as we edit the approach. Now we have enough waypoints to create an approach, so we will go ahead and add one – right click, select Add and then select

Runway

Approach Type

Fix Type

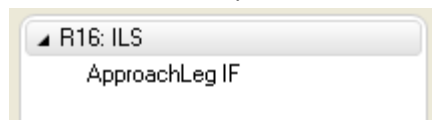
Fix Ident

IAF Type

IAF Ident

Approach. You will define the basic attributes of the approach in the pop-up that appears. You can see that I have indicated that this is an ILS approach for Rwy 16, and that the initial fix will be Terminal Waypoint OTTOE. I have read in some forum posts that ILS approaches will only work with ATC if the initial fix is a VOR. I have not found this at all. Approaches seem to work fine with any type of initial fix, so long as everything in the approach is defined **completely** and **consistently** – and this is the key to getting the approach to work. More on this later. Having added our approach with its initial fix defined as OTTOE, we will see the approach appear in the object editing boxes at the right of the ADE Approach Mode screen. These are very important for properly editing our approach. The box at the top right shows the components of the approach, and it is here that we will add additional components. At the moment, the only component that

exists is the Initial Fix, so all we see is this:



When we select an item in this list at the top right, the box at the bottom right will show the attributes for the item selected – this is very important to keep track of. The only way I have found to edit the attributes of the Approach itself is to click on the main line for the Approach at top right – so, if you click on the bar that says R16 ILS in the picture above, you will see the basic attributes for the Approach itself (as opposed to any of its legs) in the box at bottom right:

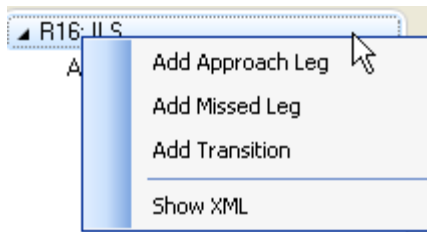
Approach: R16: ILS	
Type	ILS
Rwy #	R16
Rwy Des	NONE
Suffix	0
GPS Overlay	<input type="checkbox"/>
Fix Type	TERMINAL_W...
Fix Region	K7
Fix Ident	OTTOE
Appr Alt Meters	640.08
Missed Alt Met...	944.88
Heading & Default Turn	
Heading Deg	161.799988
Rwy Heading	0
Default Turn	LEFT

These attributes must be consistent with the actual legs of the approach, or the approach will not work. In the release of ADE that I have been using (1.46.02), ADE will let you compile the approach with inconsistencies or with incomplete items without issuing any warnings, for the most part, but the approach will not work with ATC if it is incomplete or inconsistent. So, we can see above that the approach is defined as having an initial Fix Type of TERMINAL_WAYPOINT with the initial Fix Ident being OTTOE. The approach altitude and missed approach altitude are defined in metres. You can change these if you wish to other reasonable (or real-world) values. Note that these values are entered in metres, so if you use feet in FS you will need to convert from feet to metres before entering the values here. The values above represent an approach altitude of 2100 feet and a missed approach altitude of 3100 feet. If you click on the line that says ApproachLeg IF, you will see at bottom right the attributes for the Initial Fix 'leg' of the approach:

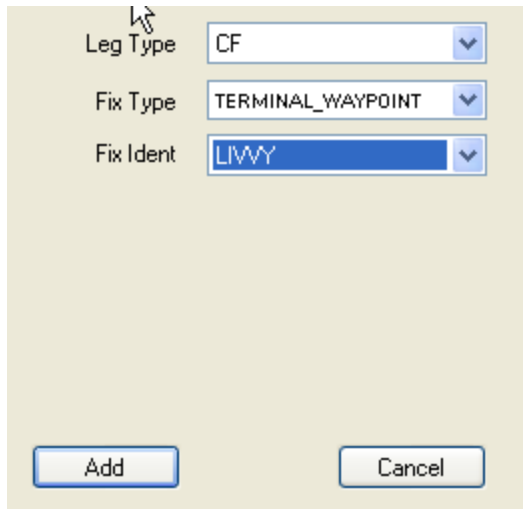
Approach Leg: IF	
Required	
Fix Type	TERMINAL_W...
Fix Region	K7
Fix Ident	OTTOE
Optional	
Rec Type	NOT_SET
Rec Region	
Rec Ident	
Theta Deg	0
Rho NM	0
Alt Desc	PLUS
Alt1 Meters	640.08
Alt2 Meters	0

Currently, since we just created the approach, these are consistent, showing the Initial Fix as TERMINAL_WAYPOINT OTTOE. But if you change the values here, they will **not** (at least in 1.46.02) automatically change in the main approach attributes, so you will need to bring those up and change the values there too, or your approach will **not** work (e.g. if the definition of the approach says that the initial fix is a VOR, but the actual Initial Fix leg definition points to a waypoint – perhaps this is how the idea got started that the initial fix must be a VOR... if VOR is chosen as the Fix Type for the approach in the main attributes, then indeed the initial fix must be a VOR, but if TERMINAL_WAYPOINT is selected as Fix Type in the main Approach attributes, then the initial fix **must be** a TERMINAL_WAYPOINT, and so on....)

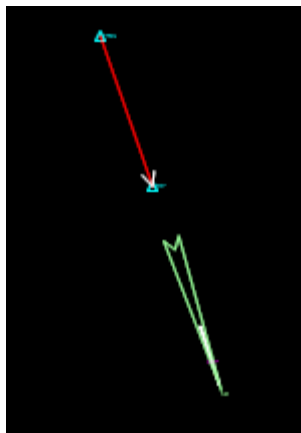
So, now we need to add the rest of the legs to our approach. We do this by right-clicking on the approach bar at top left and selecting the appropriate item to add:



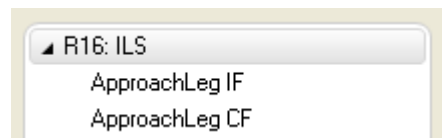
First we will need to add approach legs to bring the approach from the initial fix to the runway. The next waypoint we want to fly to after OTTOE is LIVVY, so we add an Approach Leg to LIVVY:



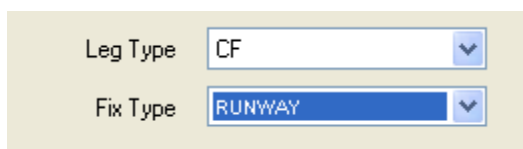
This will add a leg, which will appear both on the map:



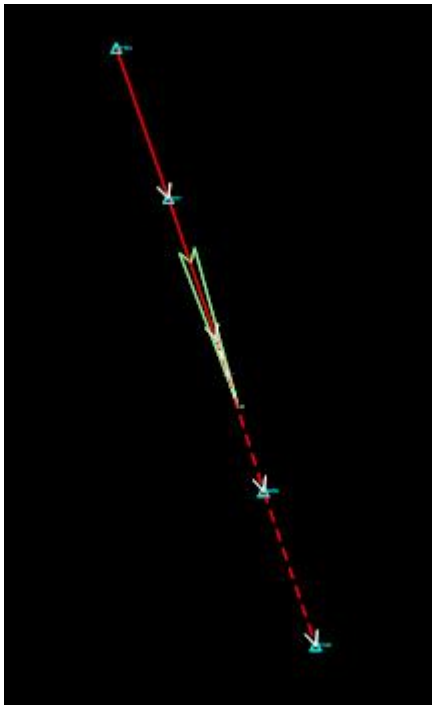
and in the list at right:



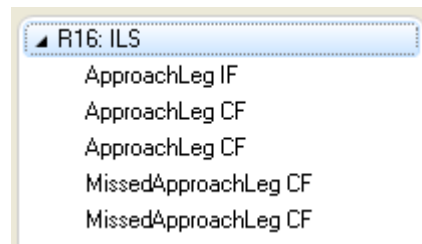
Note that the leg on the map is red – this is a *bad thing*. If your approach has any legs that show in red on the map, then generally it will **not** work. We will need to fix this. But for now let's add the rest of our legs – another approach leg to the Runway:



And then Missed Legs to each of the waypoints we placed after the runway. So now our map looks like this:

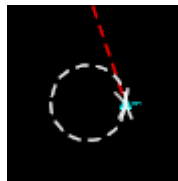


and the list like this:



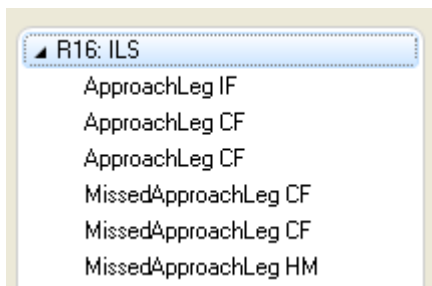
We will generally want some kind of hold pattern in the missed approach. To get this, we just add another Missed Leg, and choose a type starting with H:

Leg Type	HM
Fix Type	TERMINAL_WAYPOINT
Fix Ident	HH16N

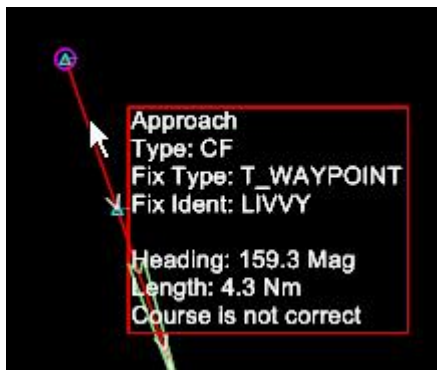


This will look like this on the map: , at least until we fix up its attributes a bit, later.

Now we have defined enough legs for a complete approach, but all except the hold are displaying on the map in red, and the approach certainly will not work this way. We need to select each leg in the list at top right:



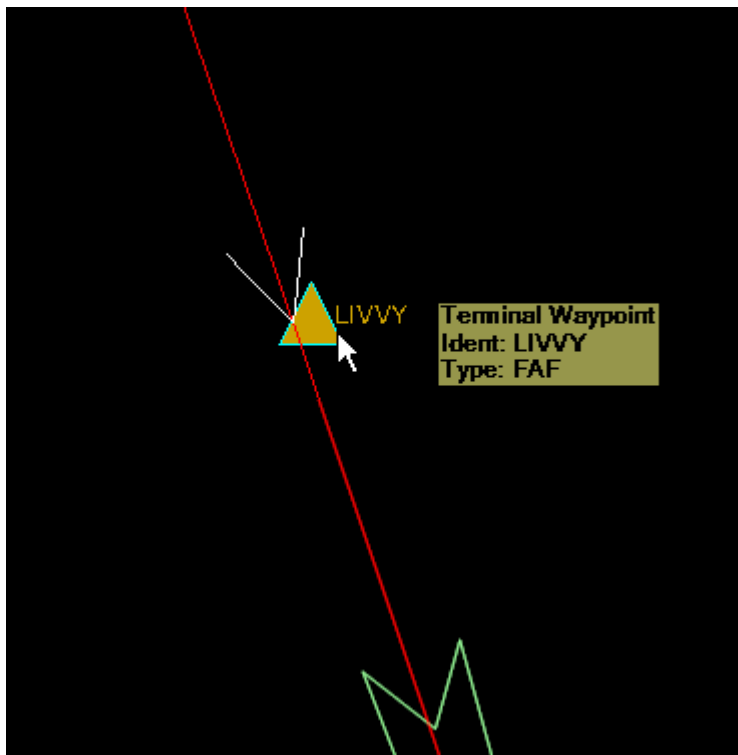
and edit the attributes, at least those indicated as Required, in the box at bottom right. If you put your mouse cursor over one of the red legs on the map, you will see a pop-up:



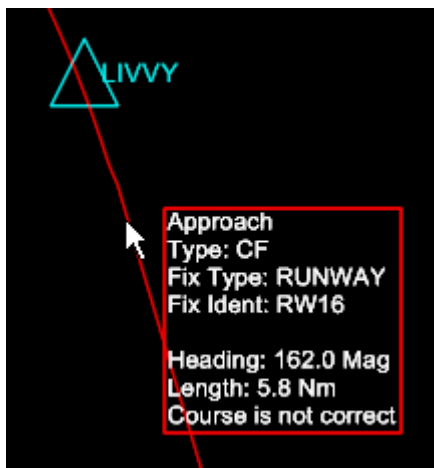
This shows some attributes for the leg, and gives us a clue as to why the leg is red – the message ‘Course is not correct’. What does this mean? Are we not indicating the aircraft should fly in the right direction? What it means is that the value for the course in the leg attributes is not set correctly:

Approach Leg: CF	
Required	
Fix Type	TERMINAL_W...
Fix Region	K7
Fix Ident	LIVVY
Fly Over	<input type="checkbox"/>
Course Type	MAGNETIC
Course Deg	0
Distance NM	0
Optional	
Turn Dir	NOT_SET
Rec Type	NOT_SET
Rec Region	
Rec Ident	
Theta Deg	0
Rho NM	0
Alt Desc	NOT_SET
Alt1 Meters	0
Alt2 Meters	0

Indeed, as you can see, both Course Deg and Distance NM (the course and distance for the leg) are set to zero. And these are **required** attributes, so the approach will not work if they are not set. I don't quite understand why ADE doesn't just value these items, since clearly the heading and length of the leg are known (they're listed in the pop-up shown above – 159.3° Mag and 4.3 Nm)... but perhaps I'm missing something. In any case, you can, in fact, just take the values from the pop-up that appears when you put your mouse over a leg, and enter them in the box at bottom right. You must do this for each leg (except the hold). And if you subsequently change the leg, for example by moving a waypoint, then you must update the attributes for the leg in the box at bottom right again, or the approach **will not** work. Given that the attributes entered at bottom right must match the final configuration of each leg, it is best to fiddle with the legs first and make sure you have them the way you want them, **before** filling in the attributes in the box for each leg. Generally you will want your approach legs to line up with the runway. Since we just placed our waypoints by approximate clicking (see above), the legs are not going to be exactly right at the moment. I'd suggest fixing them by gently moving the waypoints. To do this zoom right in on waypoint – click on it with your mouse, then zoom in with the mouse wheel. Then you'll find it easy to select the waypoint, and you can move it by dragging:



The legs attached to a waypoint should move with it, so you can use this to adjust both the length and heading of a leg. So we can work out from the runway. We can see from the plate that LIVVY should be 5.8 Nm from the runway on a heading of 162°. So we can drag the LIVVY waypoint until the pop-up for the leg from LIVVY to the runway shows these values:



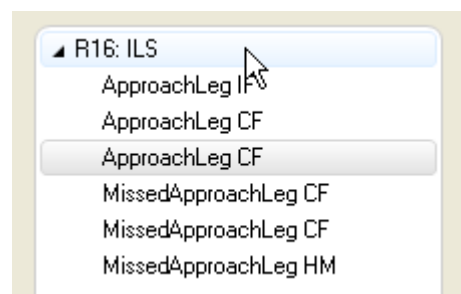
Unfortunately you can't see the pop-up for the leg at the same time you are dragging the waypoint, so it's a bit fiddly getting it to just where you want it, but it certainly can be done – I'd suggest getting the distance right first and then making very small sideways movements to get the heading right. This is not all strictly necessary to get the approach to work – the exact distance really doesn't make any difference to the functioning of the approach (so long as the attributes in the box agree with the map), and the heading can be a bit off, and you can still fly the approach fine. But... most of us probably like to get things tidy, and, as far as possible, even agreeing with the real-world approach. Once you have your waypoints, and hence your legs, the way you want them on the map, fill in the attributes for each leg by selecting it (either on the map or in the list at top right), and then entering the values in the box at bottom right:

Approach Leg: CF	
Required	
Fix Type	RUNWAY
Fix Region	K7
Fix Ident	RW16
Fly Over	<input type="checkbox"/>
Course Type	MAGNETIC
Course Deg	162
Distance NM	5.8
Optional	
Turn Dir	NOT SET

If you do that for each leg, you map will now look like this:



All of the legs are white, except for the one that is selected, which is purple. This is how the approach **must** look (in terms of colours) if it is going to work. However, an approach that looks like this is no guarantee of a working approach – there still could be inconsistencies between the attributes of one leg and another, or between the attributes of the approach itself and the legs – so check and check again the attributes of each item, by selecting them and inspecting the box at bottom right, not forgetting to click on the main bar for the approach itself to check its attributes:

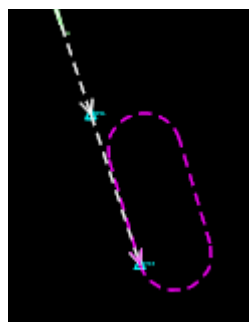


The final thing you might want to do is fix up the attributes for the hold. This seems to be what you get by default when you add a hold:

Missed Approach Leg: HM	
Required	
Fix Type	TERMINAL_W...
Fix Region	K7
Fix Ident	HH16N
Turn Dir	NOT_SET
Course Type	MAGNETIC
Course Deg	0
Leg Basis	Distance
Distance NM	0

I'd suggest changing to a time based hold:

Missed Approach Leg: HM	
Required	
Fix Type	TERMINAL_W...
Fix Region	K7
Fix Ident	HH16N
Turn Dir	NOT_SET
Course Type	MAGNETIC
Course Deg	162
Leg Basis	Time
Time	1

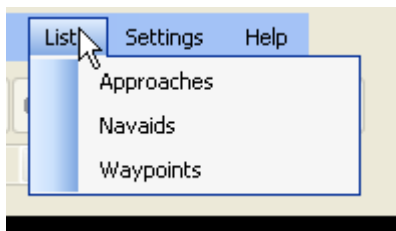


which will look like this:

Hopefully, at this point you should be able to compile your airport, place your BGL file in the appropriate scenery folder (taking care, of course, to remove any duplicate definition BGLs for the same airport), and ATC should offer you the approach. Fly into the airport, and if they don't offer the ILS first, then use the options to 'Request another runway' and 'Request another approach'. If you select Rwy 16 and then choose 'Select another approach', you should see the ILS as a choice – if you don't, then your approach isn't working, and it's time to go back into ADE and look for inconsistencies or incomplete items. I certainly had to go around this quite a few times... **but** whenever my approaches would not work there was **always**, when I looked carefully enough for it, some incompleteness or inconsistency in the approach definition in ADE. If the approach is defined completely and consistently, it **will** work (at least in my experience), and the types of fixes used for the different legs all seem to work, so long as everything is consistent.

Editing an Existing Approach

What if there is already an approach but it is not working? Or what about when you come back to ADE to modify an approach you created earlier – how do you do that? This is not entirely obvious, since there is nothing to click on in the ADE Approach Mode to choose an existing approach for editing – when you start with Approach Mode you will see any waypoints and navaids that have been defined, but not approaches themselves. To edit existing approaches, click on the Lists button in the top menu and select Approaches:



This will bring up a box showing any approaches already defined, and then you can select any item in the list:

Approaches				
Type	Suffix	Runway	Fix Type	Fix Ident
ILS		R16	TERMINAL_WAYPOINT	OTTOE

and then click the Edit button at the bottom right to edit that item. Once you select an approach for editing in this way, the legs of the approach will be shown on the map, and the approach and its components (legs and transitions, if any) will be shown in the boxes at right. You can then proceed to work with the approach as discussed above.

A Few Notes About Flying ILS Approaches in FS

So long as the approach is complete and consistent in ADE, ATC should offer it to you. This does not necessarily mean it will be straightforward to fly. As mentioned briefly above, ATC seem to just vector you in to the localizer course around ten miles out from the first fix of the approach (not at the first fix)... so you need to make sure that the first fix of your approach is not too far from the runway, or ATC will vector you in and tell you to follow such-and-such a heading at such-and-such an altitude until you capture the localizer – but you'll find yourself staring at a blank spot on your instruments where the localizer should show up, because you're too far away and the localizer is out of range. For example, if the first fix in your approach is around 20 miles from the runway, ATC will vector you in about 30 miles out, and your Nav radio will not be able to receive the localizer signal. When you're editing an approach, you can avoid this by making the initial fix close enough to the runway. If you want to create additional patterns for the approach, use the Add Transition option when you right-click on the approach in ADE to create Transitions – ATC will only use these if you specifically select them, and they are handled separately from the ILS approach itself. Basically you fly them yourself based on the plate, and they should bring you into the approach properly, rather than using ATC vectors.

If you are relying on ATC vectors, you need to be careful:

1. If ATC vector you in, and your instruments are detecting both the localizer and the glideslope, then you're fine – you can hit the MCP Approach (APP) button, and everything should go fine.
2. If ATC vector you in, and your instruments are detecting the localizer but not the glideslope, don't hit the APP button, as this will mess up totally, with most default and freeware planes at least. If you only see the localizer, then hit the VOR/LOC button, capture the localizer, then, when you see the glideslope on your instruments, hit the APP button.
3. If ATC vector you in and your instruments aren't detecting the localizer at all, you could try a couple of options:
 - a. Instead of flying the intercept course given by ATC, fly toward the airport, i.e. fly the actual approach course, until you detect the localizer, then turn to the course given by ATC and hit VOR/LOC.

- b. If you have loaded the approach into your GPS or FMC (which I pretty much always do once assigned an approach), then another option is to switch to GPS navigation and let the GPS/FMC navigate you into the approach, which it will do. You can then switch over from GPS to NAV when the localizer is detected.

Conclusion

I hope all this has been of some help. I know my style is a bit long-winded... sorry.

If you know of better ways to deal with any of this stuff, please let me know.

If you're stuck and need help trying to use these instructions, you can email me and I'll try to help. I do work full-time, though, so I may not be able to respond immediately.

Happy flying!

Ken Leedham

kleedham@idirect.ca