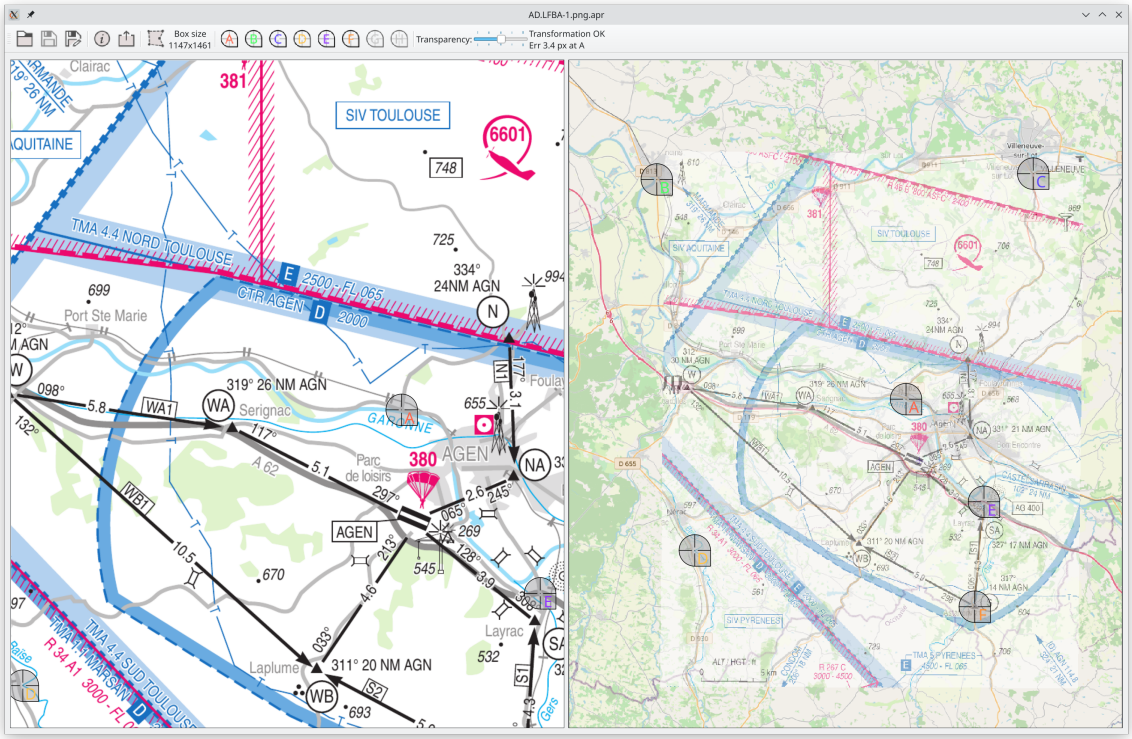
Approacher
A software for Approach maps georeferencing

Kanardia d.o.o.

September 2021



Revision 1.0
Use with Nesis III with software version 3.9 or later only.

Contact Information

Publisher and producer:
Kanardia d.o.o.
Lopata 24a
SI-3000
Slovenia

Tel: +386 40 190 951
Email: info@kanardia.eu

A lot of useful and recent information can be also found on the Internet. See `http://www.kanardia.eu` for more details.

Copyright

Credits

This document was written using TeX Live (LaTeX) based document creation system using Kile running on Linux operating system. Most of the figures were drawn using Open Office Draw, Inkscape and QCad applications. Photos and scanned material was processed using Gimp. All document sources are freely available on request under the licence mentioned above and can be obtained by email. Please send requests to info@kanardia.eu.

Revision History

The following table shows the revision history of this document.

Revision	Date	Description
	1.0	Frist public release

Contents

1 Introduction

First of all, we would like to thank you for choosing Kanardia.

Approacher offers an efficient way to georeference VFR airfield approach maps and enable them to be used with Nesis III. This manual describes the installation process, step by step instructions for the map preparation and how to use the resulting files with our Nesis displays.

1.1 Supported Instruments

Resulting approach maps can be used with Nesis III 8.4" and Nesis 7" instruments only running software version 3.9 or later.

1.2 Support

For help, feedback or in case of application errors, please contact: `support@kanardia.eu`.

1.3 Internet Connection

In order for Approacher to run correctly it needs access to reasonably fast Internet connection. Approacher will connect to the Open Street Map server and dynamically download map tiles of the approach map area. Approacher will not work without an active Internet connection.

1.4 Quick Overview

Approacher is a desktop application used to process approach maps to make them visible on Nesis screen. Source approach map must be available in one of file formats recognised by Approacher. Such files are just plain *pictures* and have no geographic information. Approacher allows entering missing geographic reference points in an efficient way. In addition it allows clipping off chart portions of no visual interest (text information, paper frames, etc.)

The whole process has three typical steps:

- Obtain and convert source approach map into a format suitable for further processing.
- Identify at least three characteristic points on the approach map and define their geographic coordinates. In addition, clip unused parts of the original map (paper edge, legends and other parts that are not significant on the map).
- Build the final map and copy the result into Nesis.

2 Installation

Approahcer is provided for Linux, macOS and Windows operating systems. This section provides step by step instructions for each system separately. Uninstallation procedure is also provided.

2.1 Download

Go to `https://www.kanardia.eu/support/firmware/` and search for a suitable installer for your operating system. Click the link to download the application to your computer. In the first step the application is downloaded from our server and in the second step it is installed to your computer.

2.2 Installation

2.2.1 Linux

Linux installation in neatly packed in one gz archive, which is simply a wrapper around an AppImage. AppImage allows for a very simple installation on any Linux distribution without breaking any dependecies. See `https://appimage.org/`, for more details.

1. Unzip the archive to get the `Approacher.AppImage`.
2. Move the `Approacher.AppImage` file to your Desktop or to another folder of your choice.
3. `Right-Click` on the Approacher icon and select `Properties`.
4. Open the Permissions tab.
5. Make sure that 'Is executable' checkbox is checked.

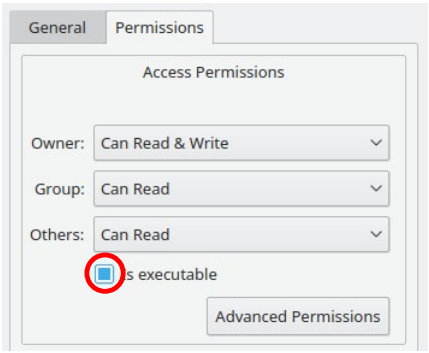


Figure 1: Linux permissions. `Is exacutable` must be checked.

6. Select `OK` to close the window.

Thanks to AppImage, no further installation steps are required. Double click (or single, depending on your OS settings) to run.

2.2.2 MacOS

1. Unzip the archive
2. Open the `Installer.dmg` file. You will find the Approacher app and a link to the Applications folder inside.
3. Drag Approacher to Applications folder.

4. Close the installer and eject it.
5. Open Launchpad, find Approacher and run it.

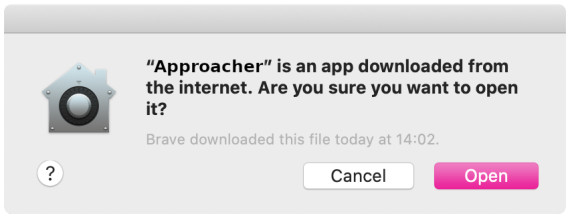


Figure 2: Select `Open` if asked for permission.

6. If a dialog pops-up, asking for permission to run, click `Open`.

2.2.3 Install on Windows

1. Unzip the archive.
2. Run the `installer.exe`.
3. If the system asks for permissions, select `Yes`.

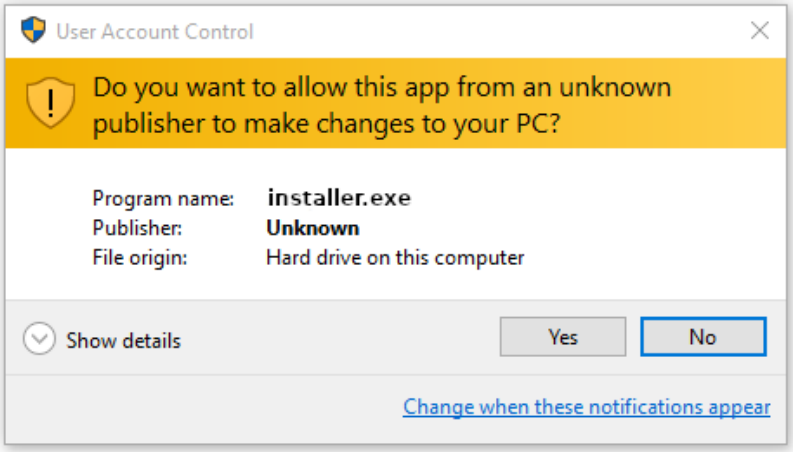
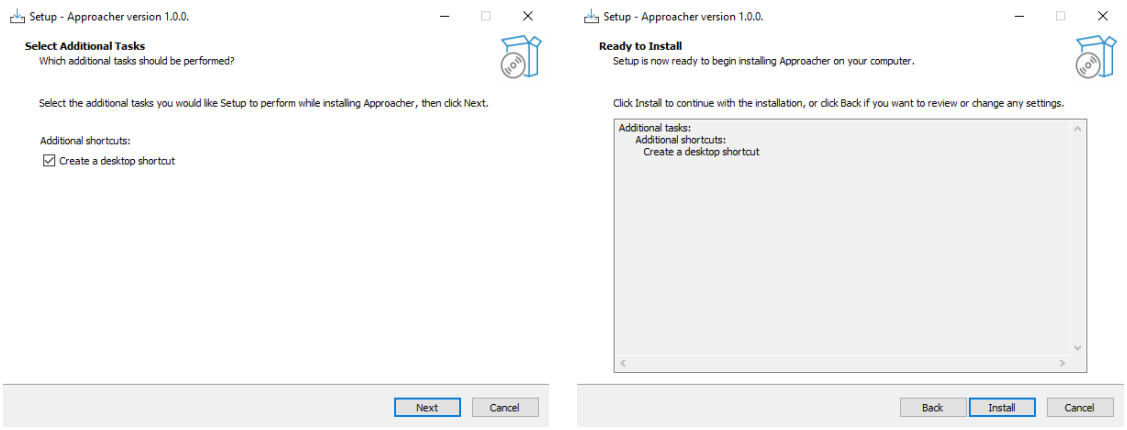


Figure 3: Give permission for installation.

4. Check the 'Create a desktop shortcut' if you wish to have a shortcut on your desktop. Select `Next`, Figure 4a.
5. Click `Install` and wait for the installation to complete. Figure 4b.
6. Click `Finish`. The installation is completed.

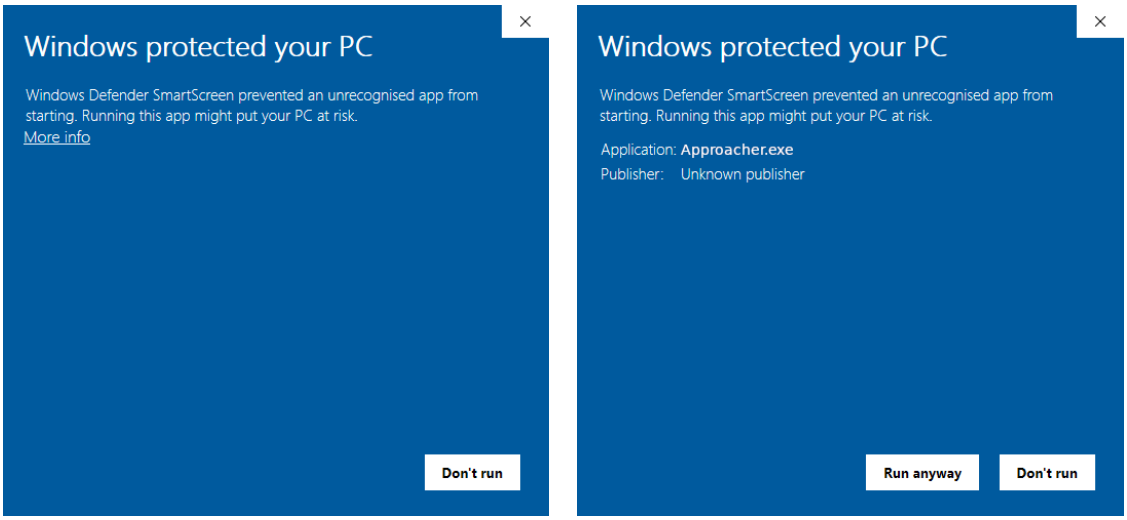
After completing the installation, find Approacher in the Start menu or on your Desktop.

In case that Windows Defender prevents you from running the application. Follow the two steps illustrated in Figures 5a and 5b.



(a) Initial window (b) Select desitnation folder.

Figure 4: Destination on Windows system.



(a) Select `More info` (b) Select `Run anyway`.

Figure 5: How to proceed with Windows Defender.

2.3 Uninstall

2.3.1 Linux

Simply delete the Approacher.AppImage file.

2.3.2 MacOS

1. Open `Finder`.
2. Find the `Applications` subfolder.
3. Select Approacher.
4. Press the `(CMD + ) Backspace` key on your keyboard.

2.3.3 Windows

1. Open `Control Panel`.
2. Under section `Programs` click `Uninstall a program`.
3. Find Approacher on the list.
4. Select it and click `Uninstall`.
5. If the system asks for permission: 'Do you want to allow this app to make changes to your device?', select `Yes`.
6. Confirm the uninstallation.

3 Prepare The Map Image File

This section explains how to prepare a VFR approach map and convert it into appropriate form – image file. Namely, Approacher expects source map to be in proper file format. Most approach maps are provided in different file formats or they are even in paper form.

Approacher can work with the following source formats:

- PNG (Portable Network Graphics)
- JPG and JPEG (Joint Photographics Experts Group)
- BMP (Windows Bitmap)
- GIF (Graphics Interchange Format)

If the source VFR approach maps in one of the formats listed above, it is a good chance, that Approacher will be able to read it and you can skip this section completely.

3.1 Maps in PDF Format

Vast majority of approach maps are provided in the PDF format. This format can't be used directly and you need to convert it to one of the formats listed above. We recommend using PNG format, as is a lossless format, which takes a bit more memory on your PC drive but it creates no compression artifacts.

There are many possible ways to do the conversion and we will show some of them. Maybe the fastest and simplest is on-line conversion on the Internet.

3.1.1 Source File Example

We will show an example on an approach map provided by SIA, France. Please note that the Internet sites are very dynamic and their content and address may change anytime.

At the time of the writing, the file is available from `https://www.sia.aviation-civile.gouv.fr`. This page is provided by SIA (Service de l'Information Aéronautique de la Direction Générale de l'Aviation Civile du Ministère de la Transition Ecologique et Solidaire, en charge des Transports.)

Use the following steps to get the file:

- The above mentioned link opens a parent page.
- Select the `Préparation de vol` and then select `Atlas VAS France`.
- A new page opens. Select `VAC Aérodromes`.
- This opens a list of many aerodromes. For our test purpose, select `AGEN LA GARENNE` and press `OK` to download appropriate PDF file.
- Your browser will download the file and save it as `AD-2.LFBA.pdf`. The exact file location depends on your browser and OS system settings.

This gives original file in the PDF format. It can be opened by any PDF reader. In this case, the file has five pages internally. For the approach chart, we only need page 1 (top left). Page 3 (bottom left) is also useful as it designates several points with known coordinates. Figure 6 illustrates the content of first four pages.

3.1.2 On-line Conversion

There are several online sites, which are able to convert a PDF file into PNG file. Maybe the most simple to use is `https://pdf2png.com`.

1. In your favorite browser open the `https://pdf2png.com`. You can also click on this link.
2. Click on the `UPLOAD FILES` button and select the AD-2.LFBA.pdf file from your computer.
3. Web site will process the file for a few moments. Once the conversion was completed, click on the thumbnail to download conversion results. The exact action depends on your browser settings. If asked, select the `Save File` option (or similar).
4. The downloaded file will have the same base name, but different extension (zip). Results are packed into a zip file. In this example the resulting file is `AD-2.LFBA.zip`
5. The zip file contains several PNG files, one PNG for each page.
6. Extract the AD-2.LFBA-1.png file from the zip. This is the image file which will be further processed by Approacher.

There are also many other sites, which do the same job. They all are used in a similar way. A few of them are listed below – all were tested.

- `https://www.freeconvert.com/pdf-to-png` also gives good result.
- `https://pdf.to/png` works fine. You can download only the page you need directly in png format. Resulting names are a bit strange (e.g. 2c818add822b46258.png_1.png).
- `https://cloudconvert.com/pdf-to-png` good quality, simple to use.
- `https://pdftopng.net/` – the conversion is a bit coarse. Other sites may give better result.

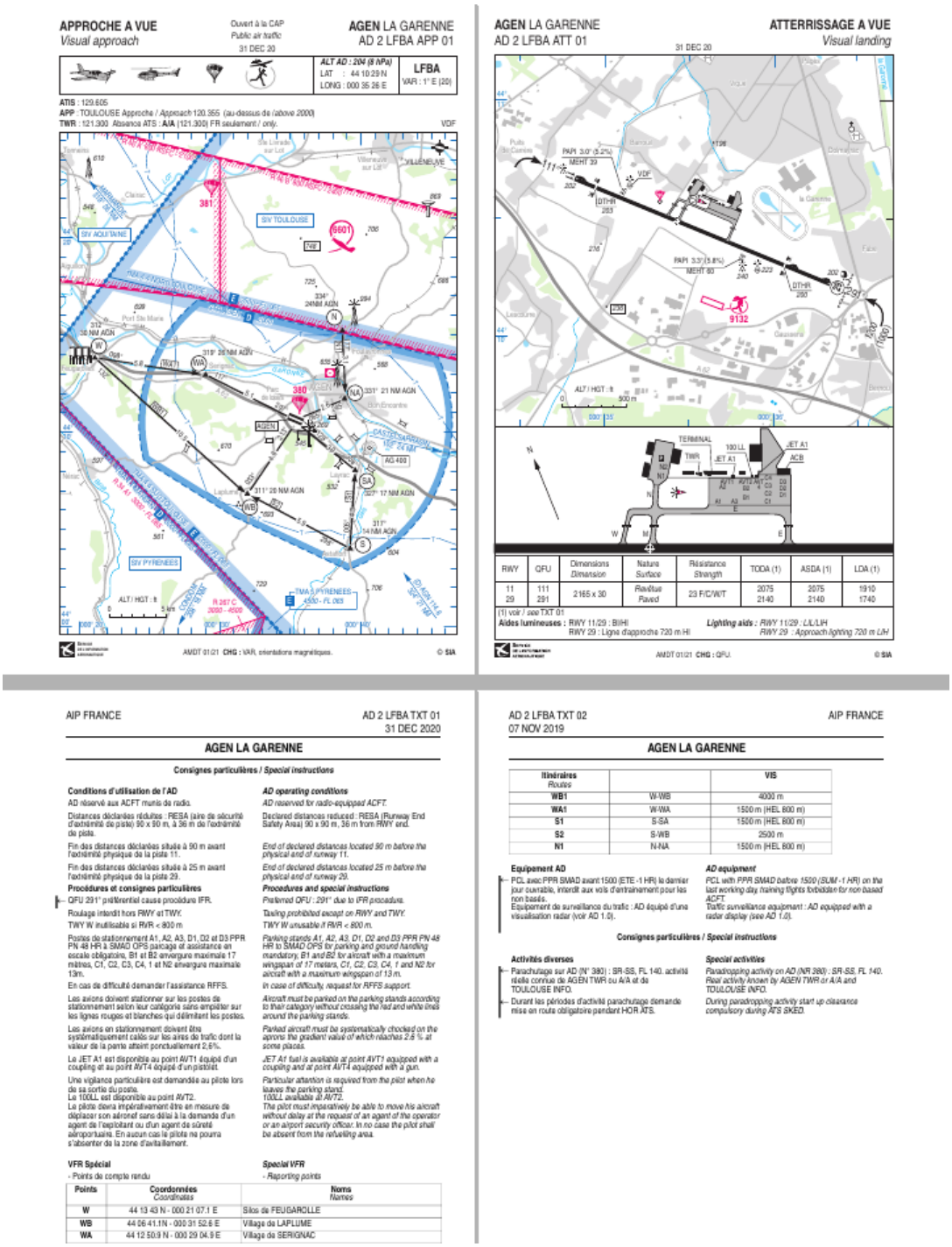


Figure 6: First four pages in the AD-2.LFBA.pdf file. The point of interest is page one which shows how to approach to the airport. The map is courtesy of Service de l'information aéronautique.

3.1.3 Conversion With Gimp

If you have `Gimp` installed on your computer, you can use it for conversion. (Do not install Gimp just for this reason. It is better to use one of on-line services instead).

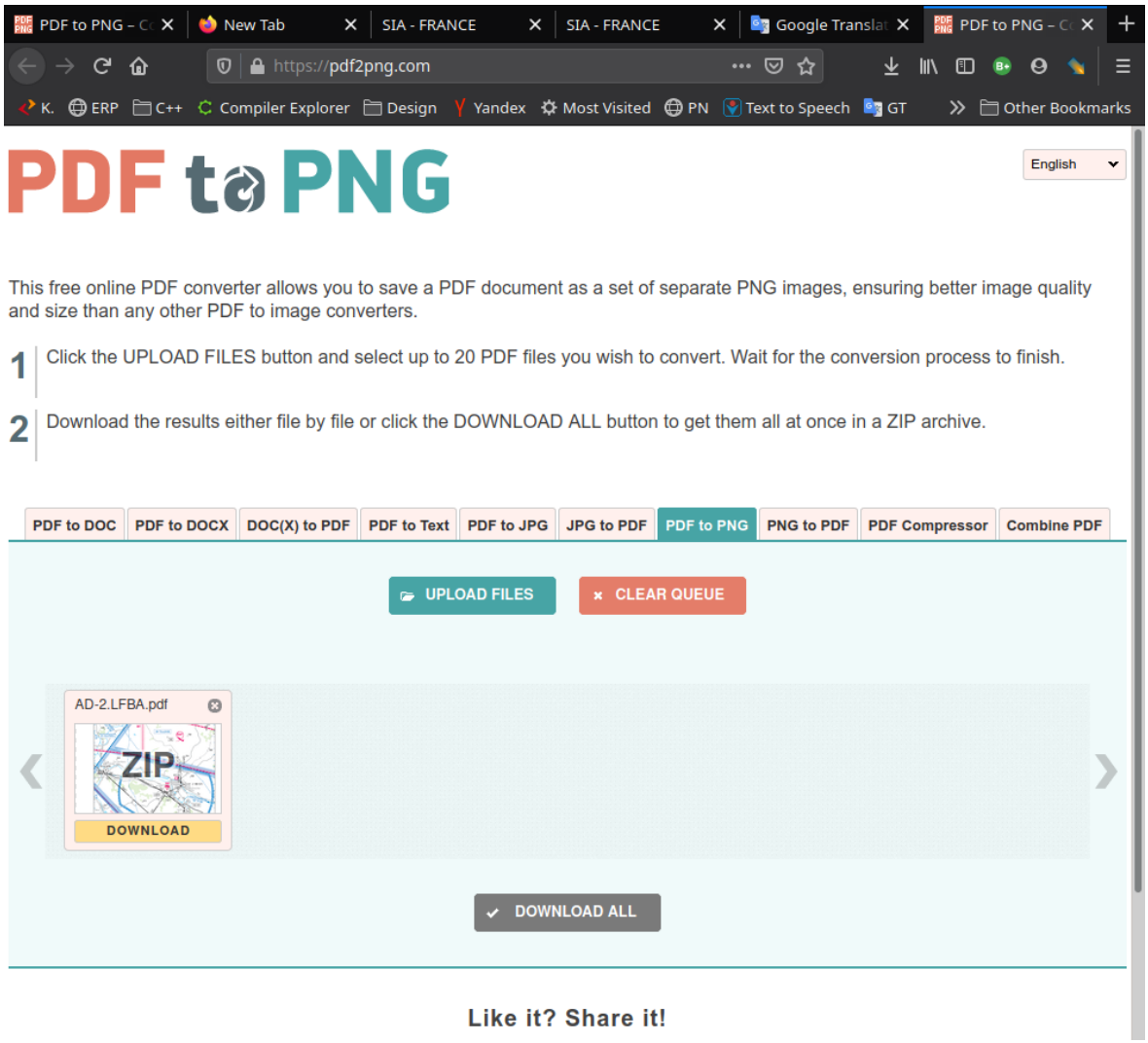


Figure 7: PDF2PNG web site in action. Situation after the PDF file was converted.

1. Start `Gimp`.
2. Select the `Open` command and search for the PDF file. In our case, this is `AD-2.LFBA.pdf`. Select it and press the `Open` button.
3. Gimp will ask you for the conversion parameters. You may want to adjust them as follows
   - `Select range` ... select the page of interest, 1 in our case.
   - `Open pages as` ... select `Images`.
   - `Resolution` ... select a value between 200 and 250. `250` in this case works well. This will automatically adjust number of pixels.
   - `Use Anti-aliasing` ... make sure this option is checked. This gives better results.
   - Click on the `Import` button to start the conversion.
4. Once the file is imported, select the page of your interest and select the `File|Export As ...` command.

5. Check the file location and file name. Change extension into `png` and press the `Export` button.
6. A new window with further conversion settings appears. Keep defaults and simply press the `Export` button again. This will create the image file you need.

Gimp is a very powerful tool. If you know how to use it, then you do not instructions anyway. If you do not know how to use it, we recommend one of on-line conversions instead.

3.1.4 Command Line Conversion

If you are lucky enough to use one of the Linux OS[1], you may try to use the `pdftoppm` command line.

1. Open some command line shell and navigate to folder with the source file (pdf).
2. Issue the following command: `pdftoppm -r 250 AD-2.LFBA.pdf LFBA -png` and press enter. Here `AD-2.LFBA.pdf` is an input file and `LFBA` is the base name of the output file. `png` extension will be added automatically.
3. A few moments later, you will get several png files in the same folder. The file we are looking for is `LFBA-1.png`. You can delete others.

The command line switch `-r 250` defines the resolution. Values between 200 and 250 are typically used. If the switch is omited, the default value of 150 will be used, which yields slightly too coarse results in most cases.
The command line switch `-png` defines the output format.

3.2 Paper Maps

Sometimes approach maps are simply printed on paper. You can use such maps too. In most cases they come on a small sheet of paper (US-letter or A4 size or even smaller). These can be scanned on a scanner or on a multi-functional printer and converted into an electronic form.
One such example is shown on Figure 8. The map was scanned on the multi-function printer configured for tif format. Scan resolution was 300 dpi. The resulting image file was clipped with the help of GIMP app and then exported to DFS-EDGZ.png.

3.2.1 Scan Format

Most of the scanners default settings is PDF format. This is OK, but you have to do the conversion on the resulting file, see section 3.1. Most scanners can be configured to save the scan in a TIF (sometimes TIFF) or in JPG format. Try to use JPG format. If you got TIF, convert it into PNG.

3.2.2 Scan Resolution

The scanner shall be set to resolution about 250 or 300 dpi.

[1] `pdftoppm` can be also installed on Windows OS, but the installation is a bit complex.

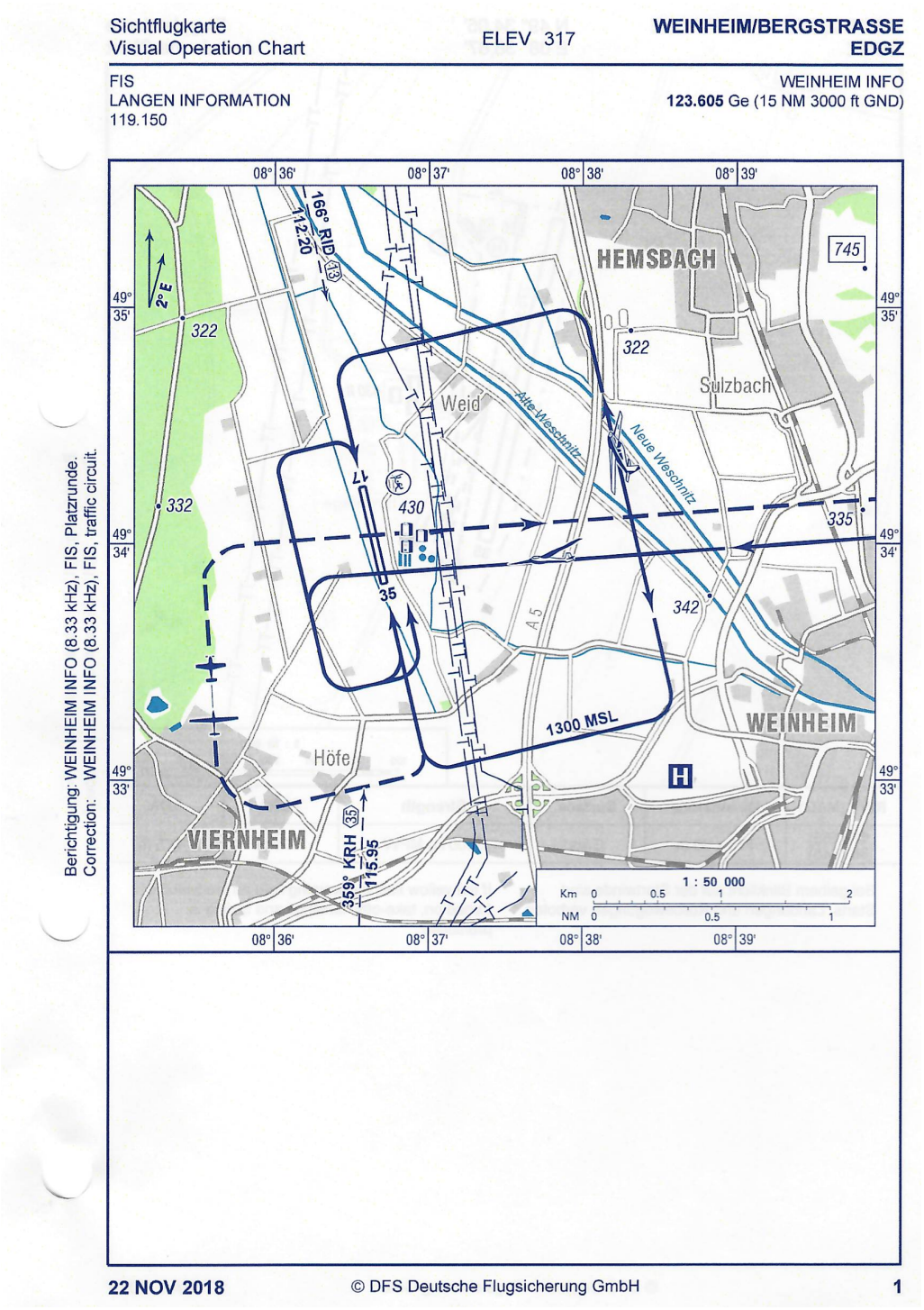


Figure 8: A scanned paper approach and traffic circuit map. The map was clipped using GIMP, to better fit into the manual. The map is courtesy of DFS Deutsche Flugsicherung GmbH. The map shall not be used for navigational purposes.

3.2.3 Clipping

Depending on the approach map paper size, the scan may have significant *white* area. You can clip this area with some specialized software like GIMP, for example. But if this area is not too large, you can keep it. It will be clipped later.

3.2.4 Orientation

The map shall be placed on the scanner as parallel to scanner guides as possible. Also, if possible, make the resulting map oriented *North up*. Most maps are already prepared this was, but not all. But do not worry too much. Geo-referencing will solve the orientation and misalignment automatically – map will be rotated as soon as three reference points are defined. It is just easier to work with maps oriented to North, because the reference map will be also North oriented, which makes map to map comparison easier.

4 Georeferencing

Georeferencing is a process where map pixel (x,y) coordinates are bound with geodetic coordinates (longitude, latitude).

4.1 Some background

In previous section we showed a way to get a map into some suitable electronic format (gif, jpg, jpeg, tif or similar). The resulting file consists of many pixels organized in a rectangular grid. A simple x-y coordinate system is put on top of this grid. The origin is in top left corner, x axis is extending leftwards and y axis downwards. Unfortunately, these x-y coordinates do not tell the geographic position of individual pixels.

Luckily a typically approach map usually represents only a small patch of the Earth surface – not much more than a few dozen kilometers in each direction. Also, the maps do not need to be extremely accurate and a small error is tolerated. This means that a simple linear transformation between pixel coordinates and geodetic coordinates suffices.

The linear transformation has a couple of unknown parameters. These parameters can be calculated, if we can associate at least three coordinates on the approach map with their true geodetic coordinates. Although three coordinate pairs are enough for the calculation, knowing more pairs improves the overall solution.

Once such pairs are found, all other pixels can be converted to geographic coordinates, too. Furthermore, conversion goes in both direction. Any geographic coordinate can be converted into pixel coordinate (x-y). This means that the approach map can be drawn over part of the Earth map.

For the illustration purposes we will use the `AD2.LFBA-1.png` image file that was prepared in section 3. But before we dig into the details, let's take a short overview of the Approacher app.

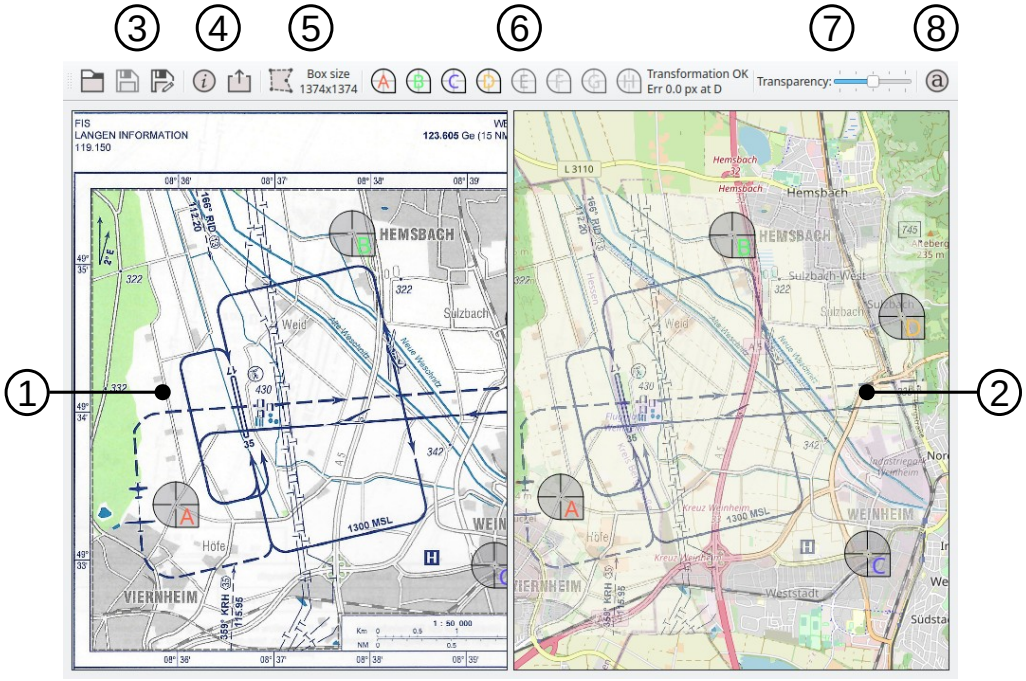


Figure 9: The main window of the Approacher app. All work is done here.

4.2 Quick Overview

Figure 9 illustrates main elements of the Approacher app.

① The left panel shows the approach map image. This is the image file it was prepared in the section 3. Move mouse over the left panel and use mouse wheel to zoom in and out. When map is zoomed in, it can be also dragged around.

② The right panel shows a reference map – OpenStreetMap tiles. This map is dynamically downloaded from the Internet. When mouse is over the right panel, use mouse wheel to zoom and mouse drag to move the map.

③ Leftmost three icons are used to load the source image or approacher project, save the project and to save the project under a different name.

④ The info icon is used to specify some additional information – attributes of the approach map like airfield designation and map description. Next to this one is the export icon, which prepares the map for use with Nesis.

⑤ The icon activates the map image *border clipping* mode. It is used to define which area of the image shall be shown on the screen. Usually some parts of the source image are redundant and not suitable to be shown on the Nesis screen. The box size next to the icon tells how many pixels of the image are in use – this is a bounding rectangle around the border polygon.

⑥ Coordinate pairs *A*–*H* allow for a quick access of some pair. When an icon A–H is selected, pair of points with selected letter appear centered on each panel. Next to coordinate pairs icon is information about transformation and corresponding error expressed in pixels.

⑦ Once three coordinated pairs are defined, transparency slider can be used to show the cropped part of the source image over the reference map on the right panel. This is used to visually estimate how well both maps overlap.

⑧ The last icon opens a window with some information about the Approacher app.

This concludes a quick overview. Next section reveal how to use these elements in practice.

4.3 Loading The Approach Map Image File

Start the Approacher app and click on the open icon,  . Search for the approach map image file – a file with png, tiff, tif, jpg or similar extension. Confirm the selection. The image shall appear on the left panel.

For example, open the `AD2.LFBA-1.png` image file. A situation similar as shown on Figure 10 shall appear on the screen. Zoom out on the left panel a bit to see the whole image.

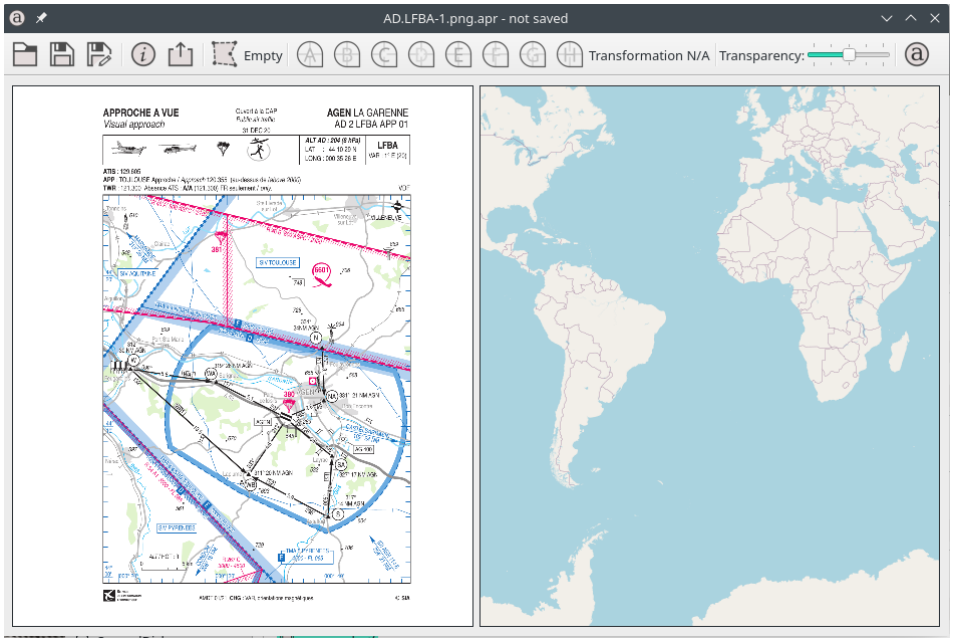


Figure 10: Situation after the image file has been loaded.

Click anywhere on the right panel. Use mouse to drag the map and mouse wheel to zoom in to the geographic area, which corresponds to the left panel. The right panel is always oriented North up. Figure 11 shows an example where the map in the right panel shows similar geographical area as in the left panel.

4.4 Geo-referencing

Once both maps are visible, we can start with the geo-referencing process. In principle this can be done in two ways:

- Locating the same geographical features in both maps. Details are given in section 4.4.1.

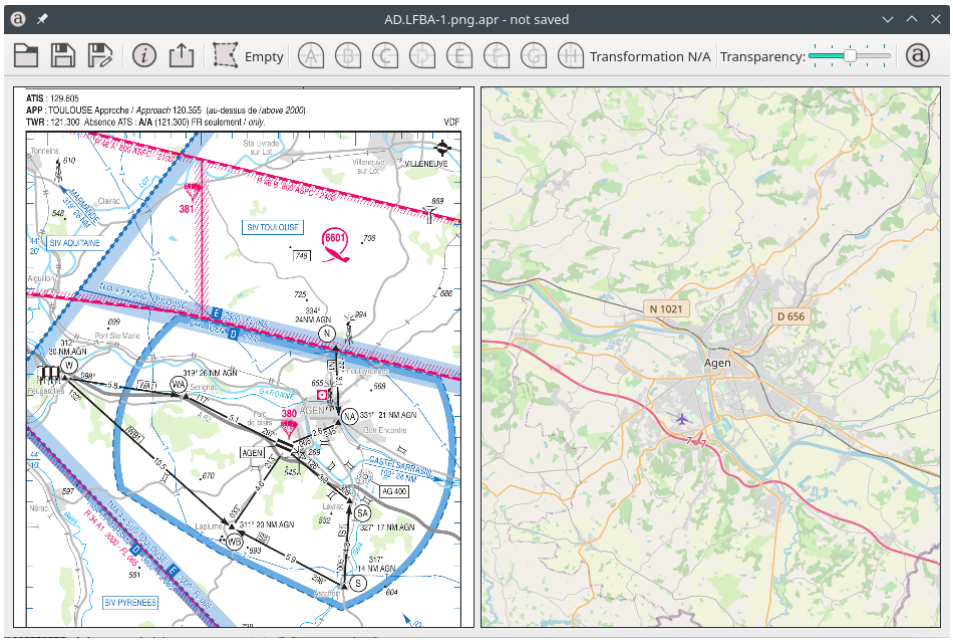


Figure 11: Situation after both panels show similar geographical area. In this case this is the area around French city Agen.

- Assigning known coordinates to points on the map, like reporting points, VORs, NDBs etc. Details are given in section 4.4.2.

Both principles can be also combined – some pairs are defined with geographical features and some points are defined trough known cooridanates.

The `LFBA` example is a good one as it features both possibilities.

Please note, that although the second possibility seems more attractive (and a bit simpler) it may give worse results. Namely, it strongly depends on how well were symbols placed on the source image. If they are slightly wrong (and this happens frequently) this will worsen the final precision. In general, solution with geographical feature seems more reliable.

4.4.1 Locate Distinctive Map Features

Observe both panels and try to find some distinctive geographic features that appear on both panels. Typical features are railway crossings, road junctions, specific road, railway, river curves, etc. They must appear on both maps: approach image on the left and OSM map on the right.

Important: The first three coordinate pairs shall form a triangle. They shall never form a line.

The example that we are working on has good road features. Let's use the following ones:

(A) For the first point, take crossroad in Tonneins in top left part of the source image in left panel. Zoom in and locate the crossings on the right panel too. Try to put it into the center.

- Click on the crossings in the left panel. This will create (A) symbol on both panels.

- The symbol on the right panel is misplaced. Move it so that it will mark correct position.

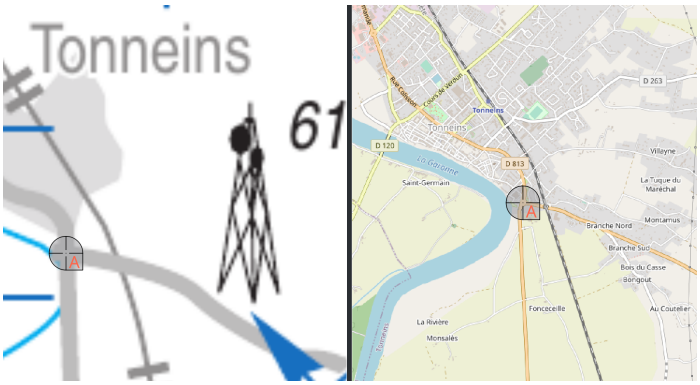


Figure 12: Crossing in Tonneins. Click on the left panel and then adjust the position on the right panel.

This defines the first pair of coordinates designates as (A). Figure 12 illustrates the situation.

(B) The second point can be located in top right corner of source image in a town Villeneuve. Again crossroad can be used. Figure 13 illustrates the situation.

- In the left panel, zoom in to top right corner, locate the crossing in Villeneuve.
- Zoom in and locate the same position on the right panel.
- Click on the crossing on the left panel. This will place the (B) marker on both panels.
- Move the (B) marker on the right panel to correct position.

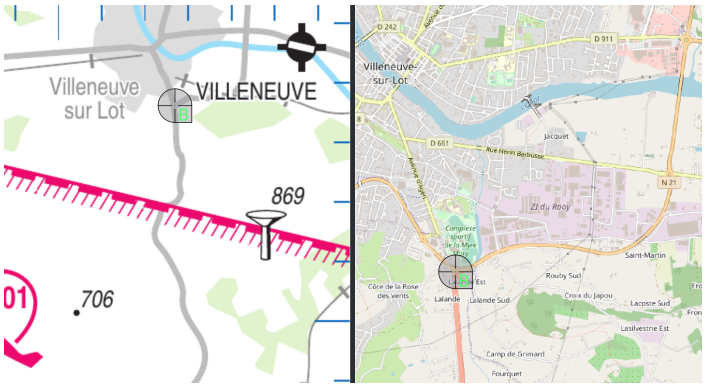


Figure 13: Crossing in Villeneuve.

(C) The third point is a characteristic river band near village Nérac. A crossing in village would be probably a better choice, but river bend will do as well.

Three coordinate pairs are minimum for Approacher to combine maps on both panels. Once the third point is defined, source image from the left panel will be drawn transparent over the right panel.

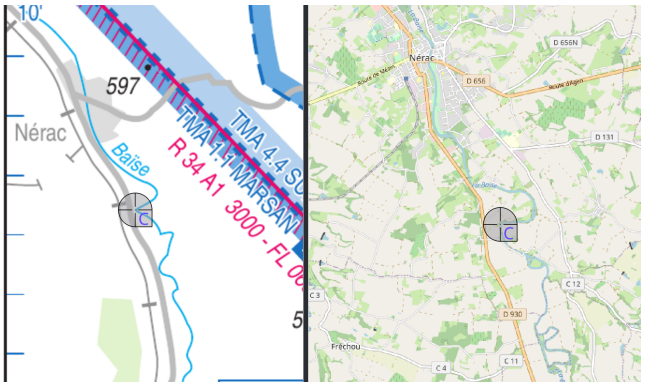


Figure 14: Characteristic river bend near village Nérac.

The transparency can be adjusted by moving the slider in the toolbar. Move the slider back and forth and observe how well both images match on the right panel.

The quality of the match must not be observed on the given coordinate pairs. It shall be observed in unmatched points away from the coordinate pairs.

If the match is good enough, you can move to the clipping step. If match is not good enough, try to add more coordinate pairs and verify positions of existing ones. Approacher allows you to add up to eight pairs (more than five pairs are seldom used in practice).

(D) Although three coordinate pairs are enough in theory, you can add more pairs. In general, adding one or two more points is a good idea. Let's add the fourth point for a good measure. A crossroad North of Layrac is a good candidate.

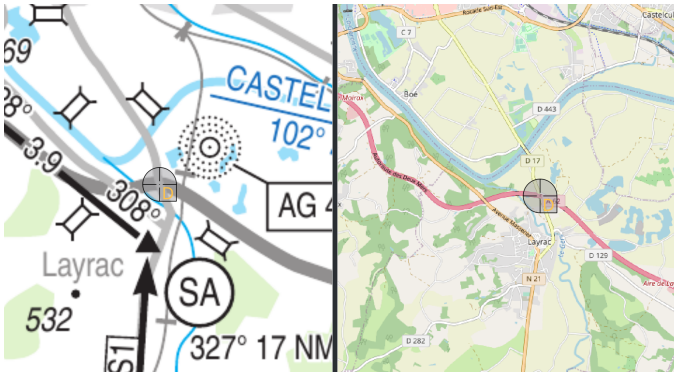


Figure 15: Crossroad North of Layrac.

Once four or more coordinate pairs are used, Approacher estimates positioning error of each coordinate pair. Error estimate is shown on the toolbar. It identifies the largest error expressed in pixels together with the coordinate pair id.

This puts us at the end of georeferencing using distinctive map features. If you estimate that transparent overlay on the right panel is good enough the geo-referencing is complete and we can proceed to clipping.

Save

Save current work into Approacher file project – click on .

4.4.2 Known Coordinates

In many cases the source image defines several points with known geographic coordinates. VFR reporting points, VORs and NDBs are such typical points.

During the map preparation in section 3.1.1 the pdf file was split into several pages as shown on Figure 6. Page 3 lists several VFR points and their coordinates (W, WB, WA, S, SA, N, NA). Let us repeat geo-referencing using these points.

- Open the source image file `AD2.LFBA-1.png`. Again, we get a situation similar as shown on Figure 10.
- Zoom in the left panel, so that individual VFR points are visible.
- Identify the points which are far apart and they form a good triangle. In this case, we will use points N, W, S.

`N` Locate the point `N` in the left panel and zoom in so that triangle will be clearly visible.

- Click on the center point of the triangle. This will put (A) pair on both panels.
- Right click the (A) symbol and select `Edit coordinate` from the pop-up menu.
- A window appears, Figure 16. The window is used to enter geographic coordinates. The document gives coordinates in minutes, degrees, seconds format. Click on the `DMS` tab and enter the coordinates. You will have to round the seconds to the nearest whole number.

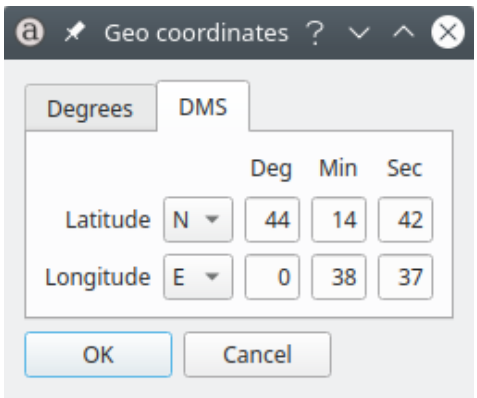


Figure 16: Coordinates of the **N** reporting point.

`W` Locate the point `W` on the map and repeat the procedure - click on the symbol center, then right click on the icon and select the `Edit coordinate`. Figure 17 shows its coordinates.

`S` and `WB` points are handled in the same way. They are shown on Figures 18a and 18b respectively. Two additional points were added although one point would be enough.

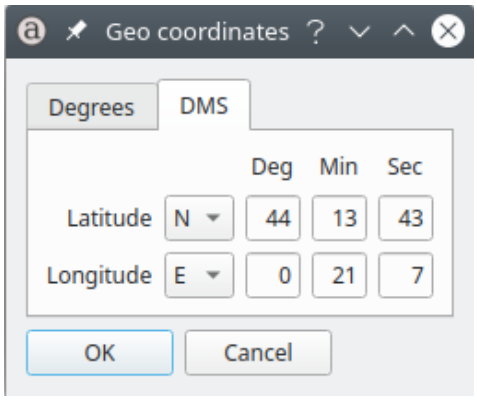
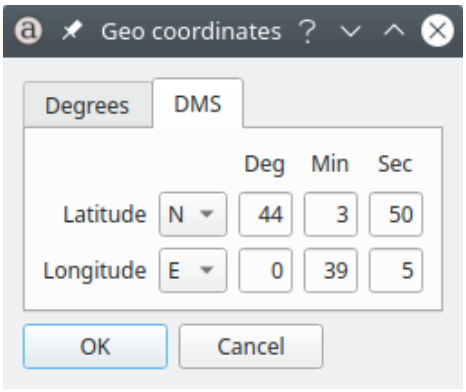
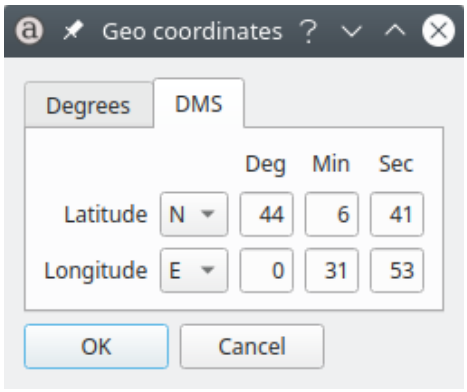


Figure 17: Coordinates of the **W** point.



(a) Point `S`.



(b) Point `WB`.

Figure 18: Additional reporting points.

Once three or more point pairs were added the map is georeferenced and we may continue with the next steps like precision assessment and border clipping. But first `Save` current work.

4.5 Precision Assessment

As soon as three pair of points were defined the panel source image appears on the left panel as a semi-transparent overlay. This allows you to see trough the image and to assess the precision of the image placement. Main features on the overlay must match the OSM main map. Example for the LFBA is shown on Figure 19.

The transparency of the overlay image can be adjusted using the transparency slider from the toolbar. Move the slider left and right and observe the overall overlay match.

Approach source images are many times simplified, so the match can't be perfect, but the overall precision still must be good enough. Zoom in, to see the details and move around. Move the transparency slider left and right and judge the quality of the overlay.

If you are happy with the results, you can continue with the clipping. If the overlay does not match the underlying map, check all the pairs. Maybe one (or more) pairs are not placed correctly. Maybe you should add more pairs. If you were using known coordinates, the position of the coordinates on the overlay may not be precise enough (there is nothing you

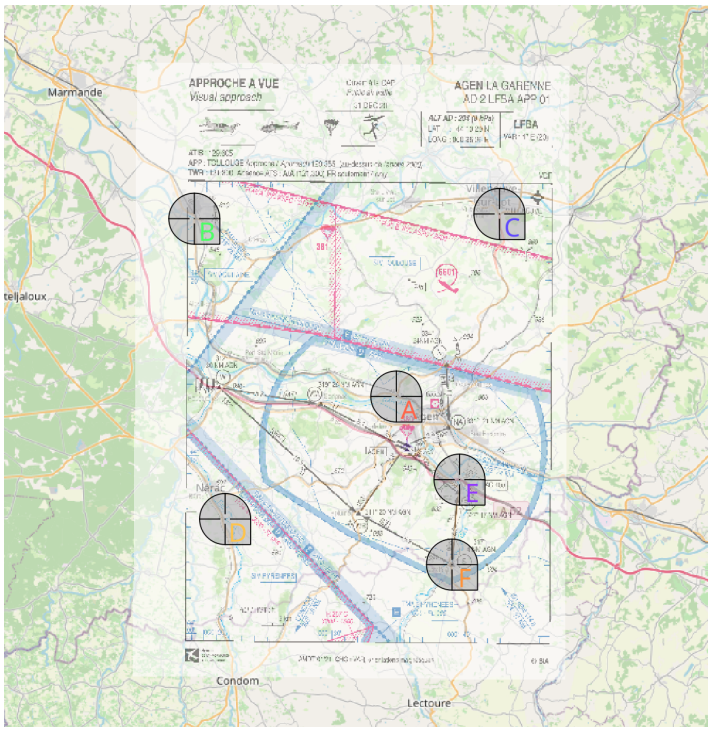
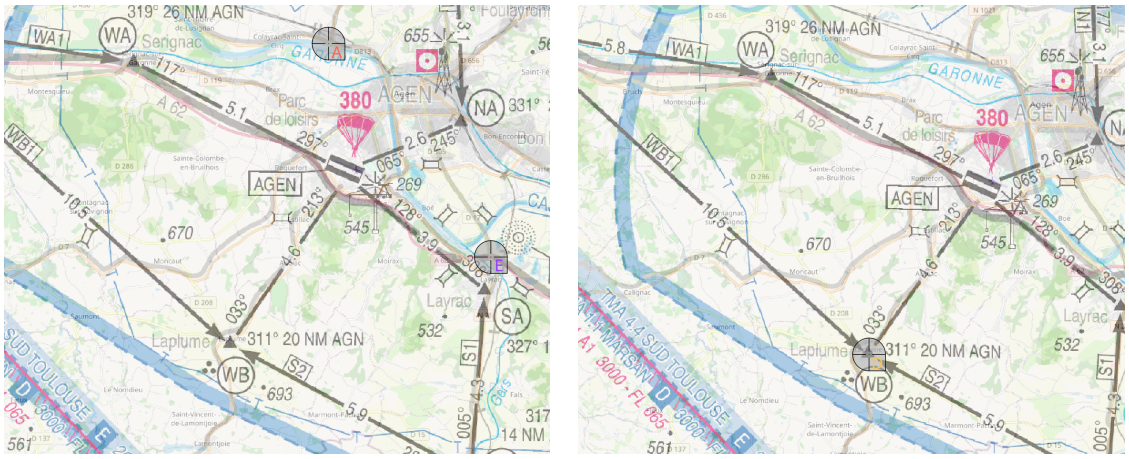


Figure 19: Illustration of the right panel, after the three point pairs were provided.

can do about it). You may delete them and use geographical features found on both maps instead.



(a) Map features. (b) Known coordinates.

Figure 20: A comparison of two solutions. The left one was obtained following distinct map features approach and the right one was obtained following known coordinates approach. Result in both cases is pretty good.

4.6 Image Border Clipping

Figure 19 shows the source image overlay without any border clipping. In most cases we are only interested in the geographical part of the image and not in other information that also appears on the source image, like large white frame, for example.

The `Border Clipping` tool (Figure 9, label ⑤) can be used to define a polygon of points, which define an area on the source image, which will be shown on the Nesis screen and on the right panel. The clipping area polygon must be defined on the left panel.

1. Use mouse scroll button over the left panel and make sure that complete area, which you want to see on the map is visible.
2. Click on the `Border Clipping` tool,  .
3. Click on the source image in sequence. Each click creates one point of the polygon. Add as many point it may be necessary. In most cases, four points are enough.
4. Once a border point is created, drag a point around to find its best position.
5. When a border point was selected, pressing `Delete` key removes it from the polygon.
6. If you create a mess, delete all points and create a new polygon.
7. Once the border clipping polygon was defined, click on the `Border Clipping` tool again.

As soon as a valid polygon is formed (at least three points), the area of interest also appears on the right panel. Figure 21 shows an example of the clipping polygon defined on the left panel.

4.7 Additional Information

Some additional information must be defined before the approach image is ready for Nesis.

Click on the ⓘ icon (Figure 9, label ④, left) to open the window. Enter the data required. If you do not know the original map creation date, you may use current date. Set some reasonable expiration date – these maps do expire. Nesis will use the map even if it has already expired. The expiration date is only used as a reminder in the Nesis map info window.

4.8 Pack Approach Map for Nesis

Once the source maps was georeferenced, precision was checked, border clipping polygon was defined and additional information was entered, we are ready to build the final approach map for Nesis.

The icon  on the right of ④ on Figure 9 creates the final approach map ready to be copied to Nesis. The command first checks if all data was provided and if all is well it asks for the file name. The file name extension is `nam`, which stands for *Nesis Approach Map*. Due to hardware specific reasons, the source image and all the data that was provided will be further processed. The final image used by Nesis will be cropped according to the bounding

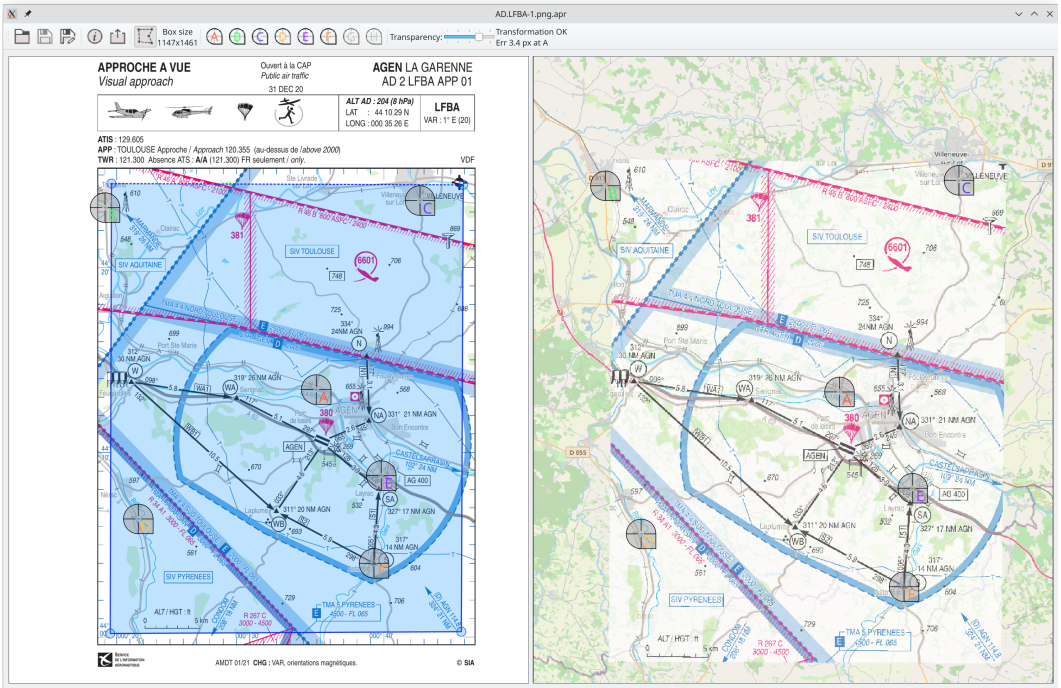


Figure 21: Border clipping example. Once polygon is defined only the internal area is shown on the right panel. Same area will be also shown on the Nesis screen.

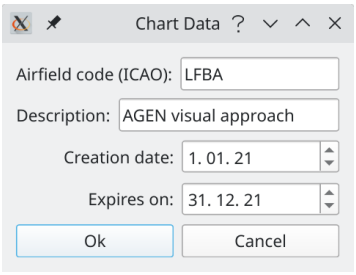


Figure 22: Example of additional information for LFBA approach map.

rectangle of the border clipping polygon scaled up or down so that the longer side matches 1024 pixels. In most cases, this means slight reduction of the original image resolution.

Please do not confuse the `nam` file type with the `apr` file type. The former is only used by Nesis, while the later stores all information entered in Approacher app on your PC.

5 Use in Nesis

Sections 3 and 4 revealed how a map is prepared for the Nesis use. The process resulted in a file with the `nam` extension. This section explains how an approach map is copied to Nesis and used.

5.1 Copy to Nesis

Once you have an approach map file ready for Nesis (`nam` file extension) you have to copy it to Nesis.

1. Make sure your USB memory stick is using FAT32 disk format. Your PC may understand several formats, but Nesis only understands FAT32 format.
2. Copy the selected `nam` file to USB memory stick using your PC.
3. Make sure to use *safe remove (or similar)* option before you remove the stick from the PC. This ensures that all data is truly copied before removal.
4. Start Nesis and insert the USB memory stick.
5. Select the `User options` page.
6. Select the `Maps` icon.
7. If USB was properly detected, select `Copy from USB`.
8. Nesis will ask you which map type you would like to copy. Select `Approach`.
9. Select the approach file from the list of detected files. If you put the approach file into some folder, you will have to navigate to this folder.
10. Once the file (or several files) were copied, close all windows. Nesis will restart and it will search for approach files during startup.

5.2 Using in Flight

Approach maps are shown automatically over the base map layers. At the time being, only two approach maps will be shown on the screen simultaneously, but we may increase this number later on. You can load any number of approach maps into Nesis. Nesis will choose between them automatically regarding the current map main (center) coordinate.

You can't really switch the approach maps off/on, but you can adjust their transparency instead.

1. Switch to the main map screen.
2. Touch the map layers icon.
3. Select the `Approach transparency` option and adjust the transparency between 0 and 100%. A 0% means the approach maps are invisible and 100% means they are opaque. Values between 60-80% work the best.

The approach maps are zoom dependent. When the main map is zoomed out, the approach maps become very small and hence they are not shown at all.

Figure 23: Finally, the LFBA approach map is shown on the Nesis screen. The transparency was set to 60%.

5.3 Multiple Maps For Same Airfield

For the time being, only one approach map can be used per airfield. If you installed several maps for one airfield, it is difficult to predict which one will be used by the system. In this case delete the redundant maps – keep only one per airfield.

In the future we may remove this restriction.

5.4 Test Before Use

Before an approach maps is used in-fligh, it must be tested. The simplest way to test is to load it into Nesis. Once loaded, activate the main `Map` page and move the moving map to the area where map shall appear. Make sure that maps appears on correct place and that it is oriented correctly. Zoom in and check the details – airfield position and major roads, railways, etc. must match on both maps.

If they do not match, delete the map from Nesis.

1. Open the `Options` page,
2. Select the `Maps` icon,
3. Select the `Maps info` option.
4. Select the `Approach maps` item and search for the map, which is misplaced.
5. Select the map and then select the `Delete` option. This will remove the map from Nesis.

6 Another Example

Sections 4 and 5 use step-by-step approach to reference an approach map for the LFBA airfield. Here we will do the same, but in a more brief manner for the EDGZ approach map in Germany. Initially, this was a paper map, produced by DFS. In section 3.2 we gave some instruction how to scan the map to obtain the source image file. This resulted in a file DFS-EDGZ.png, see figure 8. In this section we will prepare the approach map for use in Nesis from the EDGZ file.

The map is courtesy of DFS Deutsche Flugsicherung GmbH. The map shall not be used for navigational purposes. We were kindly allowed by DFS to use this map as an example for educational purposes.

6.1 Loading The Image

Load the image source file DFS-EDGZ.png. The EDGZ airfield is connected to Weinheim, a town close to city of Mannheim, Germany.

1. Start the Approacher app.
2. Select the  and search for the `DFS-EDGZ.png` source image file.
3. Click on the right panel and then use zoom (wheel on the mouse) and pan (click and drag) first to locate Mannheim and then the actual area from the source image. Figure 24 shows an example.
4. Press `Save` button. This will save current situation into the `DFS-EDGZ.png.apr` file. You can also use `Save As` instead and save it under different file name.

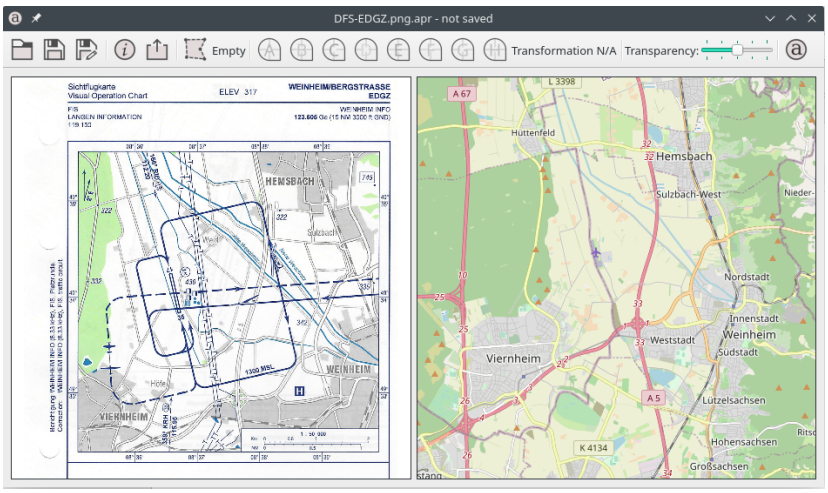


Figure 24: Situation with the source image on the left and similar area on the right.

6.2 Georeferencing

The source image does not have any points with known coordinates. This means that we will have to find similar geographic features on both maps.

1. In the bottom left corner of the source image is a highway and railway crossing. Click on this in the source image (left panel) and then move the point on the appropriate spot on the right panel. Zoom in if necessary. Figure 25 illustrates the situation.

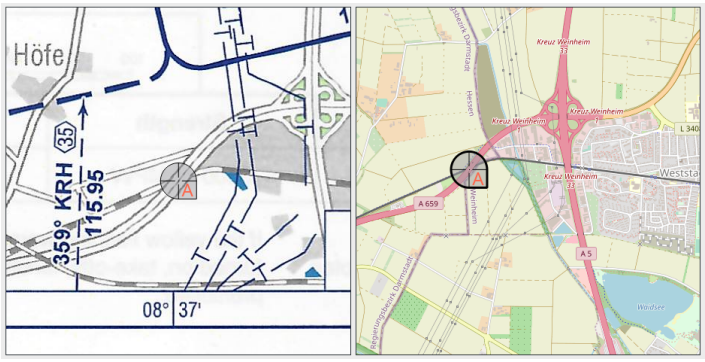


Figure 25: Railway and highway crossing next to *Kreuz Weinheim* was used for the first point.

2. On the top left of the source image there is a distinguished Y road junction, South of the *Hüttenfeld*. See Figure 26.

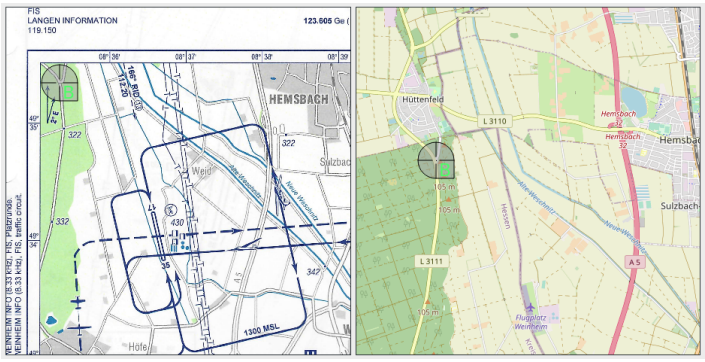


Figure 26: Y road junction South of the *Hüttenfeld* was used for the second point.

3. The third point shall form a triangle with the previous two points. A crossroad in *Weinheim* – bottom right on the source image seems a good candidate, Figure 27.

4. Once the point was given, the source image appears on the right panel. Use transparency slider to check the alignment. The alignment seems pretty good.

5. Adding the forth point is always a good idea. Let's add a railway crossing in *Sulzbach*. See Figure 28.

6. Once the fourth point was added, Approacher can *estimate* a position error. In our case the error is about 5 pixels at point C. Small error is acceptable. Remember that source images are usually simplified a bit. You may continue adding points if you want.

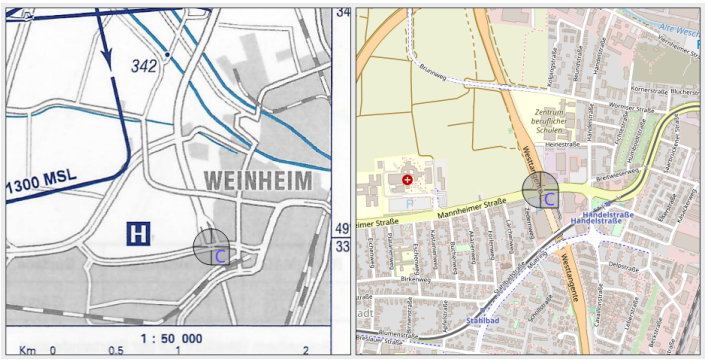


Figure 27: Road crossing in *Weinheim* is the third point.

Figure 28: Railroad crossing in *Sulzbach* is the fourth point.

Figure 29 illustrates the match of the airfield position. All major geographic features seem to match.

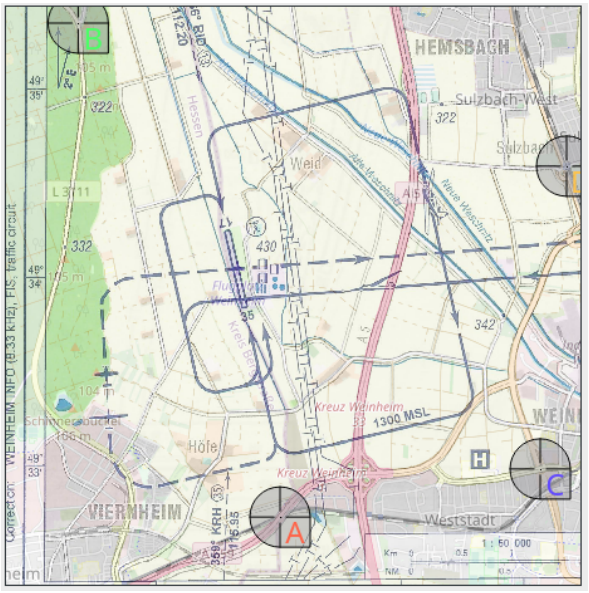


Figure 29: A final check of the match. Airfield is in correct position and also all other geographical features are well aligned.

7. Save current results.

6.3 Clipping

The source image has a lot of *white* area, which is of no use. This can be removed.

1. Zoom the left panel so that the area of the interest is visible.
2. Select the – `Border Clipping`.
3. Define the border polygon points.
4. Click on the `Border Clipping` icon again. This completes the operation.

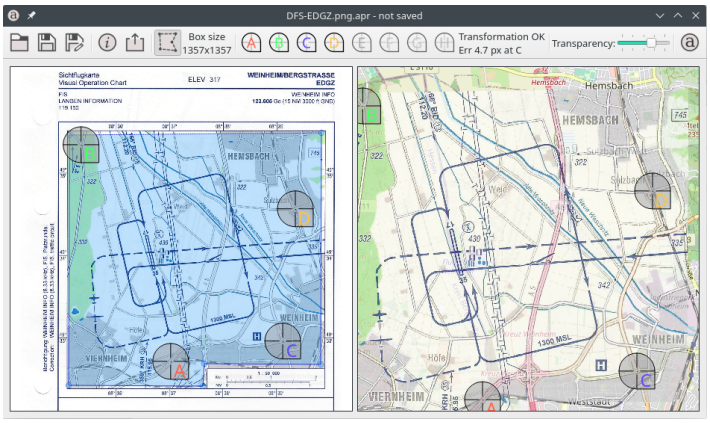


Figure 30: The clipping border polygon was defined. Overlay image on the right is automatically adjusted.

5. Save current work, click .

6.4 Approach Map Information

We are almost complete. Approacher requires some additional Information. Click the icon and enter the required data. An example is shown on Figure 31.

Click on the `Save` icon to save the work.

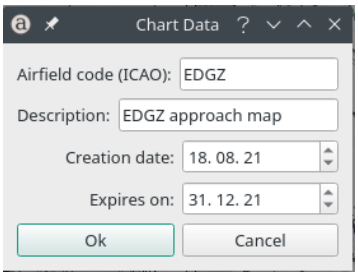


Figure 31: Additional data for the EDGZ approach map.

6.5 Prepare for Nesis

In the last step, we will create a file with `nam` extension, which can be then copied into Nesis.

1. Click on the icon.
2. Approacher will run some checks. In the case of error, a report will be shown.
3. If all was well Approacher asks you where to save the file. Enter the file name and press the *Save* button. Figure 32 illustrates an example.

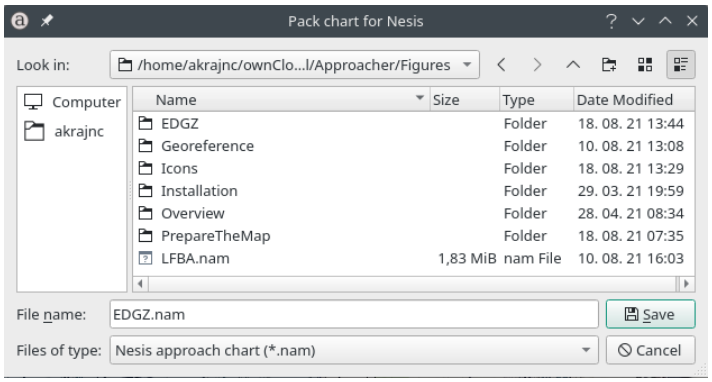


Figure 32: Saving the final result, ready for Nesis.

6.6 Use in Nesis

Once the approach map is created it can be used with Nesis.

1. Copy the resulting `nam` file to USB memory stick.
2. Make sure you used *Safe remove* or similar option before removing USB memory stick from PC.
3. Start Nesis, insert the USB stick.
4. Open the `User Option` page with icons.
5. Select the `Maps` icon.
6. Select `Copy from USB`, select `Approach` and search for the approach file with the `nam` extension.
7. Select the file. This will validate and then copy the file into Nesis.
8. Close all windows. Nesis restarts and the approach maps are ready to be used.

7 Approach Map Sources

There are many different sources approach maps.

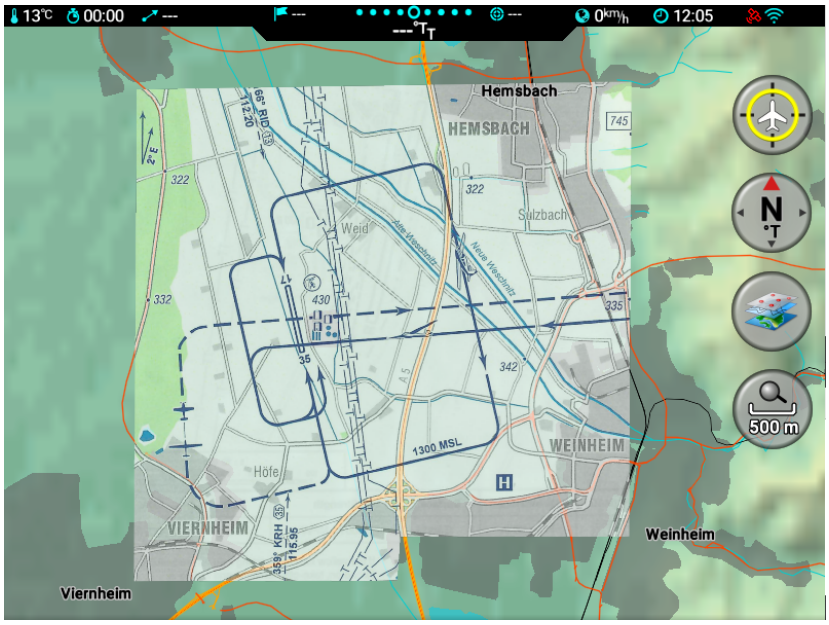


Figure 33: Use in Nesis, the EDGZ approach map is shown over the base Nesis map. The transparency is set to 70%.

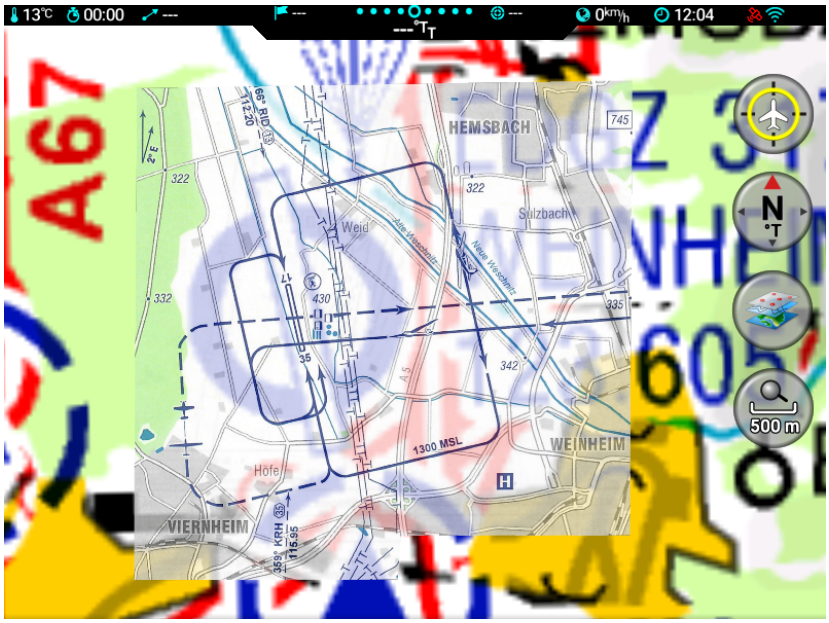


Figure 34: Use in Nesis, the EDGZ approach map is shown over the ICAO map of Germany. The transparency is set to 80%.

7.1 AIP

Maybe the most relevant sources are national AIPs. Many times they are called eAIPs. Most of them are nowadays available online as PDF documents. We can't provide direct links here as they are changing frequently but a simple internet search will quickly yield a good result.

An AIP is a pretty complex document, but they all follow the same structure and once you

know where to look for the map, you will quickly find what you are looking for.
Every country prepares this a bit differently, but in general, a typical search goes as follows:

1. Enter `AIP Country name` into your internet search engine.[2]
2. The search usually results in correct page to be on the top or close to the top.
3. Once the page is opened, try to find the effective AIP package document link. They are usually on the first page. The link may guide you to the html or pdf documents. Both are OK.
4. AIPs have several parts. Aerodrome information is in *Part 3* or sometimes *Part III*.
5. Part III documents have several sections. The section with charts are located in `AD 2 Aerodromes`.
6. AD 2 has many subsections. In most cases, there is a *Charts related to an aerodrome* subsection at the end. This is what you are looking for. But is can also happen, that charts are provided in a different place inside the AD 2.
7. Sometimes charts are integrated into the document itself but most frequently links to external documents are provided. Each aerodrome has many links and we are after the *VFR approach* chart/map or similar. Open these documents and take a look inside.
8. Once you get proper *pdf* approach map file, proceed according to the instructions from this manual.

Here are some examples:

- A search for `AIP Slovenia` gives almost a direct hit. Locate the AIP package which is effective and then search for the `Part 3`. Open the `AD 2 Aerodromes` section, open the list of aerodromes and locate the `Charts related to an aerodrome` sub section at the end. There will be many links to various charts. The charts of our interest are VFR approach charts. In the Slovenia case, there are four such charts.
- A search for `AIP Austria` also results in a correct link being on top. Click on the `aktuelle Ausgabe / current version` opens the effective AIP. Locate `Part III` and then `AD 2`. There are links to individual aerodromes and their charts.
- A search for `AIP Finland` leads you to their page. Search for `AD` and then for `AD 2`. There will be a list of aerodromes and once an aerodrome is selected, you will see the charts. Search for the `Visual Approach and Landing Charts, VAC`.
- A search for `AIP Estonia` is similar. Open their eAIP page and currently effective issue link. Then select `Part 3`, and `AD 2` and then the aerodrome of your interest.
- `AIP France` follows the same pattern, though it seems that they do not publish VFR approach charts in AIP. They can be find on a sister site, see section 3.1.1 on page 9 for an example.

Note that not all countries provide AIP information online. Some require that you buy this information and some require that you register to get the eAIP service.

[2] We recommend using DuckDuckGo.

7.2 Other sources

There are many other sources available. If you feel that we should document them here, please provide us a link to the source and we will include them here.

8 Copyright Issues

Almost all maps/charts available on-line are published under some kind of *copyright*. This means that you can probably use the map for your own purposes and you can process it with the Approacher app for your own use in Nesis. However, most probably, you are not allowed to distribute the resulting approach maps in *nam* format on the Internet or in any other way. Namely copyright laws in the EU are pretty complex, they vary from country to country and in most cases they do not support so called *fair use* case. For this reason, we can not publish Nesis approach maps on our web site unless we get an exclusive permission to do so.

In the future we will try to get in touch with some agencies and the individuals which hold the copyright. If we manage to get permission, we will publish the map online on our website `https://www.kanardia.eu`.