X-PLANE

NAVIGATION DATA (NAV.DAT & EARTH_NAV.DAT) FILE SPECIFICATION

VERSION 810

REVISION HISTORY

7 May 2009	Spec converted to this new format to support new web site (http://data.x-plane.com).
8 Sept 2009	Error in usage of row type 13 fixed in "applicability" section below.
31 May 2010	Corrected error in specification of VOR and localizer radio frequencies. Added elevations to NDB spec. Corrected references to apt.dat.
29 July 2011	Fixed minor error in definition of nav-aid frequencies

APPLICABILITY

This specification (XP NAV810) is supported in X-Plane 8.10 and later (currently, X-Plane 9.30). It is identified in the data files as "810 Version" on the second row of the file.

The prior specification for airport data was XP NAV740, which is recommended for X-Plane 7.40 – 8.09. Changes in the spec for XP NAV810 were:

- A new row code for DMEs (13) for which the frequency display will be shown on X-Planes charts. DMEs with a row type 12 will have their frequency display suppressed on X-Plane's chart to prevent clutter (such DMEs are usually co-located with a VOR or an ILS).

OVERVIEW & SCOPE

This specification defines all radio navigation data for X-Plane, including NDBs, VORs (inc. VORTACs and VOR-DMEs), and ILS components (localisers, glideslopes, marker beacons). The effect of this data is to:

- Allow these radio navigation facilities to be used when flying in X-Plane.
- Display the navigation facilities on X-Plane's chart.
- Render objects in the X-Plane scenery system to represent each facility.

BASIC CONCEPTS

- Latitudes and longitudes are described in a decimal notation (eg. 20.12345678).

    - A latitude of 50 degrees 30 minutes south would be defined as -50.50000000
- North latitudes and east longitudes are positive. South latitudes and west longitudes are negative.
- All headings are referenced to true north (not magnetic north). X-Plane has an internal model of magnetic variation.

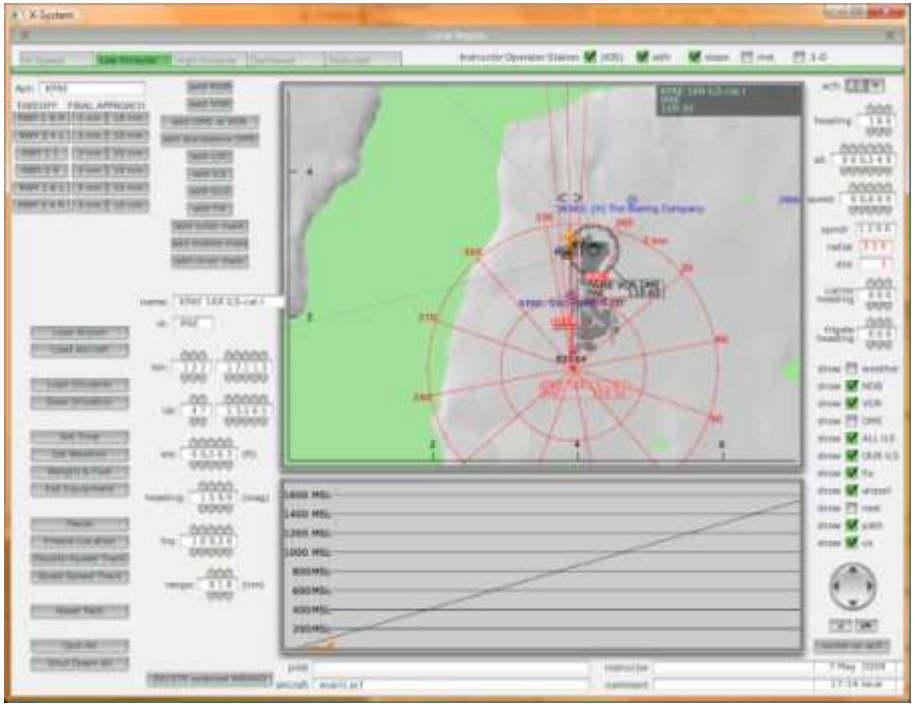
FILE CHARACTERISTICS

The earth_nav.dat (and nav.dat) files are plain text files:

- Fields in the data can be separated by one or more white space characters.
- By default, the files are generated so that rows of data are consistently aligned, but this is not required.

FILE STRUCTURE

The navigation data can be edited in X-Plane in the "Location | Local Map" view, and by clicking on the "edit" button at the top of the screen.



If data is changed here, then X-Plane will ask for confirmation that the new data should be saved when quitting X-Plane. This will ensure that all structural requirements listed here for airport data are met.

[Note that the current version of X-Plane displays headings for an ILS in magnetic degrees on this screen, but that this data is converted to a true heading when the data is saved to earth_nav.dat.]

In common with most other X-Plane data file specification, header rows of data define the origin (PC or Mac) of a particular copy of a file, and define the file specification version. The file specification may be followed by a reference to a sequential release data cycle and build number for the data, and a copyright message:

```
I
810 Version - data cycle 2009.01, build 20081054, metadata NavXP810.  Copyright © 2009, Robin A. Peel (robin@xsquawkbox.net)...
```

The complete copyright message should be left intact if you redistribute this data. The GNU GPL (general public License) under which this data is released is designed to encourage modifications, enhancements and redistribution, even in commercial derivative products. More details about this license are available on my website (http://data.x-plane.com).

Subsequent rows of data define each nav-aid. Sequence is not important, but by default this file is sorted by row code, then by nav-aid name.

The file is terminated by a '99':

```
99
```

ROW CODES

Each row of data begins with an integer code that defines the type of data:

Row Code	Meaning	Comment
2	NDB (Non-Directional Beacon)	Includes NDB component of Locator Outer Markers (LOM)
3	VOR (including VOR-DME and VORTACs)	Includes VORs, VOR-DMEs and VORTACs
4	Localiser component of an ILS (Instrument Landing System)	
5	Localiser component of a localiser-only approach	Includes for LDAs and SDFs
6	Glideslope component of an ILS	Frequency shown is paired frequency, not the DME channel
7	Outer markers (OM) for an ILS	Includes outer maker component of LOMs
8	Middle markers (MM) for an ILS	
9	Inner markers (IM) for an ILS	
12	DME, including the DME component of an ILS, VORTAC or VOR-DME	Frequency display suppressed on X-Plane's charts
13	Stand-alone DME, or the DME component of an NDB-DME	Frequency will displayed on X-Plane's charts

Row Code	Meaning	Comment

EXAMPLE DATA

Here is some example data for the Seattle, Washington, USA area (note the separate data row for the DME component of the Seattle VORTAC):

```
2  47.63252778 -122.38952778      0   362  50       0.0   BF   NOLLA NDB
3  47.43538889 -122.30961111    354 11680 130      19.0   SEA  SEATTLE VORTAC
4  47.42939200 -122.30805600    338 11030  18     180.343 ISNQ KSEA 16L ILS-cat-I
6  47.46081700 -122.30939400    425 11030  10  300180.343 ISNQ KSEA 16L GS
8  47.47223300 -122.31102500    433     0   0     180.343 ---- KSEA 16L MM
12 47.43433300 -122.30630000    369 11030  18       0.000 ISNQ KSEA 16L DME-ILS
12 47.43538889 -122.30961111    354 11680 130       0.0   SEA  SEATTLE VORTAC DME
```

DEFINITION OF DATA FIELDS

Each column in each row is defined below, using the example data from Seattle shown above. Note that:

- Some row codes store data in an identical specification, and these have been grouped together in the table below (eg. the marker beacons).
- The specification aims to be internally consistent. For example, the format or latitudes and longitudes is always the same, and all headings/orientations are defined as true (not magnetic) degrees.

Row	Meaning *Example value*	Comment *Explanation*	*Valid values*
2	NDB	Non-directional beacon	
	2	Row code for an NDB	2
	47.63252778	Latitude of NDB in decimal degrees	Eight decimal places supported
	-122.38952778	Longitude of NDB in decimal degrees	Eight decimal places supported
	0	Elevation in feet above MSL	Integer. Used to calculate service volumes.
	362	Frequency in KHz	Integer. Decimal frequencies not supported.
	50	Minimum reception range in nautical miles	Integer
	0.0	Not used for NDBs	0.0
	BF	NDB identifier	Up to four characters. Not unique
	NOLLA NDB	NDB name	Text, suffix with "NDB"
3	VOR	Includes VOR-DMEs and VORTACs	
	3	Row code for a VOR	3
	47.43538889	Latitude of VOR in decimal degrees	Eight decimal places supported
	-122.30961111	Longitude of VOR in decimal degrees	Eight decimal places supported
	354	Elevation in feet above MSL	Integer. Used to calculate service volumes.
	11680	Frequency in MHZ (multiplied by 100)	Integer - MHz multiplied by 100 (eg. 123.45MHz = 12345)
	130	Minimum reception range in nautical miles	Integer
	19.0	Slaved variation for VOR	Up to three decimal places supported
	SEA	VOR identifier	Up to four characters. Not unique
	SEATTLE VORTAC	VOR name	Text, suffix with "VOR", "VORTAC" or "VOR-DME"
4, 5	LOC	Includes localisers (inc. LOC-only), LDAs and SDFs	
	4	Row code for a localizer associated with an ILS	4=ILS localizer, 5=stand-alone localizer (inc LOC, LDA & SDF)
	47.42939200	Latitude of localiser in decimal degrees	Eight decimal places supported.
	-122.30805600	Longitude of localiser in decimal degrees	Eight decimal places supported.
	338	Elevation in feet above MSL	Integer.
	11030	Frequency in MHZ (multiplied by 100)	Integer - MHz multiplied by 100 (eg. 123.45MHz = 12345)
	18	Minimum reception range in nautical miles	Integer
	180.343	Localiser bearing in true degrees	Up to three decimal places supported
	ISNQ	Localiser identifier	Up to four characters. Usually start with "I". Not unique
	KSEA	Airport ICAO code	Up to four characters. Must be valid airport code
	16L	Associated runway number	Up to three characters
	ILS-cat-I	Localiser name	Use "ILS-cat-I", "ILS-cat-II", "ILS-cat-III", "LOC", "LDA" or "SDF"

Row	Meaning *Example value*	Comment *Explanation*	*Valid values*
6	Glideslope	Glideslope associated with an ILS	
	6	Row code for a glideslope	6
	47.46081700	Latitude of glideslope aerial in decimal degrees	Eight decimal places supported
	-122.30939400	Longitude of glideslope aerial in decimal degrees	Eight decimal places supported
	425	Elevation in feet above MSL	Integer.
	11030	Frequency in MHZ (multiplied by 100)	Integer - MHz multiplied by 100 (eg. 123.45MHz = 12345)
	10	Minimum reception range in nautical miles	Integer
	300180.343	Associated localiser bearing in true degrees prefixed by glideslope angle	Up to three decimal places supported. Glideslope angle multiplied by 10,000 and added (eg. Glideslope of 3.25 degrees on heading of 123.456 becomes 325123.456)
	ISNQ	Glideslope identifier	Up to four characters. Usually start with "I". Not unique
	KSEA	Airport ICAO code	Up to four characters. Must be valid airport code
	16L	Associated runway number	Up to three characters
	GS	Name	"GS"
7, 8, 9	Marker beacons	Outer (OM), Middle (MM) and Inner (IM) Markers	
	8	Row code for a middle marker	7=OM, 8=MM, 9=IM
	47.47223300	Latitude of marker in decimal degrees	Eight decimal places supported
	-122.31102500	Longitude of marker in decimal degrees	Eight decimal places supported
	433	Elevation in feet above MSL	Integer
	0	Not used	0
	0	Not used	0
	180.343	Associated localiser bearing in true degrees	Up to three decimal places supported
	----	Not used	Use "----" to indicate no associated ID
	KSEA	Airport ICAO code	Up to four characters. Must be valid airport code
	16L	Associated runway number	Up to three characters
	MM	Name	"OM", "MM" or "IM"

Row	Meaning *Example value*	Comment *Explanation*	*Valid values*
12, 13	DME	Distance Measuring Equipment	
	12	Row code for a DME	12=Suppress frequency, 13=display frequency
	47.43433300	Latitude of DME in decimal degrees	Eight decimal places supported
	-122.30630000	Longitude of DME in decimal degrees	Eight decimal places supported
	369	Elevation in feet above MSL	Integer
	11030	Frequency in MHZ (multiplied by 100)	Integer - MHz multiplied by 100 (eg. 123.45MHz = 12345)
	10	Minimum reception range in nautical miles	Integer
	0.000	DME bias in nautical miles.	Default is 0.000
	ISNQ	Identifier	Up to four characters. Not unique.
	KSEA	Airport ICAO code (for DMEs associated with an ILS)	• Only used for DMEs associated with an ILS. • Up to four characters. Must be valid ICAO code
	16L	Associated runway number (for DMEs associated with an ILS)	• Only used for DMEs associated with an ILS. • Up to three characters
	DME-ILS	DME name (all DMEs)	• "DME-ILS if associated with ILS • Suffix "DME" to navaid name for VOR-DMEs, VORTACs & NDB-DMEs (eg. "SEATTLE VORTAC DME" in example data) • For standalone DMEs just use DME name

FURTHER INFORMATION

Resources are available for airport designers on my web site at http://data.x-plane.com