

NavView User Guide – 03 Geodesy

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3. GEODESY

If Roles and Privileges are enabled, the following are what is allowed for each role:

Roles	Privileges
Not Logged In	Cannot add, edit or remove a Horizontal or Vertical CRS
User	Cannot add, edit or remove a Horizontal or Vertical CRS
Online/Supervisor	Cannot add, edit or remove a Horizontal or Vertical CRS
Admin (Administrator)	Can add, configure/edit or remove a Horizontal or Vertical CRS

3.1 EPSG DATABASE

NavView has adopted the European Petroleum Survey Group (EPSG) Geodetic Parameter Set maintained and published by the Geomatics Committee of the International Association of Oil and Gas Producers (OGP) (<u>https://spatialreference.org/ref/</u>). This dataset includes parameters for Coordinate Reference Systems (CRS), coordinate operations and units, each with its own unique identifier.

The NavView installation and update processes copy the EPSG database included in the installation package to the following folder:

C:\ProgramData\4D Nav\Geodesy\EPSG

Note: When User defined Horizontal CRS and transformations are added to NavView, these are written to the EPSG database file located in this folder. If a NavView update is applied, the EPSG database file located in this folder will be overwritten resulting in the loss of these. Therefore, it is recommended that when using User defined CRS and/or transformations, a backup copy of the EPSG database file be kept so it can be copied back to the above folder after any NavView updates.

3.2 COORDINATE REFERENCE SYSTEMS

NavView uses EPSG Horizontal and Vertical CRS. A Horizontal CRS can be Geographic 2D or Projected.

A Geographic 2D CRS is used for positioning on the surface of an ellipsoid, i.e., latitude and longitude. Associated with the Geographic 2D CRS is a datum defining the relationship of the CRS to the earth. An example of a Geographic 2D CRS is *WGS 84*.

A Projected CRS is used for positioning on a map projection. A Projected CRS always has a source Geographic CRS and therefore an associated datum. Examples of a Projected CRS are WGS 84 / UTM zone 31N, whose source Geographic CRS is WGS 84, and ED50 / UTM zone 31N, whose source Geographic 2D CRS is ED50.

A Vertical CRS uses the direction of gravity in the definition of the height and depth of a position. An example of a Vertical CRS is Mean Sea Level (MSL).



Note: EPSG also supports a Geographic 3D CRS for position on and above/below the ellipsoid. However, NavView supports the use of a separate EPSG based Vertical datum in conjunction with either the Geographic 2D or Projected CRS. This is referred to as a Compound CRS.

In addition, NavView supports user defined CRS for cases where the EPSG database does not address the requirements. These are added to the local copy of the EPSG database and available for use in the same manner as standard EPSG CRS are.

NavView allows the operator to add multiple Horizontal CRS to be used as required for a given project, one of which at any given time is set to be the Working CRS. This enables NavView to support switching back and forth between contiguous map projection zones in real time and to accept and output positions in a CRS other than WGS 84 or the local working datum. The former facilitates operations that start in one zone and finish in another, such as a rig move. The latter is of particular interest when working with USBL and DP systems that are configured to present and accept positions in WGS 84 UTM.

- **Note:** Only a Projected CRS can be set to Working because the Working requires both map projection and geographic coordinate support.
- **Note:** NavView automatically adds the WGS 84 Geographic 2D CRS, EPSG code 4326. This CRS cannot be removed.
- **Note:** When NavView opens a new project, the Projected CRS WGS 84 / World Mercator, EPSG code 3395, is automatically added and set to Working.

Similarly multiple Vertical CRS with their associated transformations can be added and used with only one set as Working at any one time.

3.3 TRANSFORMATIONS

The transformations supported by NavView are as defined by EPSG and included in the EPSG database.

In addition, NavView supports user defined transformations for cases where the EPSG database does not address the requirements. These are added to the local copy of the EPSG database and available for use in the same manner as standard EPSG transformations are.

The following user defined transformations are included with the EPSG database shipped with NavView installations:

- EPSG Code 99010 ITRF2014 to NAD27(1)
 - Source CRS: ITRF2014 EPSG Code 9000
 - Target CRS: NAD27 EPSG Code 4267
- EPSG Code 99020 ITRF2014 to NAD83(CSRS)(1)
 - Source CRS: ITRF2014 EPSG Code 9000
 - Target CRS: NAD83(CSRS) EPSG Code 4617
- EPSG Code 99030 ITRF2014 to ETRS89(1)

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- Source CRS: ITRF2014 EPSG Code 9000
- Target CRS: ETRS89 EPSG Code 4258
- EPSG Code 99040 ITRF2008 to NAD27(1)
 - Source CRS: ITRF2008 EPSG Code 8999
 - Target CRS: NAD27 EPSG Code 4267
- EPSG Code 99050 ITRF2014 to WGS84(1)
 - Source CRS: ITRF2014 EPSG Code 9000
 - Target CRS: WGS84 EPSG Code 4326
- EPSG Code 99060 ITRF2014 to NAD83(2011)(1)
 - Source CRS: ITRF2014 EPSG Code 9000
 - Target CRS: NAD83(2011) EPSG Code 6318
- EPSG Code 99061 ITRF2014 to NAD83(2)
 - Source CRS: ITRF2014 EPSG Code 9000
 - Target CRS: NAD83 EPSG Code 4269

3.4 COORDINATE OPERATIONS

The NavView geodesy supports standard coordinate operations, changing coordinates from one CRS (source) to another CRS (target). Conversions refer to coordinate changes where the datum of the source and target CRS is the same. For example, the conversion of WGS 84 / UTM zone 31N map projection coordinates to WGS 84 geographic coordinates.

Transformations refer to coordinate changes where the datum of the source and target CRS are different. For example, WGS 84 to ED50.

3.5 ACCESS GEODESY CONFIGURATION

The Geodesy configuration is viewed and configured via the Project Explorer or the Setup ribbon.

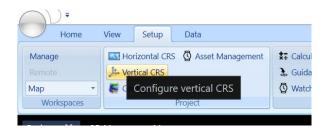
- 1. Expand Setup Ribbon.
- 2. Click the Horizontal CRS button in the Project section.

D:	
Home	View Setup Data
Manage	Horizontal CRS 🖞 Asset Management
Remote	Le Vertical C Configure horizontal CRS Guidance
Мар	🥰 Configuration 🖞 Watch Re
Workspaces	Project
Explorer X	О Мар Мар

FIGURE 3-1 HORIZONTAL CRS CONFIGURATION ACCESS

3. Click the Vertical CRS button in the Project section.







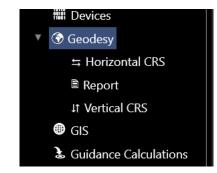


FIGURE 3-3 ACCESS IN EXPLORER

3.6 USING THE HORIZONTAL CRS VIEW

The Horizontal CRS view presents the Horizontal CRS and associated coordinate operations for review and editing. The view has two main tabs: Horizontal CRS and Transformations. Each of these displays a list of the respective items in the left panel and associated Details and Test tabs in the right panel. The Details tab includes hypertext (underlined blue text) that when clicked expand to provide additional information for that item.

3.6.1 HORIZONTAL CRS TAB



FIGURE 3-4 HORIZONTAL CRS - DETAILS TAB

Coordinate Reference Systems lists the Horizontal CRS currently setup for use in NavView in a data grid sortable by columns.

Name: EPSG name or user entered name

Code: EPSG code, including those assigned to user created CRS



Kind: Projected or geographic 2D

Working: Yes, if CRS is the Working Projected CRS, No if not

Details tab displays the parameters for the selected CRS. Click on the hyperlinks in the Details to view the EPSG details for that item.

		C:\Prog	amData\4D Nav\Geodesy\EPSG\EPSG-v9_9.sdf	
rizontal CRS Transforma	itions			
oordinate Reference System			Details Test	
Name	Code Kind	Working		
WGS 84	4326 geog	raphic 2D No	Selected CRS: WGS 84 (4326)	Working CRS: NAD27 / BLM 15N (ftUS) (32065)
WGS 84 / World Mercator	3395 proje	cted No		(103) (52003)
	32065 proje	forking User	N 0*00.0000*	E N/A i T N/A N/A Point scale factor 0.00000000 Convergence 0.000007 WGS 84 (4326) using OGP. Usa Conus

FIGURE 3-5 HORIZONTAL CRS - TEST TAB

Test tab displays the coordinate operations for the selected CRS with respect to the Working CRS.

Selected	Coordinate Operations
Projected CRS:	Selected Projected coordinate conversion to/from its source Geographic 2D CRS coordinates
	Selected source Geographic 2D coordinate transformation to/from Working Projected CRS source Geographic 2D CRS
	Working Projected coordinate conversion to/from its source Geographic 2D CRS coordinates
Geographic 2D:	Selected source Geographic 2D coordinate transformation to/from Working Projected CRS source Geographic 2D CRS
	Working Projected coordinate conversion to/from its source Geographic 2D CRS coordinates
Working CRS:	Working Projected coordinate conversion to/from its source Geographic 2D CRS coordinates



3.6.2 TRANSFORMATIONS TAB

٩	Co	nfigure Horizon	tal CRS					_		×
				C:\Program	nDi	ata\4D Nav\Geode	esy\EPSG\E	PSG-v9_9.sdf		
	Hor	rizontal CRS	Transformations							
	Co	oordinate Trans	formations —			Details Test				
		Source	Target	Transformation		Transform				
		NAD27 (4267)	WGS 84 (4326)	NAD27 to WGS 84 (79) (15851)		Coordinate O	peration:	NAD27 to WGS 84 (79) Code: 15851		
						Туре:		Transformation		
						Source CRS:		4267		
						Target CRS:		4326		
						Area:				
						Scope:		Recommended for oil industry use in US Gulf of Mexico (GoM). Accuracy at 67% confidence level is 0.15m onshore, 5m nearshor and undetermined farther offshore.	e	
				Change User		Remarks:		Transformation taken from NAD27 to NADB3 (1) (code 1241) assuming htat NADB3 is equivalent to WCS 84 within the accura of this tfm. Uses NADCON method which expects longitudes positive west; EPSG CNS codes 4267 and 4326 have longitudes		
									(ЭК

FIGURE 3-6 TRANSFORMATIONS - DETAILS TAB

Coordinate Transformation lists all the coordinate transformations required to support transformations between any of the CRS currently setup for use in NavView. These are displayed in a data grid sortable by columns.

Source:	EPSG or user assigned name and code of the source geographic 2D CRS
Target:	EPSG or user assigned name and code of the target geographic 2D CRS

Transformation: EPSG or user assigned name and code of the transformation

Details tab displays the parameters for the selected transformation. Click on the hyperlinks in the Details to view the EPSG details for that item.

C4ProgramDatiA4D NavGcodey(LPSGLPSG-r9 9.sdf Horizontal CRS Transformations Ccoordinate Transformation Source Target Transformation NA027 (4267) WGS 84 (4326) NA027 to WGS 84 (79) (15851) N4027 (4267) WGS 84 (4326) NA027 to WGS 84 (79) (15851)	
Coordinate Transformations Source Target Transformation NAD27 (4267) WCS 84 (4326) NAD27 to WCS 84 (9) (15851) N4027 (267) WCS 84 (1326) N4027 to WCS 84 (1326) N4027 to WCS 84 (1326)	
Source Target Taradomation Victor V	
NAD27 (4267) WGS 84 (4326) NAD27 to WGS 84 (79) (15851) N 36° 35.7000 NAD27 (4267) N 36° 35.7021	
NAD27 (4267) WGS 84 (4326) NAD27 to WGS 84 (79) (15851) N 36° 35.7000' N 36° 35.7021'	
W 97* 25.8000* W 97* 25.8195*	
Charge User	ок

FIGURE 3-7 TRANSFORMATIONS - TEST TAB

Test tab displays the coordinate operation for the selected transformation, Source Geographic 2D CRS coordinate transformation to/from the target Geographic 2D CRS.

3.6.3 ADD A HORIZONTAL CRS TO NAVVIEW

All CRS that are required for a specific NavView application must be added to be available for use. This includes the Working CRS to be used for the general NavView operation as well as



any required to support special operations such as position output, input or included in a report where the position is not on either the WGS84 or Working CRS. For example, providing WGS84 UTM coordinates for a DP system.

In addition, if a project spans multiple map projection zones, i.e., multiple Projected CRS, each of these must be added.

- 1. Access the Horizontal CRS view.
- 2. Select Horizontal CRS tab.
- 3. Click Add to launch a wizard to step through the searching for and adding of a CRS.

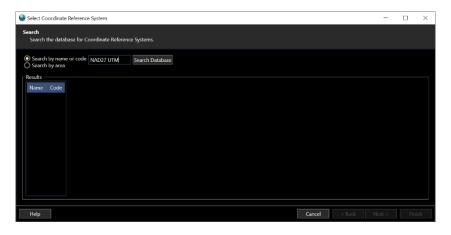


FIGURE 3-8 SELECT CRS - SEARCH BY NAME OR CODE

- 4. Select Search by name or code if either have been provided.
 - a. Enter the EPSG code or name in the associated entry box and click Search Database
- **Note:** The EPSG code and name options include user created CRS. These are assigned an EPSG code when assigned and added to the local database.
- **Note:** When entering a name, the search looks for those EPSG CRS whose name or alias contains the entry after removing the blanks (whitespaces) in both the entry and CRS name and alias. For example, entering **ed50** will result in a list of all EPSG CRS with ED50 in the name, such as ED50 and ED50 / TM 0 N; entering **ed50/utm** will result in a list of ED50 / UTM zone 28N to ED50 / UTM zone 38N.
- **Note:** When entering the EPSG CRS code, the search is specific and only lists the EPSG CRS with that exact code.
- 5. Or select Search by area if unsure of the EPSG code or name of the required CRS.



earch Search the database for Coordinate Reference Syst	tems.		
Search by name or code N 35° 00.0000' Search by area W 93° 00.0000' Sear	rch Database		
Results			
Name	Code	Summary -	
NAD27 / UTM zone 15N	26715		JTM zone 15N is a projected CRS last revised on 24-Nov-2009
NAD27 / Arkansas North	26751		able for use in North America - between 96°W and 90°W. Manitoba: Nunavut: Ontario, Guatemala, Mexico, United States
NAD27 / Arkansas South	26752	(USA) - Ar	kansas; Illinois; Iowa; Kansas; Louisiana; Michigan; Minnesota;
NAD83 / Arkansas North	26951		i; Miss (more, see 'Area' for details). NAD27 / UTM zone 15N
NAD83 / Arkansas South	26952		n geographic 2D NAD27. NAD27 / UTM zone 15N is a CRS for medium scale topographic mapping and engineering survey. It
NAD83 / UTM zone 15N	26915		ed by information from OGP.
NAD83(HARN) / Arkansas North	2764	- Details	
NAD83(HARN) / Arkansas South		Name	NAD27 / UTM zone 15N Code: 26715
NAD27 / BLM 15N (RUS)	32065	Name.	NAD27 / OTM zone ISN Code: 20715
WGS 72 / UTM zone 15N		Type:	projected
WGS /2BE / UTM zone 15N	32415	Area:	North America - 96"W to 90"W and NAD27 by country
NADB3 / BLM 15N (RUS)	32165		Construction 20, CC, how we share a stability of the Original state and the test
WGS 84 / UTM grid system (northern hemisphere)	32600	Coordinat System:	 Cartesian 2D.CS. Axes: easting, northing (EN). Orientations: east, north. UoM: m.
WGS 84 / UTM zone 15N	32615	- Janeire	
WGS 84 / World Mercator	3395	Source	NAD27
NAD83 / Arkansas North (ftUS)	3433	Geograph CRS:	ic .
NAD83(HARN) / Arkansas North (ftUS)	3441		
NAD83(NSR52007) / Arkansas North	3484	Conversio	n: UTM zone 15N

FIGURE 3-9 SELECT CRS - SEARCH BY AREA

- a. Enter a position within the work area and click Search Database
- 6. If the search is unsuccessful, Search failed will display in red below the entry box.
- 7. If the search is successful, the dialog will expand to list the EPSG CRS found to match the entry.

	m		- 0	
earch Search the database for Coordin	ate Reference Syste	ms.		
Search by name or code NAD	27 Searc	h Database		
○ Search by area				
Results				
Name	Code	Summary —		
NAD27 / Arizona West	26750 ^		M 15N (ftUS) is a projected CRS last revised on 05-Mar-2010	
NAD27 / Arkansas North			ile for use in United States (USA) - between 96°W and 90°W - nois; Iowa: Kansas; Louisiana; Michigan; Minnesota;	
NAD27 / Arkansas South	26752	Mississippi;	Missouri; Nebraska; Oklahoma; Tennessee; Texas; Wisconsin;	
NAD27 / BLM 10N (ftUS)	4410		co o (more, see 'Area' for details). NAD27 / BLM 15N (ftUS) geographic 2D NAD27. NAD27 / BLM 15N (ftUS) is a CRS for	
NAD27 / BLM 11N (ftUS)	4411		deographic 2D NAD27. NAD27 / BLM TSN (ttos) is a CRS for	
NAD27 / BLM 12N (ftUS)	4412	defined by i	nformation from OGP.	
NAD27 / BLM 13N (ftUS)	4413	– Details –		
NAD27 / BLM 14N (ftUS)	32064	Name:	NAD27 / BLM 15N (ftUS) Code: 32065	
NAD27 / BLM 15N (ftUS)	32065	Name.	NAD277 BLM T3N (RO3) CODE: 52003	
NAD27 / BLM 16N (ftUS)	32066	Type:	projected	
NAD27 / BLM 17N (ftUS)	32067	Area:		
NAD27 / BLM 18N (ftUS)	4418			
NAD27 / BLM 19N (ftUS)	4419	Coordinate System:	Carresian 20 CS. Axes reasting, northing (A.T): Orientations: east, north, 06M. HUS,	
NAD27 / BLM 1N (RUS)	4401	aystern.		
NAD27 / BLM 2N (ftUS)	4402	Source		
NAD27 / BLM 3N (ftUS)	4403	Geographic CRS:		
NAD27 / BLM 4N (ftUS)	4404			
NAD27 / BLM 59N (ftUS)	4399	Conversion:		
	4405			

FIGURE 3-10 SELECT CRS - FOUND CRS

- a. Selecting a CRS from the list will display the respective CRS details in the right panel
- b. Clicking on any hyperlink will expand that item to display its details
- c. If the search does not result in the required CRS, repeat the search process, otherwise
- d. Select the desired CRS in the list, confirm the details, then click Next

Note: If the CRS selected is a Geographic 3D CRS, the Next button will not enable. NavView does not support the selection of Geographic 3D CRS for use.



Select Coord	inate Reference System		-		×
Preview The selecte	d Coordinate Reference System.				
Summary -					
and is suitab Arkansas; Illi Mississippi; I Gulf of Mexi	41 SN (1015) is a projected GTS shart revixed on 65-Mm-2010 for run in thirlds attact (ISA) = behaven 6KW and 90W - noic, lowe; Kanase Louidane, Michigan: Minnesota. Misouri : Nelwanka; Cikalame; Riemeave; Roaz; Wacomin; co c, Lonce; e. e. Hers for defails (NAUS) / All N19 (HIS)				
Minerals (inc defined by in	peographic 2D NAD27. HAD27 / BLM 15N (RUS) is a CRS for Multing oil) management, exploration and production. It was formation from OGP.				
Details					
Name:	NAD27 / BLM 15N (ftUS) Code: 32065				
Type:	projected				
Area:					
Coordinate System:					
Source Geographic CRS:					
Conversion:					
Help	Cancol	< Back	Next >	Fini	ich
ricip	Canter	A DOUK			911

FIGURE 3-11 SELECT CRS - FINISH SELECTION

- e. Review the details to confirm they define the required CRS
 - i. Click Finish if correct
 - ii. Click Back or Cancel if not
- 8. You will be prompted with an option to set the newly added CRS as the working, answer accordingly.



FIGURE 3-12 NEW CRS ADDED - SET TO WORKING PROMPT

9. You will be prompted with an option to go directly to configuring the associated transform, answer accordingly.



FIGURE 3-13 NEW CRS - CONFIGURE TRANSFORM PROMPT

10. Answering No in step 9 will result in returning to the Configure Horizontal CRS window Horizontal CRS tab with the new CRS listed, answering Yes will result in returning to the Configure Horizontal CRS window Transform tab (see Configure Transformations).

3.6.4 CREATE AND CHANGE A USER PROJECTED CRS

A user can add and configure a Projected CRS to address cases where an existing EPSG CRS does not apply.



- **Note:** The User CRS is added to the local copy of the EPSG database and is then available to be added as one of the CRS to be used by NavView. It is not automatically added to the Horizontal CRS in use by NavView.
- 1. Access the Horizontal CRS view.
- 2. Select Horizontal CRS tab.
- 3. Click User to display all the User created CRS currently present in the database.

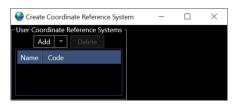


FIGURE 3-14 USER PROJECTED CRS

Note: All User created CRS present in the local EPSG database are displayed in this view.

4. To add a new CRS, click the Add split button and select to add either a Transverse Mercator or Lambert Two Standard Parallel Projected CRS.

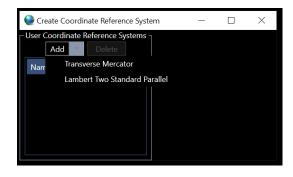


FIGURE 3-15 USER CRS - OPTIONS

- a. NavView will look for and use the lowest available EPSG code that can be assigned to the user CS and generate a default Projected CRS and add it to the database
- Note: The allowed range of codes is 40000 to 49999
 - b. The new CRS will be added to the list and ready for configuration
- 5. To configure a User CRS, select it in the list.
 - a. **Details tab** presents and behaves here as it does in the main Horizontal CRS view, displaying the CRS parameter summary complete with hypertext allowing the operator to view greater details





FIGURE 3-16 USER CRS - DETAILS TAB

- b. **Parameters tab** presents the respective map projection parameters for review and editing
 - i. Edit as required
 - ii. Click Save to save changes
 - iii. Click Revert to dump changes and revert to last saved parameters

Q Create Coordinate Reference System	-	×
User Coordinate Reference Systems Details Parameters Source CRS		
Name Code Coordinate Operation: Transverse Mercator		
User 40000 Name: User		
Latitude of Origin: N 0° 00.0000'		
Central Meridian: W 87° 00.0000'		
False Easting: 500,000.000 m		
False Northing: 0.000 m		
Scale factor: 0.999600000		
Units metre 🖙		
Save Revert		

FIGURE 3-17 USER CRS - PARAMETERS TAB

- c. **Source CRS tab** presents current source CRS (default is WGS 84, code 4326), this tab behaves in the same manner as the search database page in the wizard for Add a Horizontal CRS
 - i. Enter the EPSG name or code of the required Geographic 2D CRS, or a position in the work area
 - ii. Click Search Database
 - iii. If the search is unsuccessful, Search failed will display in red below the entry box
 - iv. If the search is successful, the dialog will expand to list the EPSG CRS found to match the entry
 - v. Select the appropriate CRS and review the details for this CRS
 - vi. Click Save to save the selection as the Source CRS
 - vii. Click Revert to dump changes and revert to last saved Source CRS



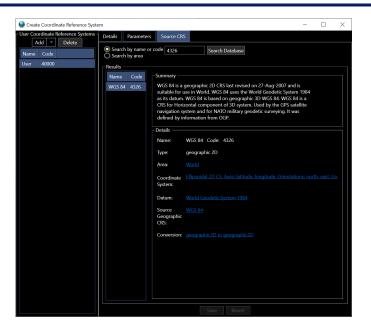


FIGURE 3-18 USER CRS - SOURCE CRS TAB

6. Close the window by clicking the X

3.6.5 SET THE WORKING PROJECTED CRS

NavView requires that one Projected CRS be always set as the Working CRS.

- 1. Access the Horizontal CRS view.
- 2. Select Horizontal CRS tab.
- 3. Select the CRS to be set to Working.
- 4. Click Set Working.
- 5. This CRS in the list will show Yes in the Working column.

Horizontal CRS	Transforma	ations		
Coordinate Refe	rence System	ns ———		
Name		Code	Kind	Working
WGS 84		4326	geographic 2D	No
WGS 84 / Wor	ld Mercator		projected	No
NAD27 / BLM	15N (ftUS)	32065	projected	Yes
Add	l Rer	nove	Set Working	User

FIGURE 3-19 WORKING CRS (PROJECTED)

Note: Only a Projected CRS can be set to Working. The Set Working button is therefore only enabled when a Projected CRS that is not already set to Working is selected.

4D NAV

3.6.6 REMOVE A HORIZONTAL CRS FROM NAVVIEW

If a CRS currently added to NavView is no longer required, it can be removed. Note that this does not remove it from the EPSG database.

- 6. Access the Horizontal CRS view.
- 7. Select Horizontal CRS tab.
- 8. Select the CRS to be removed.
- 9. Click Remove.
- 10. Respond to the confirmation prompt accordingly.
 - a. Yes to continue with the action and remove the CRS
 - b. No to abort the process and leave the CRS added to NavView
- **Note:** The Remove button will only enable if the selected CRS can be removed. The WGS 84 CRS, code 4326, and the CRS set Working cannot be removed.

3.6.7 DELETE A USER PROJECTED CRS

If a User created CRS is no longer required, it can be deleted from the local EPSG database.

- 1. Access the Horizontal CRS view.
- 2. Select Horizontal CRS tab.
- 3. Click User to display all the User created CRS currently present in the database.
- 4. Select the CRS to be removed from the EPSG database.
- 5. Click Delete.
- 6. Respond to the confirmation prompt accordingly.
 - a. Yes to continue with the action and delete the CRS from the database
 - b. No to abort the process and leave the CRS in the database
- **Note:** A User created CRS cannot be removed if it is currently added to a CRS used by NavView. If such a User created CRS is selected, the Delete button will not be enabled.
- 7. Close the window.

3.6.8 CONFIGURE TRANSFORMATIONS

NavView automatically adds a transformation operation place holder for every possible pairing of different Geographic CRS(s) added to NavView. These require configuration as there is often more than one transformation option for a given pairing.

- 1. Access the Horizontal CRS view.
- 2. Select Transformations tab.



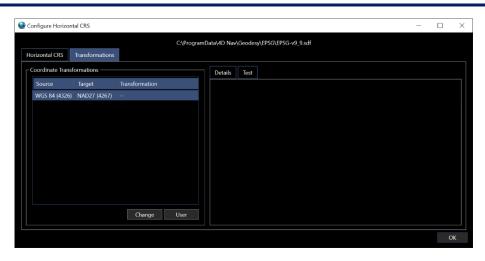


FIGURE 3-20 CONFIGURE TRANSFORMATIONS

- 3. Select the Transformation to configure.
- **Note:** If the Transformation has been previously configured, the details for the current setting will display in the Details tab. If it has not been configured, no information is displayed in this tab.
- 4. Click Change to display a list of transformations that apply to the respective source and target CRS.

Select T	ransformation				- 0	×
Search Searct	the database for transfor	mation coordinate opera	itions.			
Reverse				ransform —		
Code			Туре	Courterts Owner them	rr: NAD27 to WGS 84 (79) Code: 15851	
1180	NAD27 to WGS 84 (11)	DMA-Can MN ON	transformation -			
1181	NAD27 to WGS 84 (12)	DMA-Can E	transformation	Type:	Transformation	
1182	NAD27 to WGS 84 (13)	DMA-Can NWT	transformation	Source CRS:	4267	
1183	NAD27 to WGS 84 (14)	DMA-Can Yuk	transformation	Target CRS:	4326	
1184	NAD27 to WGS 84 (15)	DMA-Pan	transformation			
1185	NAD27 to WGS 84 (16)	DMA-Cuba	transformation	Area:		
1186	NAD27 to WGS 84 (17)	DMA-Grl	transformation	Scope:	Recommended for oil industry use in US Gulf of Mexico (GoM). Accuracy at 67% confidence level is 0.15m onshore, 5m nearshore and undetermined farther offsh	ore.
1187	NAD27 to WGS 84 (18)	DMA-Mex	transformation		Transformation taken from NAD27 to NAD83 (1) (code 1241) assuming that NAD83 is equivalent to WGS 84 within the accuracy of this fm. Uses NADCON metho	d
1249	NAD27 to WGS 84 (21)	DMA-AK AluE	transformation		which expects longitudes positive west; FPSG CRS codes 4267 and 4326 have longitudes positive east.	
1250	NAD27 to WGS 84 (22)	DMA-AK AluW	transformation	Single Operation		
	NAD27 to WGS 84 (30)	ICH-Cub	transformation	Methoda	NADCON	
15699	NAD27 to WGS 84 (87)	JECA-Mex GoM CamS	transformation	Code:	9613	
15851	NAD27 to WGS 84 (79)		transformation	Parameters		
15852	NAD27 to WGS 84 (80)	JECA-Usa GoM E	transformation	Parameters		
15853	NAD27 to WGS 84 (81)	JECA-Usa GoM C	transformation	Parameter	Value Reversable	
15854	NAD27 to WGS 84 (82)	JECA-Usa GoM W	transformation	Latitude difference fil	file conus.las Yes	
15855	NAD27 to WGS 84 (83)	JECA Mex GoM Tam	transformation	Longitude difference	ce file conus.los Yes	
15856	NAD27 to WGS 84 (84)	ESC-Usa GoM	transformation	Transformation Meth	NADCON	
15864	NAD27 to WGS 84 (85)	OGP-Usa AK	transformation			
15913	NAD27 to WGS 84 (86)	JECA-Mex GoM CamN	transformation			
					Cancel < Back Next >	
					Cancel < Eack Next >	Finish

FIGURE 3-21 AVAILABLE TRANSFORMATIONS

- a. Selecting a Transformation from the list will display the respective details in the right panel.
- b. Clicking on any hyperlink will expand that item to display its details
- c. Select the desired Transformation and click Next



Select Transformation					-		×
Preview The selected transforma	tion coordinate	operation.					
Transform							
Coordinate Operation:	NAD27 to WGS	84 (79) Co	de: 15851				
Type:	Transformation						
Source CRS:	4267						
Target CRS:	4326						
Area:							
Scope:	Recommended confidence leve offshore.	l is 0.15m on	shore, 5m nea	rshore and und	determined far	ther	
Remarks:	Transformation NAD83 is equiv method which have longitude	alent to WGS expects longi	84 within the tudes positive	accuracy of th	is tfm. Uses NA	DCON	
Single Operation	nave longitude	i positive eus					
Method:	NADCON						
Code:	9613						
Parameters							
Parameter	Value	Reversable					
Latitude difference fil	e conus.las	Yes					
Longitude difference	file conus.los	Yes					
Transformation Metho	od <u>NADCON</u>						
Help		[Cancel	< Back	Next >	Fin	ish

FIGURE 3-22 REVIEW SELECTED TRANSFORMATION

- d. Review the details to confirm they define the required Transformation
 - i. Click Finish if correct
 - ii. Click Back or Cancel if not
- 5. The newly configured Transformation will display in the Transformation tab with the respective source and target CRS.

0	Configure Horizo	ntal CRS						-		×
			C:\Progra	mD	ata\4D Nav	\Geodes	y\EPSG\EPSG-v9_9.sdf			
ŀ	lorizontal CRS	Transformations								
	Coordinate Tran	sformations ——			Details	Test				
	Source	Target	Transformation							
	NAD27 (4267)	WGS 84 (4326)	NAD27 to WGS 84 (79) (15851)							
			Change User							
			Change User							
									0	к

FIGURE 3-23 CONFIGURED TRANSFORMATION

3.6.9 CREATE AND CHANGE A USER TRANSFORMATIONS

A user can add and configure a transformation to address cases where an existing EPSG transformation does not apply. The transformation is added to the local copy of the EPSG database and is then available to be selected as part of Configure Transformations.

Note: The sign convention supported for the NavView User transformation is the Coordinate Frame Rotation (EPSG code 1032) for source CRS to target CRS as summarized below. For further information, see Coordinate Conversions and Transformations including Formulas, OGP Publications 373-7-2 available at <u>Guidance Note 7 Part 2 (tiny.cloud)</u>



Translation Vector (dX, dY, dZ)	Added to the position vector in the source CRS to obtain the position vector in the target CRS.
Rotations (rX, rY, rZ):	Applied to the coordinate reference frame, positive is clockwise rotation looking out from the origin in the positive direction of respective axis.
Scale:	Applied to the position vector in the source CRS to obtain the position vector in the target CRS.

- Note: If the transformation parameters to be used are provided in Position Vector Transformation convention, the translation and scale parameters are applied as is in the Coordinate Reference Frame convention, but the rotation sign convention is reversed.
- 1. Access the Horizontal CRS view.
- 2. Select Transformations tab.
- 3. Click User.

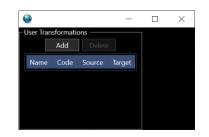


FIGURE 3-24 CREATE USER TRANSFORMATION

- Note: All User created transformations present in the local EPSG database are displayed in this view by Name, EPSG Code, Source CRS and Target CRS.
- 4. To add a new transformation, click Add.
 - a. NavView will look for and use the lowest available EPSG code that can be assigned to the user transformation, generate a default transformation and add it to the database

Note: The allowed range of codes is 50000 to 59999

- b. The new transformation will be added to the list and ready for configuration
- 5. To change a transformation, select it in the list.



2					-		\times
Jser Trar	nsformati	ons		Coordinate Reference	Systems		
	Add	Delete	•	Source CRS WGS 84	. ×		
Name	Code	Source	Target	Target CRS NAD27	*		
User	50000	4326	4267	Coordinate Frame Ro	tation (9607) ———		
				Signs are as per OG	P Convention		
				Transform Name:	User		
				tX:	0.000 m		
				tY:	0.000 m		
				tZ:	0.000 m		
				rX (Arc Seconds):	00.00000"		
				rY (Arc Seconds):	00.000000"		
				rZ (Arc Seconds):	00.00000"		
				Scale Change (ppm)	: 0.000000 ppm		

FIGURE 3-25 USER TRANSFORMATION PARAMETERS

6. Configure the transformation

Source CRS: Select a CRS from the drop-down list populated by those Geographic 2D CRS present in NavView

Target CRS:Select a CRS from the drop-down list populated by those
Geographic 2D CRS present in NavView

Note: If a previously User created Transformation has as its Source and/or Target CRS, a CRS that is no longer present in NavView, it will still display in the respective list.

Coordinate Frame Rotation: Enter the respective transformation parameters paying particular attention to the sign convention, including a suitable name

- a. Click Save to save changes
- b. Click Revert to dump changes and revert to last saved parameters
- **Note:** Until Save is executed, a newly created transformation is not saved to the local EPSG database.
- 7. Close the view by clicking X.

3.6.10 DELETE A USER TRANSFORMATION

- 1. If a User created transformation is no longer required, it can be deleted from the local EPSG database.
- 2. Access the Horizontal CRS view.
- 3. Select Transformations tab.
- 4. Click User to display all the User created transformations currently present in the database.
- 5. Select the transformation to be removed from the EPSG database.
- 6. Click Delete.
- 7. Respond to the confirmation prompt accordingly.



- a. Yes to continue with the action and delete the transformation from the database
- b. No to abort the process and leave the transformation in the database
- **Note:** A User created transformation cannot be removed if it is currently in use by NavView. If such a User created transformation is selected, the Delete button will not be enabled.
- 8. Close the window.

3.6.11 TEST COORDINATE OPERATIONS

NavView supports a coordinate operations test feature to simplify the confirmation that the geodesy is correctly configured. This is available in the Test tab for both the Horizontal CRS and Transformations tab of the Horizontal CRS view.

The test coordinate operations available in the Horizontal CRS tab depend upon the CRS present and the one selected and always involve the Working Projected CRS.

Selected CRS Supported Coordinate Operations

Geographic 2D CRS:Transformation between the Selected Geographic 2D CRS and the Working Projected Source Geographic 2D CRS

Conversion between the Working Projected Source Geographic 2D CRS and its projection

CAProgramDataV4D NavGeodesyLEPSG/EPSG-v9_9.sdf Horizontal CRS Transformations Coordinate Reference Systems Name Coode Kind Working WGS 84 4326 geographic 2D No WGS 84 4326 geographic 2D No NAD27 / BLM 15N (ftUS) 32065 projected No NAD27 / BLM 15N (ftUS) 32065 projected Ves I 1.0.061.8171 ftUS I 1 1 N 35* 00.0000' W 93* 00.0000'	I X
Name Code Kind Working WGS 84 4326 geographic 2D No WGS 84 / World Mercator 3395 projected No NAD27 / BLM 15N (ftUS) 32065 projected Yes N 35° 00.0000' N 34° 59 9946' N 34° 59 9946'	
WGS 84 4326 geographic 2D No WGS 84 / World Mercator 3395 projected No NAD27 / BLM 15N (ftUS) 32065 projected Yes N 35° 00.0000' N 34° 59.9946'	
WGS 84 4326 geographic 2D No WGS 84 / World Mercator 3395 projected No NAD27 / BLM 15N (ftUS) 32065 projected Yes Image: State of the state o	
WGS 84 / World Mercator 3395 projected No NAD27 / BLM 15N (ftUS) 32065 projected Yes I 1_640_468.397 ftUS N 12_706_128.171 ftUS I 1_7 N 34* 59.9946'	
N 12,706,128.171 ftUS	
Point scale factor 0.999600000	
Convergence 0.00010° Epsg Transformation 15851. NAD27 (4267) to WGS 84 (4326) using OGP-Usa Conus	ОК

FIGURE 3-26 HORIZONTAL CRS TEST TAB - GEOGRAPHIC 2D CRS COORDINATE OPERATION

Projected CRS: Transformation between Selected Geographic 2D CRS Source Geographic CRS and the Working Projected CRS Source Geographic CRS

Conversion between the Selected Projected CRS Source Geographic CRS and its projection

Conversion between the Working Projected CRS Source Geographic CRS and its projection



				C:\Prog	ramData\4[) Nav\Geode	sy\EPSG\EPSG-v9_9.sdf				
orizontal CRS	Transforma	ations									
Coordinate Refe	rence System	1S			Detai	s Test					
Name		Code	Kind	Working							
WGS 84		4326	geographic 2D	No		cted CRS:	zone 15N (32615)		Working CRS: NAD27 / BLM 15	N (ftUS) (320	165)
WGS 84 / Wor	rld Mercator	3395	projected	No		047011	20112 1514 (52015)			14 (1103) (321	.05)
NAD27 / BLM	15N (ftUS)	32065	projected	Yes		E 500,000			E 1,640,470		
WGS 84 / UTN	1 zone 15N	32615	projected	No		N 4,649,7	76.225 m		N 15,254,4	44.565 ftUS	
						N 42° 00 W 93° 00		+	1 N 42° 00.00 W 92* 59.9		
					Poir	nt scale facto	r 0.999600000		Point scale factor	0.999600000	
					Cor	vergence	0.00000°		Convergence	0.00013°	
Ado	i Ren	nove	Set Working	User		Epsg Tran	sformation 15851. NAE	027 (4267) to W	/GS 84 (4326) using	OGP-Usa Con	JS



Working CRS:

Conversion between the Working Projected CRS Source Geographic CRS and its projection

۲	Configure Horizo	ontal CRS										-		\times
					C:\Prog	ram	Data\4D Na	w\Geod	esy\EPSG\EPSG-v9	_9.sdf				
	Horizontal CRS	Transforma	ations											
	Coordinate Refe	erence Systen	ns ——				Details	Test						
	Name		Code	Kind	Working						W L' CRC			
	WGS 84		4326	geographic 2D	No						Working CRS: NAD27 / BLM 15	N (ftUS) (32	165)	
	WGS 84 / Wo	rld Mercator	3395	projected	No							14 (1100) (52		
	NAD27 / BLM	I 15N (ftUS)	32065	projected	Yes						E 1,659,267			
	WGS 84 / UT	M zone 15N	32615	projected	No						N 13,614,0	94.068 ftUS		
											1	†		
											N 37° 29.7 W 92° 56.1			
											Point scale factor	0.999600407		
											Convergence	0.03957°		
										Transformation no	t required.			
	Ad	d Rer		Set Working	User									
													(OK

FIGURE 3-28 HORIZONTAL CRS TEST TAB - WORKING CRS COORDINATE OPERATIONS

The test operation available in the Transformations tab is a transformation between the Source and Target CRS of the selected Transformation.



Configure Horizor	ntal CRS					-		
		C:\Program	Data\4D Nav\Geodesy\EPS	5\EPSG-v	9_9.sdf			
orizontal CRS	Transformations	:						
Coordinate Trans	formations —		Details Test					
Source	Target	Transformation	NAD27 (4267)	_→	WGS 84 (4326)			
NAD27 (4267)	WGS 84 (4326)	NAD27 to WGS 84 (79) (15851)	N 36° 35.7000' W 97° 25.8000'	- -	N 36° 35.7021' W 97° 25.8195'			
			¥¥ 57 23.8000		W 57 23.0155			
		Change User						
							C)K

FIGURE 3-29 TRANSFORMATIONS TEST TAB - COORDINATE OPERATION

Note: Coordinates are displayed based on the respective Projected CRS units and NavView Preference settings.

3.6.12 HORIZONTAL CRS TEST COORDINATE OPERATIONS

- 1. Access the Horizontal CRS view.
- 2. Select the Horizontal CRS tab.
- 3. Select the Horizontal CRS to test.
- 4. Select the Test tab.

Configure Horizontal	I CRS				:
Horizontal CRS	ransformatic	ons		C:\Prog	ogramData\4D Nav\Geodesy\EPSG\EPSG-v9_9_sdf
Coordinate Referen	ice Systems				Details Test
Name		Code	Kind	Working	
WGS 84	4	1326	geographic 2D	No	Selected CRS: Working CRS:
WGS 84 / World M	Mercator 3	395	projected	No	WGS 84 / UTM zone 15N (32615) NAD27 / BLM 15N (ftUS) (32065)
NAD27 / BLM 15	N (ftUS) 3	32065	projected	Yes	E 500,000.000 m E 1,640,470.960 ftUS
WGS 84 / UTM zo	one 15N 3	32615	projected	No	N 4,649,776.225 m N 15,254,444.565 ftUS
					i 1 i 1 N 42° 00.0007
Add	Remo	we	Set Working	User	

FIGURE 3-30 HORIZONTAL CRS COORDINATE OPERATION EXAMPLE

5. Enter a coordinate in the appropriate entry box and click an arrow pointing away from that box to automatically perform all possible coordinate operations using the entered coordinate as the base.

3.6.13 TRANSFORMATIONS TEST COORDINATE OPERATION

- 1. Access the Horizontal CRS view.
- 2. Select the Transformations tab.
- 3. Select the Transformation to test.



4. Select the Test tab.

9	Configure Horizor	ntal CRS		=		\times
_		.		mData\4D Nav\Geodesy\EPSG\EPSG-v9_9.sdf		
	Horizontal CRS - Coordinate Trans	Transformations		Details Test		
	Source NAD27 (4267)	Target WGS 84 (4326)	Transformation NAD27 to WGS 84 (79) (15851)	NAD27 (4267) N 36° 357021' W 97° 25.8000' * W 97° 25.8195'		
Ľ					O	ĸ

FIGURE 3-31 TRANSFORMATIONS COORDINATE OPERATION EXAMPLE

5. Enter a coordinate in the appropriate entry box and click the arrow pointing away from that box to perform the transformation coordinate operation.

3.7 USING THE VERTICAL CRS VIEW

The Vertical CRS defines the vertical datum and the default vertical units used by NavView when dealing with elevation, depth and height terms. In some cases, such as the import of a digital terrain model (DTM) the vertical CRS and units defaults to the Working Vertical CRS but can be edited to reference another vertical CRS. However, in the case of 3D model files, these must be in the same units as the Working Vertical CRS.

The Vertical CRS view presents the Vertical CRS and associated coordinate operations for review and editing. The view has two main tabs: Vertical CRS and Transformations. Each of these displays a list of the respective items in the left panel and associated Details and Test tabs in the right panel. The Details tab includes hypertext (underlined blue text) that when clicked expand to provide additional information for that item.

3.7.1 VERTICAL CRS TAB

Coordinate Reference Systems lists the Vertical CRS currently setup for use in NavView in a data grid sortable by columns.



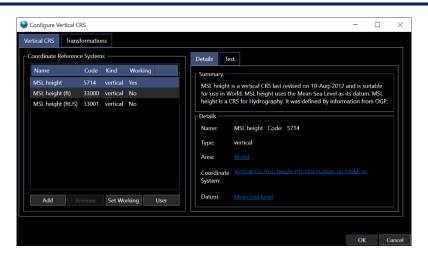


FIGURE 3-32 VERTICAL CRS

Name: EPSG name or user entered name

Code: EPSG code, including those assigned to user created CRS

Kind: Vertical

Working: Yes, if CRS is the Working Vertical CRS, No if not

Details tab display the parameters for the selected CRS. Click on the hyperlinks in the Details to view the EPSG details for that item.

Test tab does not display anything.

3.7.2 TRANSFORMATION TAB

The Vertical CRS transformation involves an offset to relate one Vertical CRS to another.

	Configure Vertical CRS						-		\times
1	Vertical CRS Transforma	itions							
	Coordinate Transformation	ns			Details	Test			
	Source	Target	Transformation	Reverse					
	MSL height (5714)	MSL height (ft) (33000)							
	MSL height (5714)	MSL height (ftUS) (33001)							
	MSL height (ft) (33000)	MSL height (ftUS) (33001)							
			Change	User					
							OK	. (Cancel



Coordinate Transformation lists all the coordinate transformations required to support transformations between the Vertical CRS currently setup for use in NavView. These are displayed in a data grid sortable by columns.

Source: EPSG or user assigned name and code of the source vertical CRS

Target:EPSG or user assigned name and code of the target vertical CRS



Transformation: EPSG or user assigned name and code of the transformation

Reverse: Indicates if transformation is applicable to being used to transform from source CRS to target CRS and back

Details tab does not display anything.

Q Co	onfigure Vertical CRS								-		\times
Vert	ical CRS Transforma	itions									
_ ^{Co}	ordinate Transformation	ns			Details	Test					
2	Source	Target	Transformation	Reverse	MSL heigh	t (5714)	→	MSL heig	ht (ft) (330	000	
N	MSL height (5714)	MSL height (ft) (33000)			0.000 m	(3711)		N/A	in (n) (550		
N	MSL height (5714)	MSL height (ftUS) (33001)									
N	MSL height (ft) (33000)	MSL height (ftUS) (33001)									
			Change	User							
									OK		Cancel

FIGURE 3-34 VERTICAL CRS TRANSFORMATIONS - TEST TAB

Test tab displays the coordinate operation for the selected transformation, Source Vertical CRS to/from the target Vertical CRS.

3.7.3 ADD A VERTICAL CRS

All Vertical CRS that are required for a specific NavView application must be added to be available for use. By default, NavView loads the following vertical CRS:

- MSL height, EPSG code 5714
- MSL height (ft), EPSG code 33000
- MSL height (ftUS), EPSG code 33001

If a one or more other vertical CRS are required, they must be added, access the Vertical CRS view.

1. Click the Add button to launch a wizard to step through the searching for and adding of a vertical CRS.

Select Coordinate Reference System	_	\times
Search Search the database for Coordinate Reference Systems.		
 Search by name or code Search Database Search by area 		
Results		
Help Cancel < Back N		sh

FIGURE 3-35 ADD VERTICAL CRS - SEARCH BY NAME OR CODE



- 2. Select Search by name or code if either have been provided.
 - a. Enter the EPSG code or name in the associated entry box and click Search Database
- **Note:** The EPSG code and name options include user created CRS. These are assigned an EPSG code when created and added to the local database.
- **Note:** When entering a name, the search looks for those EPSG CRS whose name or alias contains the entry after removing the blanks (whitespaces) in both the entry and CRS name and alias. For example, entering **msl** will result in a list of all EPSG vertical CRS with msl in the name, such as MSL depth, MSL height, etc.
- **Note:** When entering the EPSG CRS code, the search is specific and only lists the EPSG CRS with that exact code.
- 3. Or select Search by area if unsure of the EPSG code or name of the required CRS.

Select Coordinate Reference	e System		_	\times
Search Search the database for C	oordinate Referend	ce Systems.		
 Search by name or code Search by area 	N 35° 00.0000' W 93 ^b 00.0000'	Search Database		
Results Name Code				
Help	C	ancel < Back	Next >	sh

FIGURE 3-36 ADD VERTICAL CRS - SEARCH BY AREA

- a. Enter a position within the work area and click Search Database
- 4. If the search is unsuccessful, Search failed will display in red below the entry box.
- 5. If the search is successful, the dialog will expand to list the EPSG CRS found to match the entry.

Search the database for Coordinate Reference	e Systen	ıs.							
) Search by name or code N 35° 00.0000' Search by area W 93° 00.0000'	Search	Da	abase						
esults									
Name	Code		Summary						
NGVD29 height (m)	7968		MSL height (ft) is a vertical CRS last revised on 03-Oct-2022 and is						
NAVD88 depth (ftUS)	6358	6358 suitable for use in World. MSL height (ft) uses the Mean Sea Leve as its datum. MSL height (ft) is a CRS for User Scope It was							
NAVD88 height (ftUS)	6360		defined by information from User.						
MSL height (ft)	33000		- Details						
MSL height (ftUS)	33001								
EPSG example wellbore local vertical CRS	8378		Name: MSL height (ft) Code: 33000						
EPSG example wellbore local vertical CRS (ft)	8897		Type: vertical						
NAVD88 height (ft)	8228	ļ	Area: World						

FIGURE 3-37 ADD VERTICAL CRS - FOUND CRS

- a. Selecting a CRS from the list will display the respective CRS details in the right panel
- b. Clicking on a hyperlink will expand that item to display its details
- c. If the search does not result in the required CRS, repeat the search process



d. Select the desired CRS in the list, confirm the details, then click Next

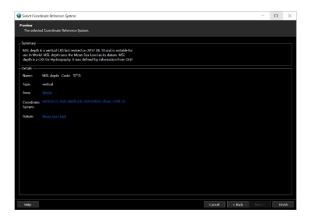


FIGURE 3-38 ADD VERTICAL CRS - FINISH SELECTION

- e. Review the details to confirm they define the required CRS
 - i. Click Finish if correct
 - ii. Click Back or Cancel if not
- 6. You will be prompted with an option to set the newly added CRS as the working, answer accordingly.

New CRS	Added			3
?	Do you wish to set vertical coord working?	linate reference system MS	L depth (cod	le: 5715) to
			Yes	No

FIGURE 3-39 ADD VERTICAL CRS - SET TO WORKING PROMPT

3.7.4 CREATE AND CHANGE USER VERTICAL CRS

A user can add and configure a Vertical CRS to address cases where an existing EPSG CRS does not apply.

- **Note:** The User CRS is added to the local copy of the EPSG database and is then available to be added as one of the CRS to be used by NavView. It is not automatically added to the Vertical CRS in use by NavView.
- 1. Access the Vertical CRS view.
- 2. Select Vertical CRS tab.
- 3. Click User to display all the User created Vertical CRS currently present in the database.



FIGURE 3-40 USER VERTICAL CRS

4. To add a new CRS, click the Add button.



a. NavView will look for and use the lowest available EPSG code that can be assigned to the user CRS and generate a default Vertical CRS and add it to the database

Note: The allowed range of codes is 40000 to 49999

- b. The new CRS will be added to the list and ready for configuration
- 5. To configure a User Vertical CRS, select it in the list.
 - a. **Details tab** presents and behaves here as it does in the main Vertical CRS view, displaying the CRS parameter summary complete with hypertext allowing the operator to view greater details



FIGURE 3-41 USER VERTICAL CRS - DETAILS TAB

- b. Parameters tab presents the respective CRS parameters for review and editing
 - i. Name: Enter an appropriate name for the new CRS
 - ii. **Coordinate System:** From the drop-down list select the option that combines the desired orientation (up positive or down positive) and units
 - iii. **Datum:** from the drop-down list select the datum, if it is not present, click the Add button and enter a name and origin for the CRS

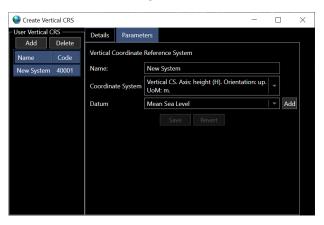


FIGURE 3-42 USER VERTICAL - PARAMETERS TAB

c. Click **Save** to save the parameters, or click **Revert** to dump the changes

6. Close the window by clicking on the X.

3.7.5 SET THE WORKING VERTICAL CRS

NavView requires that one Vertical CRS be always set as the Working Vertical CRS.

1. Access the Vertical CRS view.



- 2. Select Vertical CRS tab.
- 3. Select the Vertical CRS to be set to Working.
- 4. Click Set Working.

3.7.6 REMOVE A VERTICAL CRS FROM NAVVIEW

If a Vertical CRS currently added to NavView is no longer required, it can be removed. Note that this does not remove it from the EPSG database.

- 5. Access the Vertical CRS view.
- 6. Select Vertical CRS tab.
- 7. Select the Vertical CRS to be removed.
- 8. Click Remove.
- 9. Respond to the confirmation prompt accordingly.
 - a. Yes to continue with the action and remove the CRS
 - b. No to abort the process and leave the CRS added to NavView

3.7.7 DELETE A USER VERTICAL CRS FROM EPSG DATABASE

If a User created Vertical CRS is no longer required, it can be deleted from the local EPSG database.

- 1. Access the Vertical CRS view.
- 2. Select Vertical CRS tab.
- 3. Click User to display all the User Vertical CRS currently present in the database.
- 4. Select the Vertical CRS to be removed from the EPSG database.
- 5. Click Delete.
- 6. Respond to the confirmation prompt accordingly.
 - a. Yes to continue with the action and delete the CRS from the database
 - b. No to abort the process and leave the CRS in the database
- **Note:** A User created CRS cannot be removed if it is currently added to those CRS used by NavView. If such a User created CRS is selected, the Delete button will not be enabled.
- 7. Close the window.

3.7.8 CONFIGURE VERTICAL TRANSFORMATIONS

NavView automatically adds a coordinate operation place holder for transformations between every possible pairing of the Vertical CRS added to NavView. These require configuration as there may be more than one transformation option for a given pairing.

- 1. Access the Vertical CRS view.
- 2. Select Transformations tab.



0	Configure Vertical CRS				<u></u>		×
V	ertical CRS Transforma	tions					
	Coordinate Transformation	ns			1	Details	Test
	Source	Target	Transformation	Reverse			
	MSL height (5714)	MSL height (ft) (33000)					
	MSL height (5714)	MSL height (ftUS) (33001)					
	MSL height (ft) (33000)	MSL height (ftUS) (33001)					
			Change	User			
					0	Ж	Cancel

FIGURE 3-43 VERTICAL CRS TRANSFORMATION TAB

- 3. Select the transformation to configure.
- **Note:** If the Transformation has been previously configured, the details for the current setting will display in the Details tab. If it has not been configured, no information is displayed in this tab.
- 4. Click Change to display a list of transformations that apply to the respective source and target CRS.
 - a. Selecting a Transformation from the list will display the respective details in the right panel.
 - b. Clicking on any hyperlink will expand that item to display its details
 - c. Select the desired Transformation and click Next
 - d. Review the details to confirm they define the required Transformation
 - i. Click Finish if correct
 - ii. Click Back or Cancel if not
- **Note:** If no transformations are detected as being applicable for the selected transformation none are listed, click Cancel.
- 5. The newly configured Transformation will display in the Transformation tab with the respective source and target CRS.

3.7.9 CREATE AND CHANGE A USER VERTICAL TRANSFORMATION

A user can add and configure a transformation to address cases where an existing EPSG transformation does not apply. The transformation is added to the local copy of the EPSG database and is then available to be selected as per Configure Vertical Transformations.

- 1. Access the Vertical CRS view.
- 2. Select Transformations tab.
- 3. Click User.



						-	_		\times
User Tra	nsformati	ons ——		٦г	-Coordinate R	eferenc	e Syst	iems —	
	Add	Delete	ŝ		Source CRS	MSL h	eight	(ft)	*
Name	Code	Source	Target		Target CRS	MSL h	eight	(ftUS)	*
User	50000	33000	33001	۱L					
				1	-Vertical Offse	t (9616) —		
					Transform N	lame:	User		
					Offset:		0.000	0 m	
					Sa	ive	Rev	/ert	

FIGURE 3-44 USER VERTICAL TRANSFORMATION

- 4. To add a new a new transformation, click Add.
 - a. NavView will look for and use the lowest available EPSG code that can be assigned to the user transformation, generate a default transformation and add it to the database

Note: The allowed range of codes is 50000 to 59999

- a. The new transformation will be added to the list and ready for configuration
- 5. To change a transformation, select it in the list.
- 6. Configure the transformation.
 - **Source CRS:** Select a CRS from the drop-down list populated by those Vertical CRS present in NavView
 - Target CRS:Select a CRS from the drop-down list populated by those Vertical CRS
present in NavView
- **Note:** If a previously User created Vertical Transformation has as its Source and/or Target CRS, a CRS that is no longer present in NavView, it will still display in the respective list.

Transform Name: Enter a suitable name

Offset: Enter the offset to be added to the Source CRS elevation to obtain the Target CRS elevation

- 7. Click Save to save changes.
- 8. Click Revert to dump changes and revert to last saved parameters.
- **Note:** Until Save is executed, a newly created transformation is not saved to the local EPSG database.
- 9. Close the view.

3.7.10 DELETE A USER VERTICAL TRANSFORMATION FROM EPSG DATABASE

If a User created Vertical Transformation is no longer required, it can be deleted from the local EPSG database.



- 1. Access the Vertical CRS view.
- 2. Select Transformation tab.
- 3. Click User to display all the User Vertical Transformations currently present in the database.
- 4. Select the Vertical Transformation to be removed from the EPSG database.
- 5. Click Delete.
- 6. Respond to the confirmation prompt accordingly.
 - a. Yes to continue with the action and delete the transformation from the database
 - b. No to abort the process and leave the transformation in the database
- **Note:** A User created transformation cannot be removed if it is currently in use by NavView. If such a User created transformation is selected, the Delete button will not be enabled.
- 7. Close the window.

3.7.11 VERTICAL TRANSFORMATION TESTS

NavView provides a test feature to confirm that a selected vertical transformation is correctly configured.

- 1. Access the Vertical CRS view.
- 2. Select Transformation tab.
- 3. Select the vertical transformation to test.
- 4. Select the Test tab .

Configure Vertical CRS							·		×
Vertical CRS Transforma	ations								
Coordinate Transformation	ns			Details	Test				
Source	Target	Transformation	Reverse	MSL height	(5714)	-	MSL hei	abt (ft)	(33000)
MSL height (5714)	MSL height (ft) (33000)			0.000 m	(21.14)	-	N/A	an (n)	(33660)
MSL height (5714)	MSL height (ftUS) (33001)			0.000 11			- Ny Fi		
MSL height (ft) (33000)	MSL height (ftUS) (33001)								
		Change	User						
							OK	(Cancel

FIGURE 3-45 VERTICAL TRANSFORMATION TEST

- 5. Enter an elevation in the Source CRS (left) and click the arrow pointing to the right.
- 6. Confirm that the transformation offset is added to the Source CRS elevation to obtain the correct Target CRS elevation.
- 7. Enter an elevation in the Target CRS (right) and click the arrow pointing to the left.
- 8. Confirm that the transformation offset is subtracted from the Target CRS elevation to obtain the Source CRS elevation.
- 9. Click OK to close the window.