

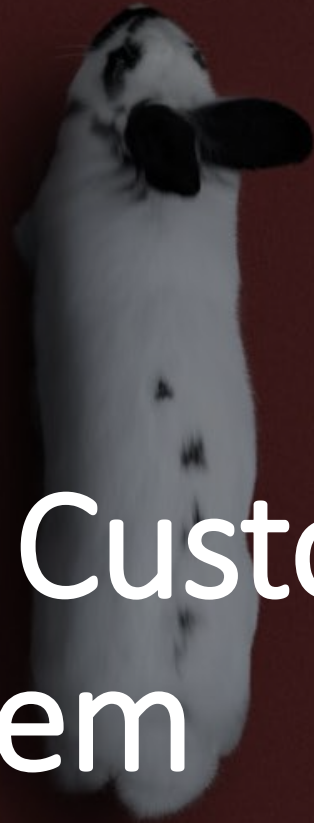
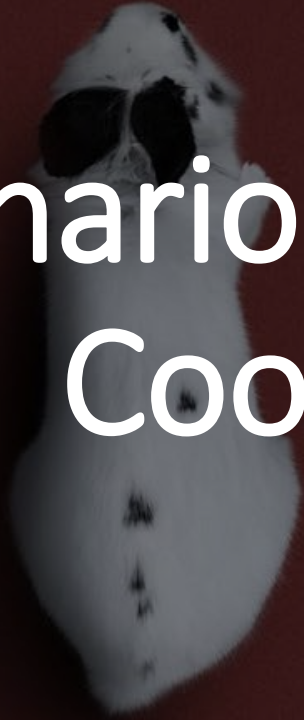
- Best Practice -

Custom Coordinate System in Petrel 2018-2022

Exploration Dept., Sirte Oil Company, Libya
Prepared by: Marcus Zou (mzou@sirteoil.com.ly)

24 November 2022

Scenarios to Apply a Custom Coordinate System



Business/Operation Scenarios and Proposal

1. You are going to work on a dataset (seismic, well, or culture), which does not fall into any natively built-in Coordinate Reference Systems (“CRS”). Then you may position your datapoints **wrongly**.
2. You **failed** to import some well/seismic/culture data into your working project, due to the to-be-imported data bearing a different CRS against your working project.

Proposed Solution: Build a **Custom CRS**



2



3



4

A Primer of Coordinate Systems

What's a Coordinate System?

Coordinate Reference System (CRS):

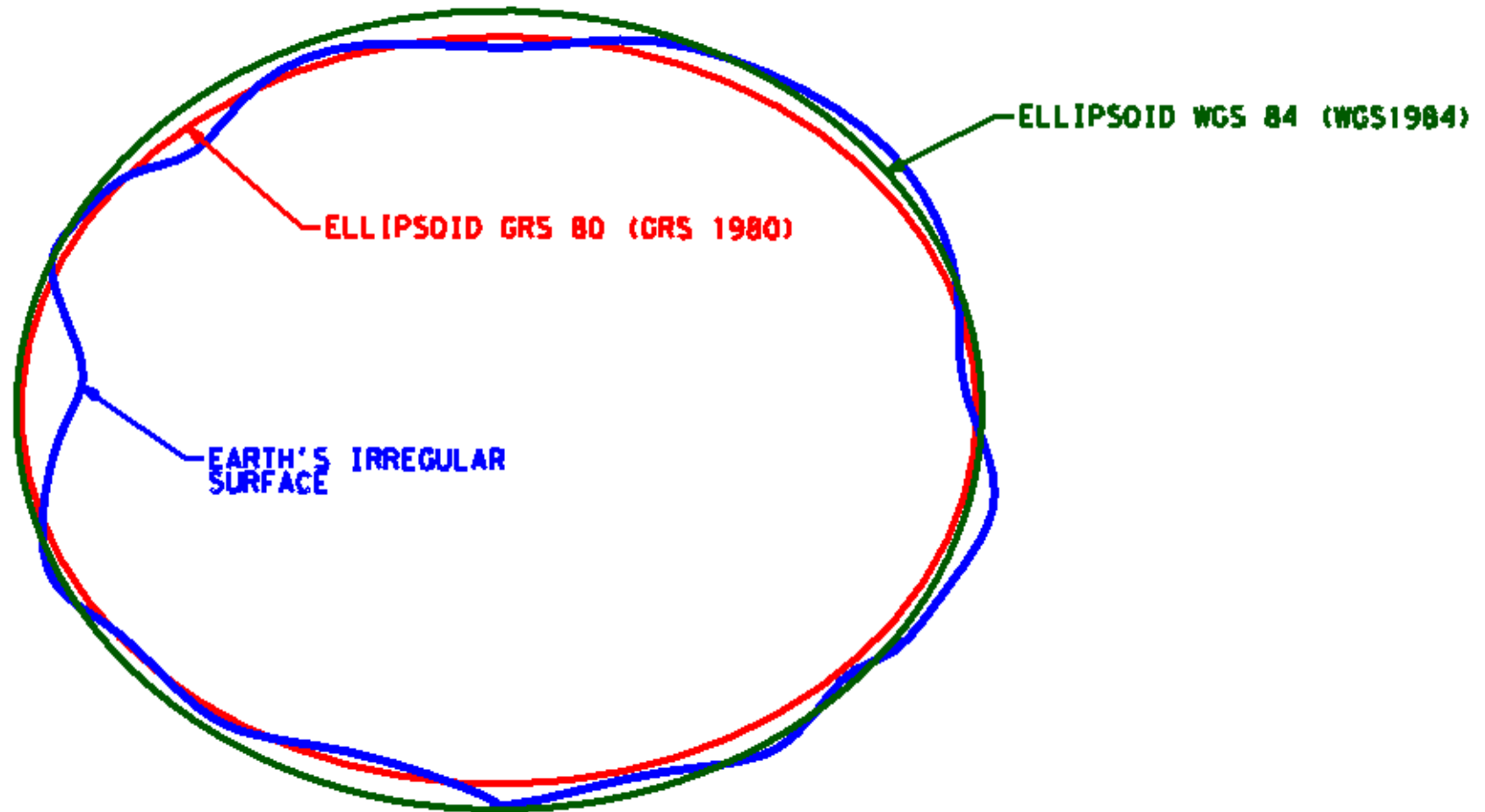
- **The mechanism to define, how the two-dimensional, projected map is related to real locations on the earth, with the help of coordinates.**

Two Types of CRS:

- **Geographic** Coordinate System: Latitude / Longitude
- **Projected** Coordinate System: X/Y values

Ellipsoid:-

a flattened three-dimensional ellipse with smooth surface to approximate the earth



Ellipsoid:-

a flattened three-dimensional ellipse with smooth surface to approximate the earth

Typically, an ellipsoid has its own specific parameters, such as, **semi-major axis** (a in meters), **semi-minor axis** (b in meters), and **inverse flattening** ($1/f = a/(a-b)$).

Ellipsoid	Semi-Major Axis a (m)	Semi-Minor Axis b (m)	Inverse Flattening 1/f
GRS80	6378137.000	6356752.314140356	298.257222101
WGS84	6378137.000	6356752.314245179	298.257223563
International 1924	6378388.000	6356911.946	297.000
Clarke 1880 (RGS)	6378249.145	6356514.870	293.465

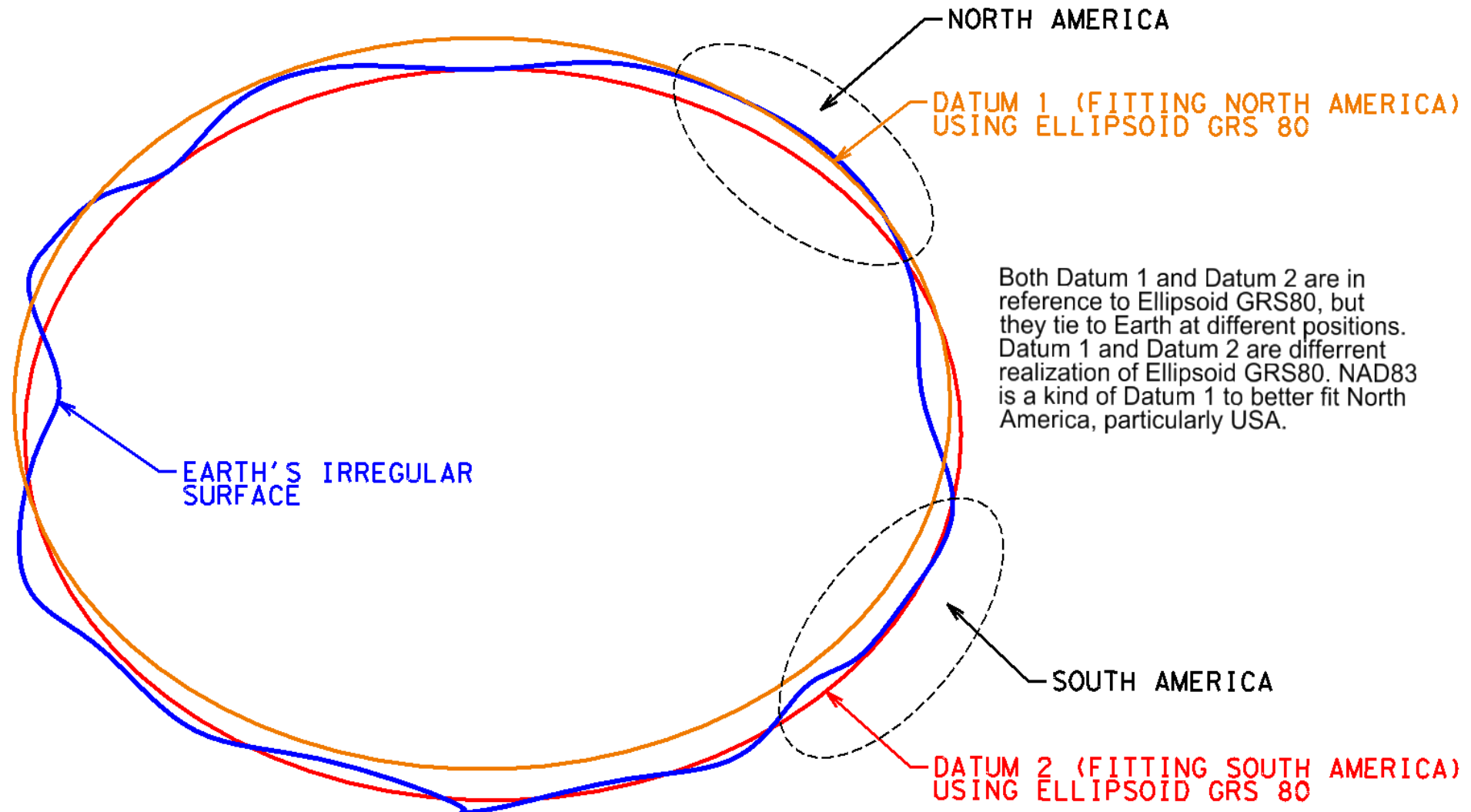
Datum:-

a model of the shape of the earth

- An ellipsoid has different realizations, which are different **ways to position itself relative to Earth depending on where its center is located.**
- **Each realization is called a datum** and therefore an ellipsoid may have different datums.
- Simply, a Datum is **a model of the shape of the earth** per se.
- Typical datum: **WGS84** (the name is same as its ellipsoid); **ED50** (its ellipsoid: International 1924/Hayford); **Nord Sahara** (its ellipsoid: Clarke 1880 RGS).

Datum:-

a model of the shape of the earth



Fun Fact -

Lat/Long values of a physical location differ from Datum to Datum.


Since longitude and latitude values are tied with datums, a location's longitude and latitude values in reference to Datum WGS84 are not same as in reference to Datum NAD83, nor Datum ED50.

City	WGS84		NAD83	
	Latitude	Longitude	Latitude	Longitude
Calgary, AB	51°02'55.0140"	-114°04'15.0456"	51°02'55.0045"	-114°04'15.0608"
St Louis, MO	38°37'37.211"	-90°11'57.847"	38°37'37.185"	-90°11'57.825"
Houston, TX	29°44'59.665"	-95°21'30.316"	29°44'59.646"	-95°21'30.290"
Pasadena, CA	34°09'22.007"	-118°07'54.995"	34°09'22.007"	-118°07'54.951"


Projection:-

the means by which you display the coordinate system and your data on a flat surface.

Mathematical calculations are used to convert the coordinate system used on the curved surface of earth to one for a flat surface.



A 3D element will **lose at least one of its three characteristics** – **angle**, **area**, and **distance** when being projected onto 2D surface, NO MATTER which projection method is used.



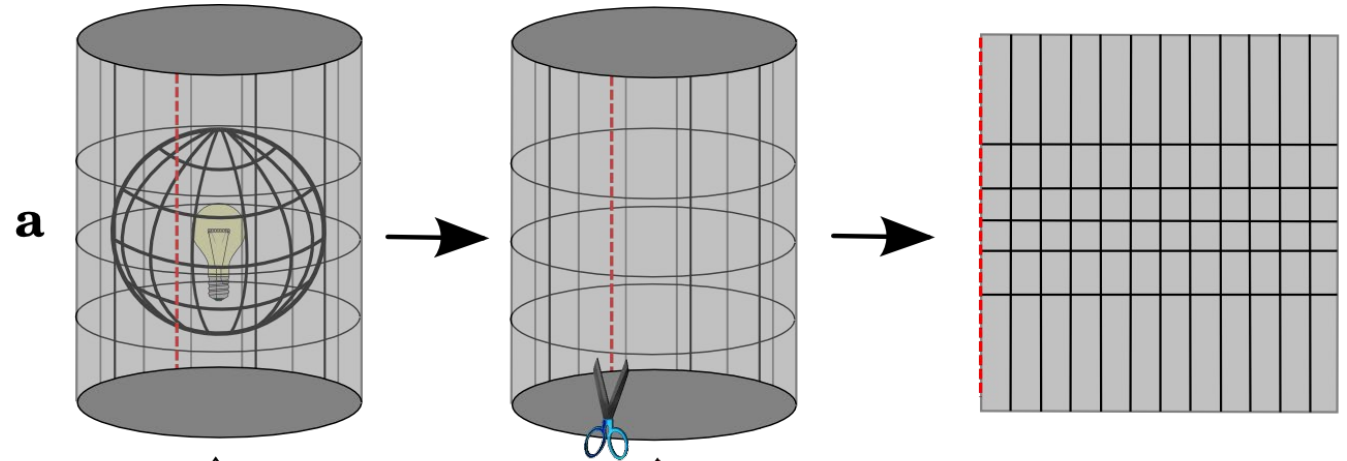
The coordinate system on 2D surface is called a Projected Coordinate System (“PCS”) with coordinate unit of foot, US foot, or meter.

Projection:-

3 Types of Projection Methods: Cylindrical, Conical, and Planar

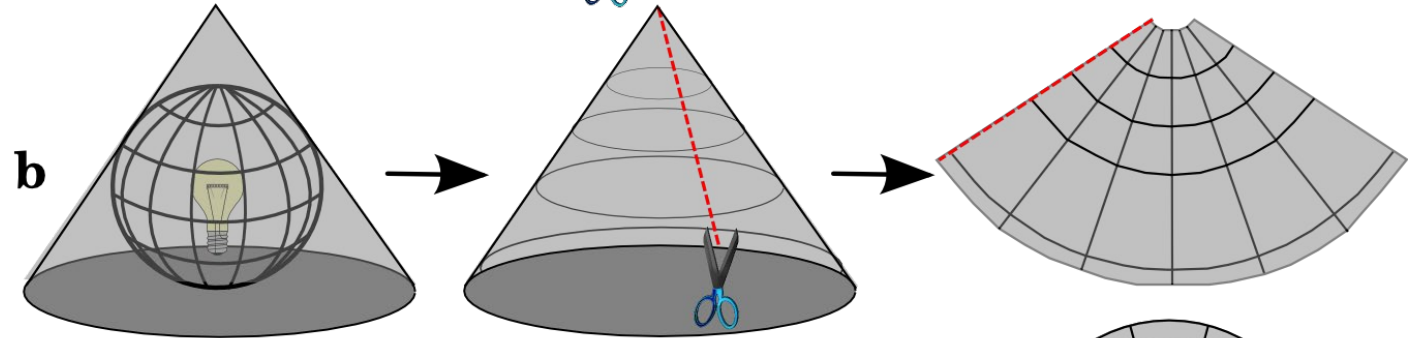
Universal Transverse Mercator →

Cylindrical
Mercator

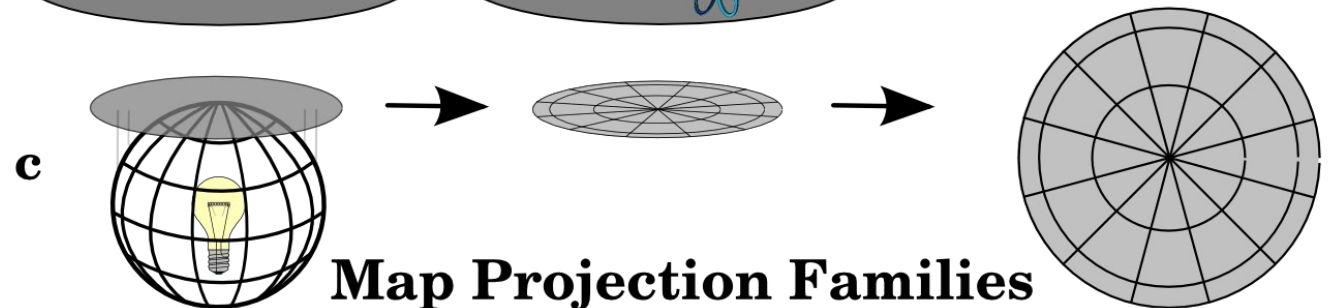


Lambert Conformal Conic →

Conical
Perspective



Planar
Orthographic



Map Projection Families

How to Create
Custom CRS in

Schlumberger
Petrel
2018-2022



1



2



3

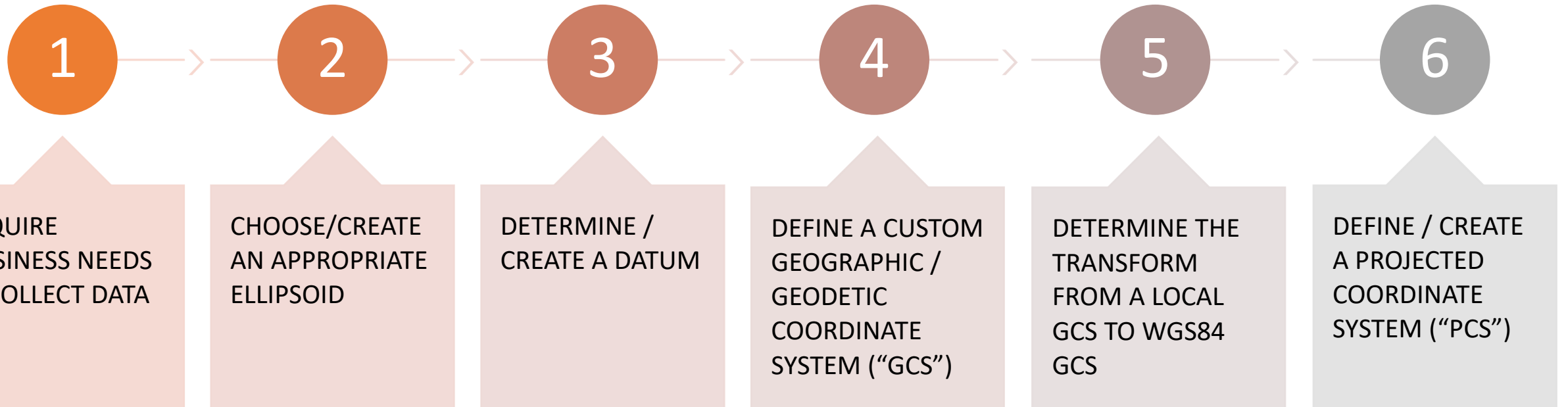


4



5

Procedures to Create a Custom CRS in Any Application



Procedures to Create a Custom CRS in Petrel 2018-2021



1. Inquire Business Needs & Collect Data



2. Select an Appropriate Ellipsoid



3. Determine / Create a Custom Datum



4. Prepare the WKT & Define Geographic / Projected CRS



5. Create a Custom Transform from a Local GCRS to WGS84



6. Define / Create a Projected Coordinate System

(1) Inquire Business Needs & Collect Data

AGOCO Lambert Datum Using 2 Parallels

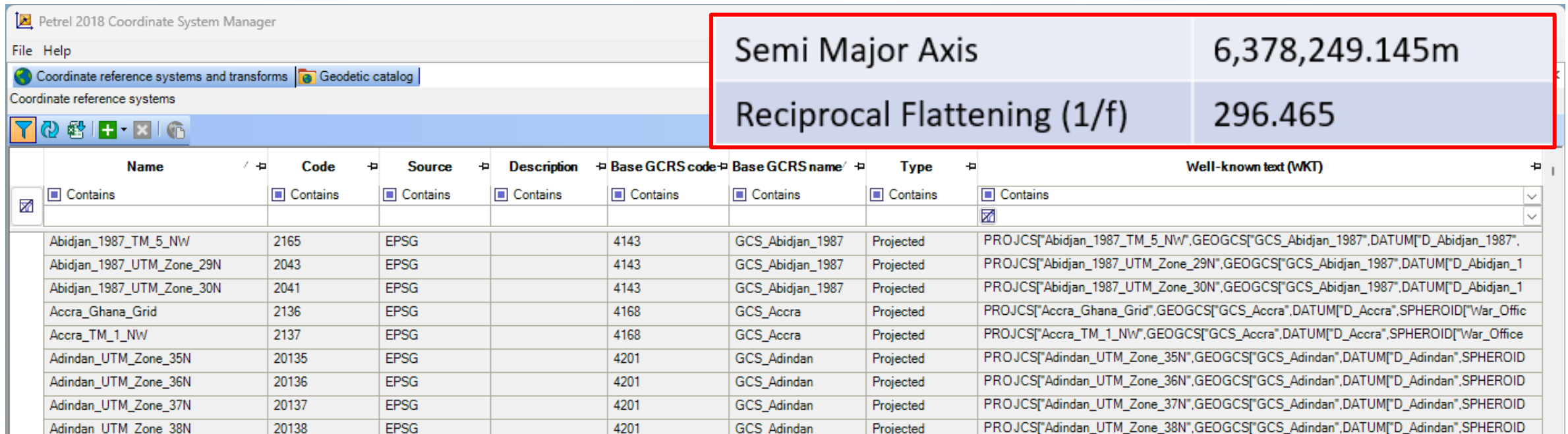
Ellipsoid	Clarke 1880
Projection	Lambert Conical Orthomorphic
Latitude of Origin	31° N
Longitude of Origin	18° E
Scale Factor @ the Origin	0.99938949
First Parallel	33° 00' 00"
Second Parallel	28° 59' 08.3"
False Northing	550,000m
False Easting	1,000,000m
Semi Major Axis	6,378,249.145m
Reciprocal Flattening (1/f)	296.465
Central Meridian	18° E
Zone	Libya North

1. A 3D Seismic cube of Concession NC-100 of west Libya has a projection of Lambert Conformal Conic ("LCC"), instead of the commonly used UTM Projection, and AGOCO-cooked Datum based on Clarke 1880 Ellipsoid.
2. Failed to load the seismic cube into Petrel or Kingdom due to lack of pre-defined Projected CRS related to that specific cube.
3. Plan to create a Custom Projected CRS ("PCRS") and Transform for converting or loading up such seismic cube into Petrel 2018-2021.

(2) Select an Appropriate Ellipsoid

Launch Petrel Coordinate System Manager → “Coordinate reference systems and transforms” tab → “Coordinate reference systems” section

As per the geodesy expertise I gained before, plus looking at the ArcGIS database, EPSG database and the ellipsoid parameters from AGOCO: typically, the “**Semi Major Axis**”, “**Semi Minor Axis**”, and “**Reciprocal Flattening (1/f)**”, this is the ellipsoid of “Clarke 1880 RGS”; then we shall choose “**Clarke 1880 (RGS)**” as our ellipsoid (EPSG:7012).



The screenshot shows the Petrel 2018 Coordinate System Manager interface. The 'Coordinate reference systems and transforms' tab is selected, and the 'Coordinate reference systems' section is active. A red box highlights the 'Semi Major Axis' (6,378,249.145m) and 'Reciprocal Flattening (1/f)' (296.465) for the Clarke 1880 RGS ellipsoid.

Name	Code	Source	Description	Base GCRS code	Base GCRS name	Type	Well-known text (WKT)
Abidjan_1987_TM_5_NW	2165	EPSG		4143	GCS_Abidjan_1987	Projected	PROJCS["Abidjan_1987_TM_5_NW",GEOGCS["GCS_Abidjan_1987",DATUM["D_Abidjan_1987",
Abidjan_1987_UTM_Zone_29N	2043	EPSG		4143	GCS_Abidjan_1987	Projected	PROJCS["Abidjan_1987_UTM_Zone_29N",GEOGCS["GCS_Abidjan_1987",DATUM["D_Abidjan_1
Abidjan_1987_UTM_Zone_30N	2041	EPSG		4143	GCS_Abidjan_1987	Projected	PROJCS["Abidjan_1987_UTM_Zone_30N",GEOGCS["GCS_Abidjan_1987",DATUM["D_Abidjan_1
Accra_Ghana_Grid	2136	EPSG		4168	GCS_Accra	Projected	PROJCS["Accra_Ghana_Grid",GEOGCS["GCS_Accra",DATUM["D_Accra",SPHEROID["War_Office
Accra_TM_1_NW	2137	EPSG		4168	GCS_Accra	Projected	PROJCS["Accra_TM_1_NW",GEOGCS["GCS_Accra",DATUM["D_Accra",SPHEROID["War_Office
Adindan_UTM_Zone_35N	20135	EPSG		4201	GCS_Adindan	Projected	PROJCS["Adindan_UTM_Zone_35N",GEOGCS["GCS_Adindan",DATUM["D_Adindan",SPHEROID
Adindan_UTM_Zone_36N	20136	EPSG		4201	GCS_Adindan	Projected	PROJCS["Adindan_UTM_Zone_36N",GEOGCS["GCS_Adindan",DATUM["D_Adindan",SPHEROID
Adindan_UTM_Zone_37N	20137	EPSG		4201	GCS_Adindan	Projected	PROJCS["Adindan_UTM_Zone_37N",GEOGCS["GCS_Adindan",DATUM["D_Adindan",SPHEROID
Adindan_UTM_Zone_38N	20138	EPSG		4201	GCS_Adindan	Projected	PROJCS["Adindan_UTM_Zone_38N",GEOGCS["GCS_Adindan",DATUM["D_Adindan",SPHEROID

(3) Determine/Create a Custom Datum

Launch Petrel Coordinate System Manager → "Coordinate reference systems and transforms" tab → "Coordinate reference systems" section

Apart from what we have selected in previous step, we can also define/customize the Datum as "D_AGOCO" by concatenating the Ellipsoid, Prime Meridian and Unit.

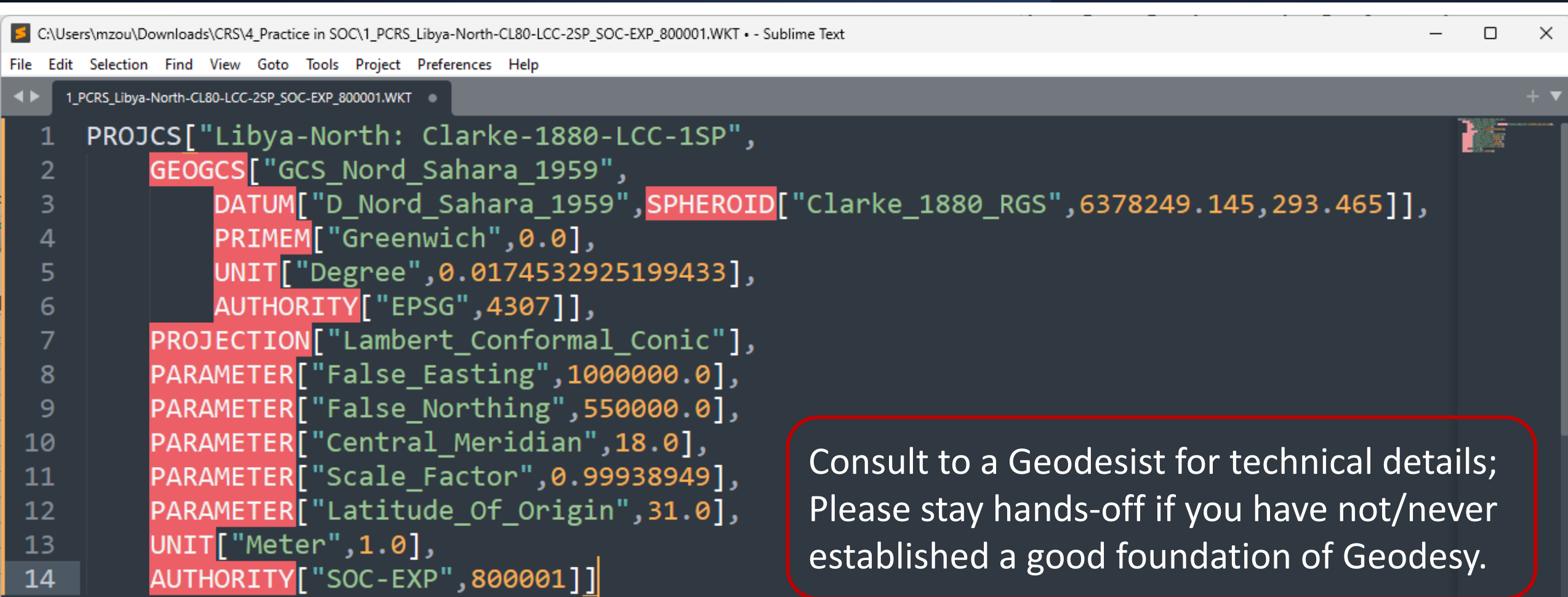
In Petrel, managing the GCS, PCS, or transforms is a tough task since Petrel has no such convenient toolset as ArcGIS, Blue Marble Geographics or Kingdom, then we have to use a text editor (Don't use Microsoft Word, nor WordPad) to handle the **WKT** (Well Known Text) script:

```
GEOGCS["GCS_AGOCO",  
  DATUM["D_AGOCO", SPHEROID["Clarke_1880",6378249.145,293.465], AUTHORITY["EPSG",7012]],  
  PRIMEM["Greenwich",0.0],  
  UNIT["Degree",0.0174532925199433],  
  AUTHORITY["AGOCO",700003]]
```

You can google out how to write a WKT file.

(4A) Prepare the WKT & Define Geographic/Projected CRS

Prepare the WKT for generating the Projected CRS named as “Libya-North: Clarke-1880-LCC-1SP” concatenating the just-defined Geographic CRS and the projection parameters.

A screenshot of a Sublime Text editor window. The title bar shows the file path: C:\Users\mzou\Downloads\CRS\4_Practice in SOC\1_PCRS_Libya-North-CL80-LCC-2SP_SOC-EXP_800001.WKT. The menu bar includes File, Edit, Selection, Find, View, Goto, Tools, Project, Preferences, and Help. The editor has a single tab titled 1_PCRS_Libya-North-CL80-LCC-2SP_SOC-EXP_800001.WKT. The code is as follows:

```
1 PROJCS["Libya-North: Clarke-1880-LCC-1SP",
2     GEOGCS["GCS_Nord_Sahara_1959",
3         DATUM["D_Nord_Sahara_1959", SPHEROID["Clarke_1880_RGS", 6378249.145, 293.465]],
4         PRIMEM["Greenwich", 0.0],
5         UNIT["Degree", 0.0174532925199433],
6         AUTHORITY["EPSG", 4307]],
7     PROJECTION["Lambert_Conformal_Conic"],
8     PARAMETER["False_Easting", 1000000.0],
9     PARAMETER["False_Northing", 550000.0],
10    PARAMETER["Central_Meridian", 18.0],
11    PARAMETER["Scale_Factor", 0.99938949],
12    PARAMETER["Latitude_Of_Origin", 31.0],
13    UNIT["Meter", 1.0],
14    AUTHORITY["SOC-EXP", 800001]]|
```

Consult to a Geodesist for technical details;
Please stay hands-off if you have not/never
established a good foundation of Geodesy.

(4B) Prepare the WKT & Define Geographic/Projected CRS

At the header of “Coordinate reference systems” section → Click “+” sign → Enter the WKT for Geographic CRS and follow the steps as below.

The image shows two overlapping dialog boxes from a GIS application.

Left Dialog: Enter Well Known Text (WKT)

WKT: `GEOGCS["GCS_AGOCO",DATUM["D_AGOCO",SPHEROID["Clarke_1880",6378249.145,293.465]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433],AUTHORITY["AGOCO",700003]]`

Buttons:

Right Dialog: New coordinate reference system

The following entries will be added to the system. Please verify before continuing.

Geographic coordinate reference system (GCRS)

Name:

Code:

Authority:

Description:

Buttons:

(4C) Prepare the WKT & Define Geographic/Projected CRS

At the header of “Coordinate reference systems” section → Click “+” sign → Enter the WKT for Projected CRS and follow the steps as below, naming as “AGOCO-CL80-LCC-2SP”.

Enter Well Known Text (WKT)

WKT:

```
PROJCS["AGOCO-CL80-LCC-2SP",GEOGCS["GCS_AGOCO",DATUM["D_AGOCO",SPHEROID["Clarke_1880",6378249.145,293.465]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433],AUTHORITY["AGOCO",700001]],PROJECTION["Lambert_Conformal_Conic"],PARAMETER["False_Easting",1000000.0],PARAMETER["False_Northing",550000.0],PARAMETER["Central_Meridian",18.0],PARAMETER["Standard_Parallel_1",33.0],PARAMETER["Standard_Parallel_2",28.985639],PARAMETER["Latitude_Of_Origin",31.0],UNIT["Meter",1.0],AUTHORITY["AGOCO",800003]]
```

For the Projection Method, you can pick up “Lambert Conformal Conic [EPSG: 9801]”, which is for the 1-standard-parallel LCC (tangent). What we need to do here is simply to provide the projection parameters, then the projection from Geographic CRS to Projected CRS will be done behind the scene by Petrel.

OK

Cancel

New coordinate reference system

The following entries will be added to the system. Please verify before continuing.

Projected coordinate reference system (PCRS)

Name:

AGOCO-CL80-LCC-2SP

Code:

800003

Authority:

AGOCO

Description:

Definition of AGOCO

OK

Cancel

(5) Create a Custom Transform from a Local GCRS to WGS84

Prepare the WKT for the Transform → Switch to “Transforms” section → Click “+” sign to create the Transform by following the steps below, naming the transform as “D_AGOCO_NC100_to_WGS_1984”.

The screenshot shows a software interface for managing coordinate system transforms. The main window is titled 'Transforms for 700003:GCS_AGOCO'. It contains two overlapping dialog boxes.

The 'Enter Well Known Text (WKT)' dialog box is on the left. It contains a text area with the following WKT string:

```
GEOGTRAN["D_AGOCO_NC100_To_WGS_1984",GEOGCS["GCS_AGOCO",DATUM["D_AGOCO",SPHEROID["Clarke_1880",6378249.145,293.465]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],GEOGCS["GCS_WGS_1984",DATUM["D_WGS_1984",SPHEROID["WGS_1984",6378137.0,298.257223563]],PRIMEM["Greenwich",0.0],UNIT["Degree",0.0174532925199433]],METHOD["Geocentric_Translation"],PARAMETER["X_Axis_Translation",113.441],PARAMETER["Y_Axis_Translation",99.247],PARAMETER["Z_Axis_Translation",152.053],AUTHORITY["AGOCO",750003]]
```

The 'New transform' dialog box is on the right. It contains the following fields:

- Name: D_AGOCO_NC100_To_WGS_1984 (highlighted with a red box)
- Code: 750003
- Authority: AGOCO
- Description: Definition of AGOCO

At the bottom of the 'New transform' dialog are 'OK' and 'Cancel' buttons.

Please note:

1. The Transform is for converting a local GCRS to the base GCRS: WGS84, so it has nothing to do with the X/Y coordinates.
2. The 3-parameters method (X/Y/Z Axis Translation) is actually good enough if the local ellipsoid/datum is not too different from WGS84, otherwise a 7-parameters method is preferred.

(6A) Create a Projected Coordinate System (“PCS”)

Switch to “Geodetic catalog” tab → Click the “+” sign to create a new conflation policy.

Coordinate reference systems and transforms						
Geodetic catalog						
	Name	Code	Source	Description	CRS code	CRS name
<input checked="" type="checkbox"/>	<input type="checkbox"/> Contains Libya	<input type="checkbox"/> Contains	<input type="checkbox"/> Contains	<input type="checkbox"/> Contains	<input type="checkbox"/> Contains	<input type="checkbox"/> Contains
	PowerPlan:LIBYA13E	501761	SIS	MENTOR:PowerPlan:LIBYA13E:Libya 13 E	500328	PowerPlan:LIBYA13E:Libya 13 E
	PowerPlan:LIBYA15E	501762	SIS	MENTOR:PowerPlan:LIBYA15E:Libya 15 E	500329	PowerPlan:LIBYA15E:Libya 15 E
	PowerPlan:LIBYA17E	501763	SIS	MENTOR:PowerPlan:LIBYA17E:Libya 17 E	500330	PowerPlan:LIBYA17E:Libya 17 E
	PowerPlan:LIBYA19E	501764	SIS	MENTOR:PowerPlan:LIBYA19E:Libya 19 E	500331	PowerPlan:LIBYA19E:Libya 19 E
	PowerPlan:LIBYA21E	501765	SIS	MENTOR:PowerPlan:LIBYA21E:Libya 21 E	500332	PowerPlan:LIBYA21E:Libya 21 E
	PowerPlan:LIBYA23E	501766	SIS	MENTOR:PowerPlan:LIBYA23E:Libya 23 E	500333	PowerPlan:LIBYA23E:Libya 23 E
▶	Libya-North: Agoco Datum + LCC (3 Params)	700001	Petrel	Libya-North_Agoco-Datum_LCC-Projection_EPSG#1253 (For UTM32N only - Longitud	800002	Libya-North:Clarke-1880-LCC-2SP

Petrel uses Conflation Policy to glue the definition of a Projected CRS with the custom Transform. This is very different (even strange) approach comparing to other applications, such as, ArcGIS, Blue Marble Geographics’ Global Mapper, Kingdom, etc.

(6B) Create a Projected Coordinate System (“PCS”)

At the “Create conflation policy” window → Name the conflation policy as “Libya-North_AGOCO_NC100_LCC” → Pick up the newly defined Projected CRS in step (4C) and its related Transform created in step (5).

Create conflation policy

Name: Libya-North_AGOCO_NC100_LCC

Code: 900003

Authority: AGOCO

Description: Libya-North_AGOCO_NC100_LCC

Select coordinate reference system

	Name	Code	Source	Description	Base GCRS code	Base GCRS name	Type	Well-known
<input checked="" type="checkbox"/>	Contains	Contains	Contains	Contains	Contains	Contains	Contains	Contains
			AGOCO					
▶	AGOCO-CL80-LCC-2SP	800003	AGOCO		700001	GCS_AGOCO	Projected	PROJCS["AGOCO-CL80-LCC-2SP",GEOGCS
	GCS_AGOCO	700003	AGOCO	Definition of AGO			Geographic2D	GEOGCS["GCS_AGOCO",DATUM["D_AGOCO

Select transform

☐ Show transforms whose area of use overlap with coordinate system

	Name	Code	Source	Description	CRS code	CRS name	Transform code	Transform name
<input checked="" type="checkbox"/>	Contains	Contains	Contains	Contains	Contains	Contains	Contains	Contains
			Libya					
	Libya-North: Agoco Datum + LCC (3 Params)	700001	Petrel	Libya-North_Agoco-Datum_LCC-Projection_EPSG#1253 (800002	Libya-North:Clarke-1880-LCC-2SP	1253	Nord_Sahara_1959_To_WGS_1984
	Libya-North: Agoco Datum + LCC (7 Params)	700002	Petrel	Libya-North_Agoco-Datum_LCC-Projection_EPSG#8562 (800002	Libya-North:Clarke-1880-LCC-2SP	8562	Nord_Sahara_1959_To_WGS_1984_3
	Libya-North_AGOCO_NC100_LCC	900003	AGOCO	Libya-North_AGOCO_NC100_LCC	800003	AGOCO-CL80-LCC-2SP	750003	D_AGOCO_NC100_To_WGS_1984
	PowerPlan:LIBYA13E	501761	SIS	MENTOR:PowerPlan:LIBYA13E:Libya 13 E	500328	PowerPlan:LIBYA13E:Libya 13 E	1133	ED_1950_To_WGS_1984_1
	PowerPlan:LIBYA15E	501762	SIS	MENTOR:PowerPlan:LIBYA15E:Libya 15 E	500329	PowerPlan:LIBYA15E:Libya 15 E	1133	ED_1950_To_WGS_1984_1
	PowerPlan:LIBYA17E	501763	SIS	MENTOR:PowerPlan:LIBYA17E:Libya 17 E	500330	PowerPlan:LIBYA17E:Libya 17 E	1133	ED_1950_To_WGS_1984_1

(6C) Define / Create a Projected Coordinate System (“PCS”)

Verify the Custom CRS by creating a new Petrel project, select the custom Projected CRS.

Settings for 'Project in Libya-North+LCC.pet'

3D settings | Misc settings 1 | Misc settings 2 | Well settings

Info | Statistics | Coordinates and units

Coordinate reference system (CRS): Libya-North: Agoco Datum + LCC (3 Params) [i] [globe] Select... [?]

Unit system: Field (customized) [v] [N] [S] ft Customize... [?]

Simulation units: ECLIPSE-Field [v]

Project time zone: (UTC+02:00) Tripoli [v] [x] DST Enabled [?]

Storage units [?] | Display options [?]

XY unit: m [v] | Lat/long format: ☒ Degrees-minutes-seconds

Z unit: ft [v] | ☐ Decimal angle (degrees)

Area unit: ft2 [v] | Geodetic datum: ☒ Project datum

Volume unit: ft3 [v] | ☐ WGS 84

Seismic time: ms [v]

Seismic velocity: ft/s [v]

Project reference datum [?]

Time (SRD): SRD Z=0.0 RV=4855.6 [v] [Create SRD...]

Depth (MSL): 0 [v] ft

[x] Apply [x] OK [x] Cancel

Coordinate reference system selection

Select coordinate reference system (CRS) [?]

Filter by string: Libya-North [v] Filter by catalog: Enterprise & Extensions Catalogs [v]

Filter by: ☐ Point inside area of use Reference position: [v] [?]

☐ Max shape distortion: 0.1 % [v] ON OE degrees lat/long [v] [Filter] [Reset]

Name	Description	Horizontal unit	Authority	Code
Undefined	Clear current CRS and set context to 'spatially ...			
Libya-North_AGOCO_NC100_LCC	Libya-North_AGOCO_NC100_LCC	m	AGOCO	900003
Libya-North: Agoco Datum + LCC (7 Params)	Libya-North_Agoco-Datum_LCC-Projection_EP...	m	Petrel	700002
Libya-North: Agoco Datum + LCC (3 Params)	Libya-North_Agoco-Datum_LCC-Projec...	m	Petrel	700001

[x] CRS details... [x] OK [x] Cancel

(6D) Define / Create a Projected Coordinate System (“PCS”)

The results at Well Property window(Left) demonstrates a very precise conversion versus the results from Kingdom (Right) as well as other system, e.g., ArcGIS, Blue Marble Geographics’ Global Mapper.

Well Property window in Petrel

Time | Surface equipment | Flow correlation | Quality attributes
Info | Settings | Statistics | Report | Make logs

Definitive survey: ☐ Not defined ?

Active plan: ☐ Not defined ?

Position ?

☒ Well head X: 1041149.77167785 Y: 443001.57374249
☐ Latitude: 30°02'0.7385"N Longitude: 18°25'36.5332"E

☐ Slot: →

Well datum: KB[628.00]

Name	Value	Description
KB	628.00	Kelly bushing

☐ Translate trajectories to position

Well head position uncertainty ?

Sea bed/ground level from MSL: 0

Radius of uncertainty: 0 at 1 standard deviation(s)

Preview Projected Coordinate System

Projected Point

Geodetic Point

Easting 1041149.77167785 m Longitude 18 25 36.53316472 deg
Northing 443001.57374249 m Latitude 30 02 00.73854963 deg

☒ Source to Target ☐ Decimal Degrees ☒ Ignore Area of Use

☐ Target to Source ☒ DD MM SS ☒ Ignore Polygon Area of Use

Convert OK

Conclusions: Custom CRS is Doable/Applicable in Petrel

Application / Version	Able to Customize Coordinate System?
Petrel 2018	Yes, tested Okay, results verified against Kingdom/ArcGIS.
Petrel 2021	Yes, tested Okay, results verified against Kingdom/ArcGIS.
Petrel 2022	Yes, tested Okay, results verified against Kingdom/ArcGIS.

Note: Coordinate Reference System (“CRS”) and Coordinate System (“CS”) are interchangeably used in line with the industry practice.

The End



References

EPSG website	www.epsg.io
ArcGIS website	www.arcgis.com
Blue Marble Geographics	www.blumarblegeo.com
Wikipedia	www.wikipedia.org
Schlumberger Ltd.	Petrel Help and Manual, 2018-2022
IHS-Markit (S&P Global)	Kingdom Help and Manual, 2017/2021