MIGRATING REFERENCE SYSTEMS: A CHANGE IN STRATEGY

Introduction

We know you've heard this before:

- The Oil and Gas industry is one of the few, if not only, industries in Canada still operating in the NAD27 datum, and
- The conversion from NAD27 to NAD83 should be performed at the same time as the conversion to the Master Land Grid (ATS 4.1, STS 2.5).

Since 2005, the primary message to the industry was to convert, or migrate, all assets and data to NAD83. This was considered an aggressive and potentially time-consuming and costly approach depending on company size and existing infrastructure. Over time, this approach was tackled by some companies while others chose to remain in their current state and identify risks to specific areas of interest. Both are valid strategies and dependent on company needs, budget and direction.

Our experiences working with the industry in migrating reference systems (datums, DLS grids) spans the globe and has clearly identified different paths for different folks. However, the consistent theme throughout has been the need and desire for spatial integrity and risk mitigation. This is the focus of this article.

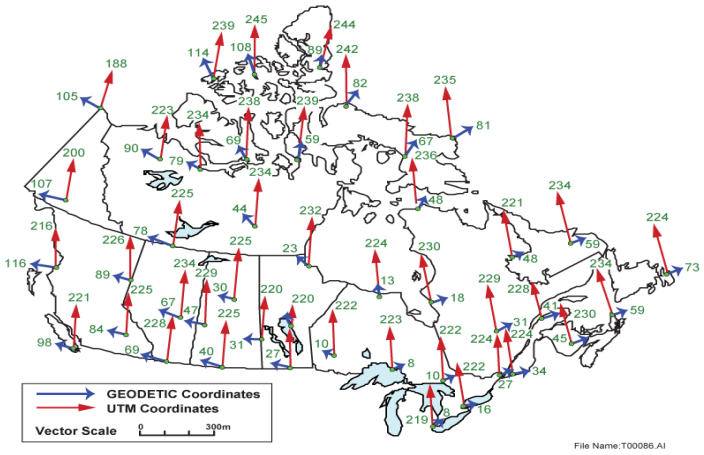
The Background

The use of spatial data, which can be defined as any dataset containing coordinates, is prevalent in our world and can be easily misinterpreted to introduce location errors up to 250 m due to datum differences between NAD27 and NAD83 (WGS84 equivalent). These errors can have a tremendous financial impact to our operations: dry holes, trespasses, regulatory penalties, down time for drilling rigs etc.

The vast majority of seismic data in Western Canada with coordinates (Latitude/Longitude and XY) is referenced to the North American Datum 1927 (NAD27). NAD27 has been in use by Canadian governments and the Oil & Gas exploration industry since the 1930's.

In 1990, the Federal government adopted the more accurate geocentric based NAD83 as the survey reference system for Canada Lands. At that time there was little incentive for oil companies to move their internal systems to NAD83 due to the significant cost involved and the availability of NAD27 data.

The coordinate differences between NAD27 and NAD83 can reach 250 m but varies depending on the coordinate system used: Latitude/Longitude or projected XY (Easting, Northing). These differences are not systematic and will vary within Canada (see Canada Map).



Over the last decade, certain factors have prompted discussions within the oil and gas industry concerning the viability of converting to NAD83.

These factors include, but are not limited to:

- the widespread use of Global Positioning Systems (GPS) for survey acquisition and well placement that are more compatible with NAD83 data,
- the increased availability of NAD83 data from vendors,
- the use of satellite imagery, remote sensing and GPS based products, and
- the potential problems encountered when transforming survey data from one datum to another on a regular basis.

As noted above, advancements in technology has played a large role in the industry's need to address the spatial discrepancies between new and legacy data.

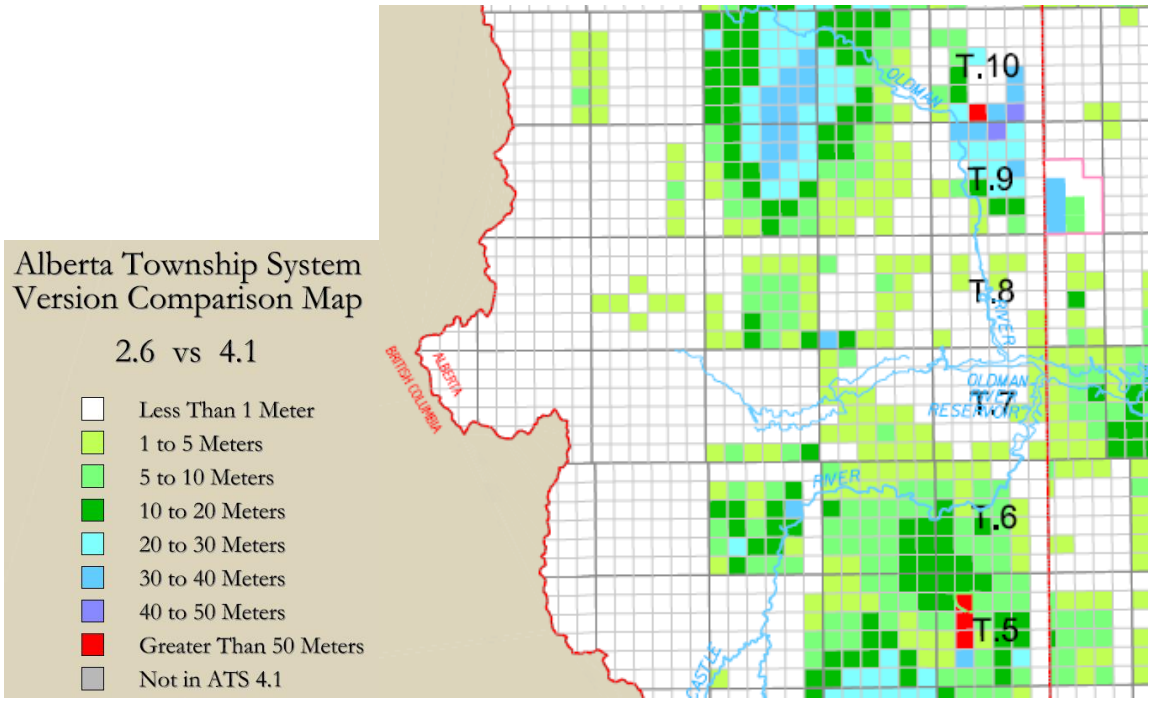
Dominion Land Surveys (DLS)

As previously mentioned, we identified the need to address DLS grids as part of any spatial data migration as it is one of the primary integrity issues. The DLS grid has continuously evolved in Western Canada since its inception in the early 1900's. Though the physical location of the township and corresponding sections does not change, the published coordinates that define it do.

Since the mid-80's, there has been an evolution of different DLS grids created in Alberta and Saskatchewan and used primarily for mapping. The quality and accuracy of these grids became more critical over time as wells were positioned relative to section boundaries, known as metes/bounds or locals. The geographic and XY coordinates (aka. Easting and Northing) are then computed from a chosen township grid version. These are known as: ATS 2.2, ATS 2.6 and ATS 4.1 for Alberta; STS 1.0, STS 2.0 and STS 2.5 for Saskatchewan. For reference purposes only, it is important to mention that SaskGIS has compiled a dynamic Township Fabric Map (TFM) product to replace STS 2.5. It is incorporated with the cadastral survey fabric and is updated yearly. This dataset has not been fully implemented into the oil and gas infrastructure but has garnered some attention.

The impact to operations is directly related to the relationship between seismic surveys, well locations and ancillary datasets such as imagery or Digital Elevation Models (DEM) since well and seismic locations could be incompatible upwards of 100 m due to the DLS grid used as a reference grid for computations. Typically, the DLS differences are 20-40 m in areas of change.

Divestco has compiled DLS Comparison Maps identifying the spatial discrepancies to assist in planning and analysis. Please contact sales@divestco.com to inquire about our polygonized, feature-encoded ESRI Shapefiles containing grid differences in three distinct forms: a) geodetic azimuth and shift vector, b) shifts in northing and easting, and c) shifts in decimal degrees.



How Will This Impact E&P?

Most decisions made by the geosciences community require spatial data. This includes surface and sub-surface data. Specific tools (or applications) will be used to assist you in the analytical and decision making process.

The integration of datasets with varying datums and grids can introduce integrity issues upwards of 250 m. The impact to geophysicists and their projects will depend on their needs. Are they chasing a tight play? … looking for the west side of a fault … modeling the reservoir based on several plays… ensuring that they've met the regulatory spacing requirements … validating that they have not trespassed …

These questions and many more, are all factors in how datums and grids can impact E&P.

How do we address these integrity issues?

As previously stated, every company has different needs and spatial risks depending on their infrastructure. Spatial integrity and reliable data is our business and we still recommend you address these issues. At one time we recommended an Upgrade to the latest grids and also a migration to NAD83. This can be overwhelming, time consuming and costly. While this is still a recommended approach, there are many ways to get to that final end state.

For the past few years we have identified and been successful in assisting companies through a Current State Assessment (CSA). A CSA helps evaluate the current state of data, data flow, software, procedures, and risks associated with how you are operating as a company and where the rest of industry is currently at.

The main objective of completing a current state analysis includes detailed scoping and strategy developments to assist in the migration to new datum's and/or grids or to help design procedures and processes to work within a stable and reliable data environment. The CSA identifies sources and types of spatially referenced data, current and recommended data management processes, and analyzes the NAD83 readiness and strategies of both data suppliers and application vendors that impact you. An immediate return, without considerable financial investment, is the identification of risks which can be mitigated through gatekeeping strategies and implementation of procedures.

Here is an overview of factors to address to understand the current risks:

- Data with spatial risks (includes DLS grid impact and datums),
- Data duplication,
- Data sharing and associated procedures,
- Impact to all business units or asset teams,
- Existing NAD83 environment and capabilities, and
- Application capabilities and limitations

Conclusion

While it is still our recommendation to migrate to the new reference system such as NAD83 ATS4.1/ STS2.5, there are also different solutions to identify and mitigate spatial risks working within your existing environment. We understand the costs associated with such a migration may not be as practical as they once were. Taking a step back and evaluating your current state will shed some light on your existing risks and provide some options on how to manage this current state going forward or devise options on an end state to work towards.

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