

# MOVING TO NAD83: Impacts and Issues for Oil & Gas Companies in Western Canada

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### Introduction

The vast majority of seismic data in Western Canada that contains any kind of locational (XY) information 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 ready availability of NAD27 data. 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, and the potential problems encountered when transforming survey data from one datum to another on a regular basis. This presentation will;

- 1) briefly describe the differences between NAD27 and NAD83,
- 2) list several reasons why an oil and gas company might or might not move their internal infrastructure to NAD83 and
- 3) outline the impacts and issues involved.

### Datum Differences

A datum can be defined simply as a point of reference. The two datums used in Canada are NAD27 and NAD83. The fundamental difference between them is the ellipsoid and its point of origin with respect to the center of the earth. On average the horizontal mapping plane coordinates can differ between NAD27 and NAD83 by as much as 250 meters. The accepted methodology for transforming between these two datums is the National Transformation Version 2.0 (NTV2) supplied by the Federal Government.

### Reasons to consider moving to NAD83

**Errors in Transformation:** A large majority of new seismic field surveys are laid out and collected with GPS or similar technologies using WGS84 (NAD83 compatible) coordinates. These coordinates must then be converted to NAD27 in the field or through survey processing companies in order to be consistent with the exploration companies' internal infrastructure. Upon completion of the interpretation of the data, any well locations chosen (which are, of course, in NAD27) are usually converted back to NAD83 for the legal well survey. Each time data is transformed there is a potential for human error with magnitudes in excess of 200m. Any company operating in NAD83 would significantly reduce their need to transform data.

**Elimination of errors and distortions inherent in NAD27:** Recent observations in NAD83 have revealed local distortions up to 40 meters in NAD27.

**Frontier Lands:** Lack of reliable survey control north of 60 degrees latitude often necessitates the creation of new control networks for companies operating in the Territories and the Arctic, usually generated in NAD83. All indications are that the Federal government will be moving all survey systems in Frontier Lands (NWT, Nunavut, offshore) to NAD83. Continuing to operate in NAD27 would involve frequent transformations between datums and an increased risk of drilling a well on incorrect coordinates. A few companies operating north of 60 degrees are already maintaining that locational data in NAD83.

**Phasing out of NAD27:** Federal and Provincial governments in Canada have been phasing out NAD27 in their data since the early 1990's. As a result it is often difficult or impossible to acquire from, or submit to, the government values based on anything but NAD83. The most up to date versions of Alberta and Saskatchewan DLS grids are now available in NAD83. Well survey plans submitted in British Columbia must be in NAD83. Eventually, any position-based data that remains referenced to NAD27 will become dated and difficult to integrate with other data.

### Reasons to consider not moving to NAD83

**Cost:** Taken as a whole, the coordinate based information possessed by oil and gas companies is a vast integrated web of data. Any transformation strategy must not be taken lightly. The surface referenced data and databases (such as well coordinate files, seismic shot point files etc.) would be relatively easy to transform. The associated datasets, however, [such as personal excel files, workstation coordinate files (containing fault polygons, culture files, horizons, picks, ties, etc.), hardcopy maps, stacked tape header coordinates, archived data] all must be managed and quality controlled effectively or similar disasters to mixing the two datums would occur. This involves time and manpower as the amount of data would need to be transformed over a period of weeks or months. This disruption to geophysicists and geologists may not be acceptable to some companies. The project management involved also requires a certain amount of expertise that would be in short supply during an industry wide initiative such as this.

**Timing:** All companies need to consider moving at the same time. The logistics and technical will (not to mention cost to some companies) may prove prohibitive to the momentum of an industry wide initiative to switch. The business of buying and selling of seismic data and working with all your partners in interpreting seismic data necessitates that all parties be operating on the same referenced datum. If some are switched to NAD'83 and others are remaining on NAD'27, severe risk for mixing datums is incurred.

## **Impacts and Issues for Oil and Gas Companies**

An important consideration for any company considering moving to NAD83 is whether or not their vendors can provide data with locational information in NAD83. This would include wells, pipelines, grid, culture, land , imagery and new acquisition surveys to name but a few. At present some of these products are available in NAD83 and are, in fact, generated in that datum and transformed to NAD27 for the exploration industry.

Another issue is the buying and selling of seismic data. Any oil and gas company fully integrated in NAD83 would presumably be selling their data in that datum. Any company purchasing data would have to be wary of survey that contained no indication of datum used. This is already an issue in Western Canada as more and more survey contractors are beginning to conduct their field operations in NAD83. Purchased data may include minimal survey information and it is often difficult to determine the original datum used without conducting a thorough survey audit. It is therefore critical for companies not to accept any coordinate referenced data which does not have the reference datum defined

Once the supply of NAD83 digital data from vendors is secured, the focus becomes updating the entire infrastructure. This includes GIS/Mapping systems, pipelines, well databases, grids, culture, locational databases, Landmark and openworks projects and anything else that contains or uses XY values. Some of these will require extensive work while others have relatively simple solutions. A fairly simple process is transforming the locational database. Stored survey XYs can be transformed using NTV2 in conjunction with custom designed software to generate NAD83 values for all points in the database. Exceptions could include a 3D survey that had been acquired using GPS and shifted to NAD27 based on a NorthEast corner or other local control during survey QC. These programs can be simply shifted back to their original values.

## **Conclusion**

It would be difficult for any oil and gas company operating in Western Canada to cost justify a complete conversion to NAD83 while they can still successfully operate in NAD27. Companies may, however, want to consider operating in NAD83 for Canada Lands since the infrastructure is heading in that direction. The deciding factor for any one company to get the ball rolling might be the unfortunate experience of drilling a dry hole due to a 250 meter datum transformation error. The cost of that one mistake could well have paid for the entire process of adjusting that company's infrastructure to NAD83. However, transforming all your future data to NAD83 does not guarantee that transformation errors or datum mix-ups won't occur since all the historic data must be transformed and integrated as well. As the world outside Calgary's oilpatch becomes completely functional in NAD83 the need to transform data between datums will only increase. The time has come for open discussion on the impact of moving to NAD83.