Use Case 2 (Directional Surveys)

Title: Directional Survey

Use Case Name	Directional Survey Data
Version	26June_2013_Draft1_ Directional Survey Data
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Goal	The intended goal is to ensure that the directional data acquired at the rig from the MWD Provider is complete in content and can be consumed in the end applications in the Office for planning and real-time drilling.
Summary Description	Refined User Stories: • As a Geoscientist, I want to visualize the entire wellbore path, along with other wellbores, below the surface to avoid collisions and to ensure that we are terminating in the pay-zone during drilling. • As a Directional Survey Specialist, I also want the tool, type, and survey company name in addition to the Geoscientist's use case. • As an Operator (Directional Driller), I want all the available data pertaining to directional surveys for geo-steering a well.
Actors	Primary Actors • Geo-Scientist • Directional Survey Specialist • Directional Driller Secondary Actors • Field Technician
Triggers	REFER TO THE NOTES (below) – What are the reasons to Survey
Pre-conditions	• Need for daily monitoring of real-time survey data as a part of standard workflow. • Need to assess well position, planned trajectory and drilling targets; adjust directional drilling parameters as required to ensure meets geological requirements • Monitor for anti-collision risk issues during planning and drilling • QA/QC raw survey data to check the accuracy of data.
Primary or Typical Scenario	• The Geoscientist starts a new research project using their preferred software. The application loads the subsurface stratigraphic formations and depths as well as the various Directional Survey wellbore paths. The application then visually displays where the wellbores intersect the surfaces for the given project. The geoscientist then looks at a particular well that is being drilled and see if any corrective actions need to be taken to avoid collisions or to correctly steer it to the pay-zone. • The Directional Survey Specialist opens their preferred software for performing directional survey analysis. The specialist compares the directional survey to other analogs to determine if the survey was cost-effective and positionally accurate. The specialist then notes the tool, type, and survey company name for future use based on errors, wellbore collisions, or accuracy. The specialist will also use the directional survey results to provide operational support and troubleshooting for wellbore positioning issues.

	• The Operator (Directional Driller) will use various software tools to analyze all the available data pertaining to directional surveys for geo-steering a well. The tools will provide real time information telling the driller exactly where the wellbore is going as drilling commences in the field. Various stakeholders will then disseminate this information across the organization to make decisions and corrections.
Alternative Scenarios	The operator will also combine the data from the Geoscientist and the Directional Survey Specialist's departmental operational stores and load the data into a DW application that will use MWD and wellbore surveying data to compare overall cost, time, steering etc. to calculate overall project cost for comparison and metrics.
Post-conditions	• Accurate data points have been recorder to visualize the entire wellbore path, along with other wellbores. • Complete records have been recorded to model the path below the surface to show whether the wellbore properly terminated in the pay-zone or not. • The tool, type, and survey company name have been accurately captured. • Various software tools are able to analyze all the available data pertaining to directional surveys for geo-steering a well.
Business Rules	1. The directional survey must include a map coordinate system/datum/zone else there is high likely hood that the well will not hit the payzone and will be off target. 2. Units of measure must always be specified for all quantitative data points 3. The depth reference name/elevation must be specified 4. The depth reference elevation must also indicate whether it is relative to the mean sea level or some other specified reference. For Offshore Rigs Air Gap (Mean Sea Level), Mudline Depth and Mudline TVD should be specified. 5. The survey needs to specify which wellbore it applies to when there are more than one. 6. The Northing reference must be specified ex. true, grid etc. 7. If the survey pertains to a sidetrack then the tie-in point must be specified. 8. The magnetic declination must be specified 9. The survey tool type must be specified 10. The vertical section origin values must be specified, ex. northing, easting, azimuth. The vertical section angle is typically the angle of the plane from the Northing Reference (True or Grid). Its orientation is measured in degrees from 0 to 359.99. 11. Create a Survey Header for each change in • Wellbore • Survey tool • Method of Use • Tie-on Point Survey name, unique and descriptive (method of use), Date when it was used, Tie-on where to start measuring from.
Notes	• Notes may include descriptions of previous or other use cases or actual experiences and the deficiencies or problems manifest in them that this use case description seeks to resolve. • Notes may include descriptions of anticipated solution challenges. • Notes may include descriptions of suggested solution approaches. **What is a survey?** **Surveys measure:** • MD – Measured Depth -The length of the wellbore, as if determined by a measuring stick

- Inc - Inclination - The deviation from vertical, irrespective of compass direction, expressed in degrees. Inclination is measured initially with a pendulum mechanism, and confirmed with MWD accelerometers or gyroscopes. For most vertical wellbores, inclination is the only measurement of the path of the wellbore. For intentionally deviated wellbores, or wells close to legal boundaries, directional information is usually also measured.
- Azi – Azimuth – The compass direction of a directional survey or of the wellbore as planned or measured by a directional survey. The azimuth is usually specified in degrees with respect to the geographic or magnetic north pole.

To tell us where the well is (location)

Using survey measurement tools such as:

- MWD
- Single Shot
- Multi Shot
- Gyro

What are the reasons to survey?

- Ensure a safe well path to the target
- Measure progress and correct the path
- Ensure you hit the oil
- Ensure you don't hit another well
- Provide good log positions to G&G
- Provide good reserves estimates
- Report data to governments
- Conduct 'forensics' investigations afterwards
- Integrated workflow with Engineering design and Operations monitoring/trouble shooting
  - Planning sidetracks
  - Torque/Drag analysis, Hole Cleaning, Well Control, Drill string Vibration, etc.
- Calculates TVDs/Locations elsewhere in OpenWells e.g.
  - KOP location in Wellbore, Formation Tops, etc.

Why Accuracy of Survey important?

Ready for audit/court

- Complete
- Correct
- Consistent

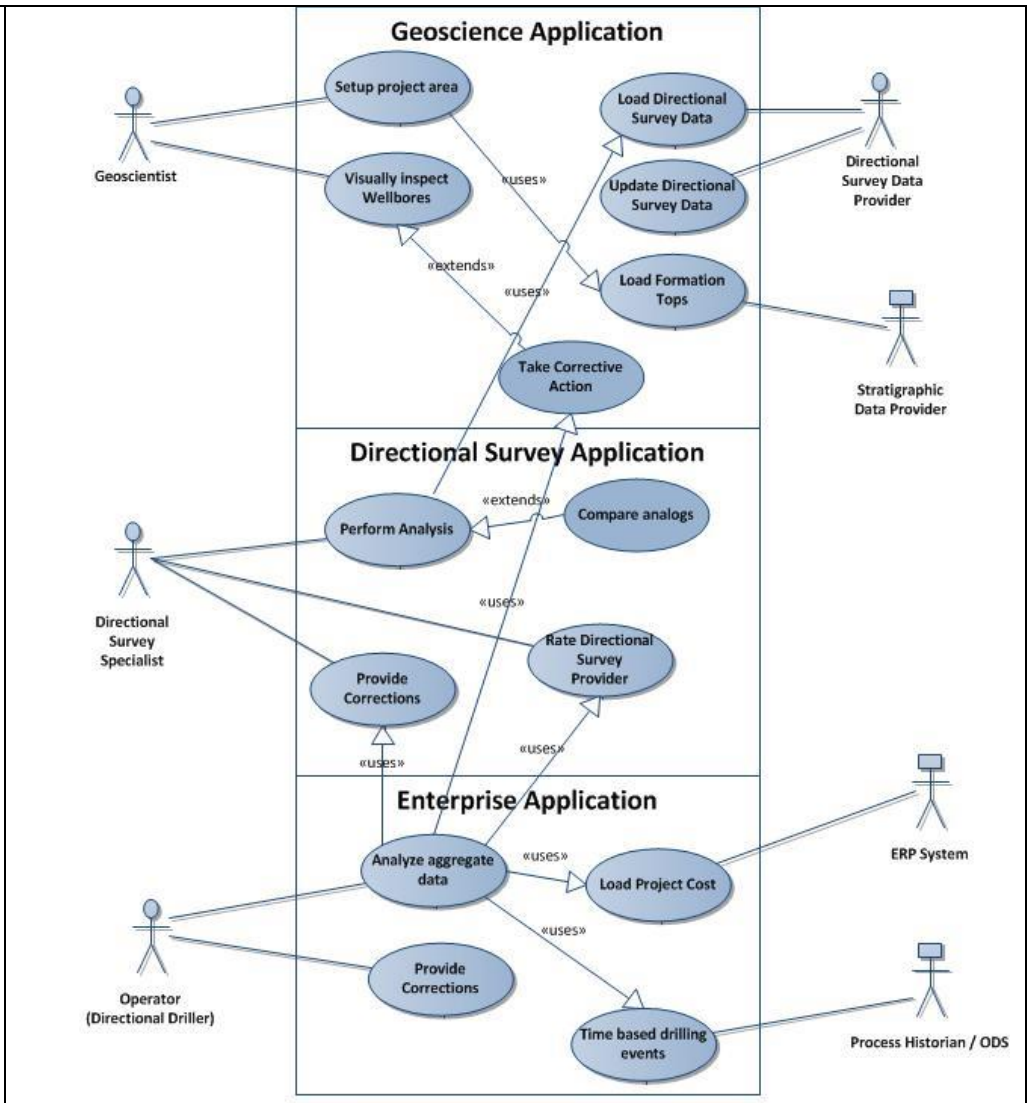
Checked for…….

- Map Systems
- Referencing

	• Elevation of Datum • Data consistency • Tool type
Definitions	• **Wellbore:** The path from Well Surface Origin to Terminating point, and uniquely identified by positions 11 and 12 in the API number, aka the Wellbore Code or Sidetrack. • **Path:** Identified by the very first point or station at the Well Origin or Surface Location that is defined by a depth, inclination, and azimuth • **Surface Location or Well Origin:** The first point identified above which will always include a reference or datum.

Most of the WITSML v1.4.1.1 trajectory data-object does not map atomically to PPDM 3.8. but could be stored as a blob. POC demonstrates that key elements do map to PPDM 3.8 but highlights the fact that WITSML carries raw data that does not have a home in PPDM 3.8. PPDM 3.9 will include more computation reference information but not realtime raw data measurements.

For this POC, the mapping provided satisfies this use case.

Use Case Diagram	 1.0 | Initial Creation | 6/27/2013 | JJ Joubert