OGP P1/11 Geophysical position data exchange format – user guide

Report No. 483-1u
November 2012

To be read with Version 1.0 of the OGP P1/11 Geophysical position data exchange format

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Version	Publication History	Date
1.0	First Publication	November 2012

Contents

How to use this document

This User Guide is a companion document to the ***OGP P1/11 Geophysical position data exchange format*** description (OGP report number 483-1), referred to in this document as the "P1/11 Format Description". It provides additional guidance and detail around the writing, application and use of the OGP P1/11 format, and the user is encouraged to refer to both documents when writing or reading P1/11 files. This User Guide is intended to provide context and examples to demonstrate various implementations of the format, and does not attempt to duplicate the complete format description, although there is inevitably some overlap in content.

Due to the use of hyperlinks between the 2 documents, for optimum benefit it is recommended to access this material by computer rather than printed copy. Where printing is necessary, this document should be printed in colour to allow recognition of the use of colour coding in the text. When printing, note that for some of the Appendices the page orientation is 'landscape'.

Hyperlinks are used to link topics in this User Guide to the relevant section of the P1/11 Format Description. Hyperlinks are stored with relative path names – for the links to remain unbroken the 2 files must be stored in the same folder. Hyperlinks appear as text underlined in purple.

When referring to header record identifiers, which are generally the first four fields in the header section, they are written inside square brackets, for example [HC,0,1,0].

Examples of records are frequently used to illustrate a point. Where too long to fit onto one line they have been wrapped and inset onto the next line. In some cases, the space characters contained in a "Description" field are replaced by an ellipsis (…). The format however in practice requires each record to be written to one line, and ends with a carriage return/line feed character.

As several of the P1/11 record definitions are common with the OGP P2/11 Positioning Data Exchange Format and P6/11 Seismic Bin Grid Data Exchange Format, this User Guide applies equally to the common records in these other formats.

1. Preliminary Information

1.1. Introduction

The OGP P1/11 format replaces the UKOOA P1/90, SEG P1 and other legacy positional exchange formats and is designed for the exchange of position data typically resulting from in-field survey operations such as geophysical (including seismic), hydrographic etc.

The purpose of this User Guide is to provide examples and guidelines for best practice in generating the necessary information (metadata) and identity (geodetic information) as well as defining the coordinate information (position data) to accurately convey and exchange such data.

The format will typically contain positions of an energy source and the corresponding receiver positions. However, P1/11 may also be used to convey positions of other objects, for example preplots, boundary information, obstructions etc. While some position data types are directly defined within this document and pertain to seismic acquisition, other data may be exchanged using this format merely by complying with the structures and definitions available. In fact some positions previously defined explicitly by position type are now enabled using object identification and coding. This extends the possibilities for positional information as well as removing ambiguity found in implementations of other formats (e.g. P2/94, P6/98, SEG P1 etc).

Note that the P1/11 format does not support the exchange of bin centre position data (formerly "Q-records" in P1/90). These are now incorporated in the P6/11 format as B6 records.

While the key position data types such as source and receiver remain directly referenced by a position type identity, the format is extensible by allowing user-defined objects and attributes. The user is allowed through proper construction of the defining values in the headers to define position objects and to incorporate additional information fields within existing or newly defined record types.

A basic premise behind the P1/11 format is that a unique relationship exists between the individual data records and the mandatory as well as optional header elements associated with them. Because of the flexibility of adding records and data within them, **it is a key requirement that the header or metadata must be retained with the data records to enable proper definition and subsequent use of the data.**

Because of the variation in use, it is understood that some records defined as mandatory for the exchange of position data (specifically new acquisition) may not be available as information in part or whole for some legacy or other positional data types. As an example the inclusion of positional accuracy estimates, which are highly desirable for all forms of source and receiver locations, may not exist for legacy data that was derived from the P1/90 format or digitized or scanned from hard copy documents. What would be considered the minimum mandatory requirement for several differently-sourced P1/11 files is given in the table in Appendix B in the P1/11 Format Description (and in Appendix A in this User Guide). The user is encouraged to attempt to provide as much detailed support information in the headers to quantify the source and level of confidence in the data being encoded. The incorporation of comment records facilitates this. Where possible, examples are provided to demonstrate best practice in defining legacy data and methods.

1.2. General Format Information

'P' files comprise a series of records containing positional information about a survey. A record is a line of ASCII text terminated by a carriage return and/or line feed character. Each record contains a number of comma-separated fields, the contents of which are prescribed by the format. A record commences with an identifier in the first field inferring the type of information the record contains (for example 'HC' identifies a header record in the Common Header section of the file, 'R1' identifies a data record for a receiver in the data section of a P1/11 file).

A P1/11 file consists of two main sections, the header (containing the metadata and geodetic identity for the survey) and the data records. In the header section the record identifier ('HC' or 'H1') is followed by 3 integer fields comprising a numbered multilevel list which in general defines the hierarchical order in which this record should be placed in its respective section. In the data records the identifier (R1, S1 etc) denotes the type of position record to which the positional information that follows refers.

The file naming convention is ***filename.p111*** with p111 (or P111) being the only valid file extension. Header records will precede data records. Files without mandatory header and data records are considered invalid.

Multiple seismic lines and positional data types per file are allowed, as long as all data and header records are consistent with each other.

Typical examples of different data types and usages are provided in this document (see Appendices). These are intended as guidelines for minimum content. Also included are examples of UKOOA P1/90, SEG-P1 and SPS files transcribed to P1/11 format, which can be used to determine the correlation between the different formats and possibility for conversions.

A P1/11 file has the following basic structure:

A) OGP file identification record [OGP]
This is required by all Px/11 formats and comprises the first line in the file. It contains basic metadata about the file such as format type (P1, P2 etc) and date/time of writing and supports file versioning. This allows for a minimum level of audit trail and file tracking from initial encoding through exchange, modification, processing and final archival.

B) Common Header [HC]
The OGP file identification record is followed by the Common Header, containing the survey definition. This part of the file contains header information that is common across all 'P' formats (P1/11, P2/11, P6/11) from the same survey. It comprises 3 main sections, a summary containing basic information to identify the survey, definitions of units and reference systems used (units of measure, time and position reference systems), and survey configuration information. Each Common Header record begins with the 'HC' identifier.

C) P1 specific header section [H1]
This part of the file contains header information that is specific to the P1/11 format, such as file contents and processing details, and defines the positional framework for preplot, survey perimeter and final position records, and should follow directly after the Common Header. Each P1-specific header record begins with the 'H1' identifier.

D) Data records [P1/S1/R1/X1/M1/N1]
Following the header section, the data records contain the preplot, survey perimeter and position data (postplot) as appropriate for the intended purpose of the file, and attribute information relevant to the position.

E) Comment records [CC]
Comments may be used to provide additional relevant information about any record in the file. A comment record can be inserted anywhere after the [HC,0,1,0] header record. A comment record should be located as close as possible to the item to which it refers.

Particular attention should be paid to including all mandatory record types. It is highly recommended that optional record and field types be added if available. The user is referred to Appendix B of the P1/11 Format Description for a more detailed description of the mandatory and optional header items relating to the P1/11 format. A summary of requirements for new acquisition is given in the table below.

Record Type	Requirement
OGP File Identification Record	Mandatory for all format types
Survey Definition	Mandatory for all format types
Reference Systems Definition	Mandatory for all format types
Survey Configuration	Mandatory for P1/11 and P2/11
Production System Information	Mandatory for P1/11 and P2/11
Receiver Information	Mandatory for P1/11 and P2/11
Object Information	Mandatory for P1/11 and P2/11
P1 Header	Mandatory for P1/11
P1 Data Records	Mandatory for P1/11

Table 1: Header Record Requirement

1.3. Data Types

Each comma-separated field in a 'P' file will be written in one of the data types listed in Table 2 of the P1/11 Format Description. The data type to be used for each record in a P1/11 file can be found in the table associated with each record definition in the P1/11 Format Description. For example, for header record [HC,1,0,0] the data type is given in the third column of the table linked to the HC,1,0,0 record definition.

Notes on specific data types follow:

Data Type	Note
Description	A text field left justified to 50 characters, used in field 5 of most header records.
Time	HH:MM:SS – Used where a fixed format is adequate, for example the OGP file identification record.
Variant	This may take the form of any of the data types. For example, time may be represented by several variants and to varying precisions, such as Date and Time (YYYY:MM:DD:HH:MM:SS.S) and Julian Day and Time (YYYY:JDD:HH:MM:SS.S). Note that time can be written to the precision to which it is recorded, for example microseconds (SS.SSSSSS) may be the required precision for some forms of acquisition.

The codes (DATATYPEREF) assigned to various types of variant data stored within data fields are listed in Table 4 of the P1/11 Format Description. The comma-separated variable format allows any resolution to be written into a record stored as a floating point number, and should be truncated commensurate with its accuracy.

1.4. Reserved Characters

The following 4 characters are integral to the format (as entity separators) and therefore cannot be used elsewhere (with the exception of comment records):

Comma	**,**	ASCII Code 44 Used to separate fields
Semi Colon	**;**	ASCII Code 59 Used to separate sub-fields in a Standard Record Extension Definition and Record Extension Fields (see Section 2.7 of the P1/11 Format Description)
Colon	**:**	ASCII Code 58 Used to separate items in Date and Time fields
Ampersand	**&**	ASCII Code 38 Used to separate items in a Variant List

Variant Lists are only used for data record fields which contain a variable number of items - a good example is the GNSS "satellites used" field from the P2/11 format where the satellite SV numbers are listed as in "5&6&7&8" etc.

2. The Common Header: Metadata, Units and Reference Systems

The P1/11 header records provide fundamental information about the data contained within the file. The subset which is replicated across P1/11, P2/11 and P6/11 formats for the same survey is called the Common Header. Additionally each P format has format-specific header records, for example the P1 format has a set of specific header records prefixed by 'H1'. These are described in section 6 below.

2.1. Header Records Common to all P formats

The following header records are common to P1 and P2 formats. (A subset is common to P6):

- Survey Definition [HC,0,1,0 to HC,0,7,0]
- Reference Systems Definition [HC,1,0,0 to HC,1,9,0]
- Survey Configuration [HC,2,0,0]
- Production System Information [HC,2,1,0 to HC,2,1,2]
- Receiver Information [HC,2,2,0 to HC,2,2,1]
- Object Information [HC,2,3,0 to HC,2,3,1]

The Common Header starts with a subset of records that identify the survey [HC,0,1,0 to HC,0,7,0], basic metadata about the survey that is explained in the P1/11 Format Description [Section 4].

Header record [HC,1,0,0] is the record which defines the number of units and reference systems used in the file, specifically the number of:

- Units of measure
- Time reference systems
- Coordinate reference systems
- Coordinate transformations

2.2. Units of Measure [HC,1,1,0 to HC,1,1,1]

Any unit of measure used within the P1/11 file is defined in this section. The unit of measure definition in record [HC,1,1,0] contains the following items:

- a unique reference number (UNITREF)
- a type of measurement unit (metre, degree, second etc)
- a format code (DATATYPEREF) which describes the way the unit is written (degrees can be written as decimal, sexagesimal, etc for example)
- the identifier (UNITREF) for the base unit for that type of unit
- the conversion factors to convert that measurement unit to the base unit
- the information source from which the unit information has been derived.

Note that the first 4 UNITREF codes are reserved as follows:

UNITREF	Units	Quantity Type	Format Reference (DATATYPEREF) in Field 9	Base SI Unit
1	Metres	Length	Floating Point (2)	Metre
2	Radians	Angle	Floating Point (2)	Radian
3	Degrees	Angle	Floating Point (2)	Radian
4	Unity	Scale	Floating Point (2)	Unity

Table 4 in the P1/11 Format Description contains a list of DATATYPEREF codes. The example below shows in a tabular structure four [HC,1,1,0] records. The last two rows demonstrate how degrees can be represented in 2 different forms (decimal degrees and sexagesimal DMS) with unique UNITREF codes, and how they are converted to their respective base SI unit.

Unit of Measure	Unit Number	Unit Name	Quantity Type Name	Format Reference	Base Unit Number	A	B	C	D	Description	EPSG Unit Code	Source Description	Source Version Details	Source Unit Code
Unit of Measure	1	metre	length	2						metre	9001	EPSG	7.6	9001
Unit of Measure	2	radian	angle	2						radian	9101	EPSG	7.6	9101
Unit of Measure	3	degree	angle	2	2	0	3.14159265	180	0	degree	9102	EPSG	7.6	9102
Unit of Measure	6	sexagesimal DMS	angle	29	3	0	0	0	0	sexagesimal DMS	9110	EPSG	7.6	9110

For values given in degrees, multiple unit definitions may be required if values are given in different representations. Those most frequently encountered are:

a) Decimal degrees (EPSG unit code 9122, for example 34.44834444). This is the required representation for latitude and longitude positions in data records. Southern hemisphere latitude and western hemisphere longitude will be preceded by a negative sign (-). Where equivalence is required to a map grid position of centimetric precision it is recommended that latitude and longitude coordinates are written to 8 decimal places.

b) Sexagesimal degrees (EPSG unit code 9108, for example DDD MM SS.SSS H) is not allowed for data records but may be used for header records expected to be visually inspected.

c) Sexagesimal DMS (EPSG unit code 9110, for example 34.265404). This pseudo-unit is used in the EPSG Dataset for storing CRS definition parameter values given in sexagesimal degrees (degrees, minutes and seconds) as a single floating point number. It is only for use in CRS definition records and not allowed in any other record type.

Other degree representations, as defined through EPSG unit codes 9107 and 9115 through 9120, may be used if the source uses them.

Further examples of the implementation of record [HC,1,1,0] are provided in Section 5.1 of the P1/11 Format Description.

Record [HC,1,1,1] is used to provide examples of unit conversions.

```
HC,1,1,1,Example Unit Conversion                        ,1,2,1.0,3,57.295779513
```

This example (number 1 as underlined) shows that 1.0 unit of UNITREF 2 (radian) converts to 57.295779513 units of UNITREF 3 (degree), defined as floating point numbers. Field 7 onwards can be repeated as required, as in the example above, or the record repeated as shown below:

```
HC,1,1,1,Example Unit Conversion                        ,1,2,1.0
HC,1,1,1,Example Unit Conversion                        ,1,3,57.295779513
```

The following example (number 8) shows that 1.0 unit of UNITREF 1 (metre) converts to 3.2808333333 units of UNITREF 5 (US survey foot).

```
HC,1,1,1,Example Unit Conversion                                ,8,1,1.0,5,3.2808333333
```

2.3. Time Reference Systems [HC,1,2,0 to HC,1,2,1]

Each Time Reference System (TRS) has a unique TRSREF code (Section 5 of the P1/11 Format Description). The TRSREF code combines a time system (such as UTC, GPS etc using the TIMEREF code) and a UNITREF code, which defines the time unit of measure (eg seconds) and the way the time system is written (the DATATYPEREF code). For example, UTC time may be recorded in a date and time format [YYYY:MM:DD:HH:MM:SS.SS] or as Julian day and time [YYYY:JDD:HH:MM:SS.SS].

In most P1/11 files there will only need to be one time reference system defined. This capability of handling multiple time reference systems is primarily intended for raw navigation data recorded in P2/11.

It is recommended that if the P1/11 file is written using a time system that is not the system used during acquisition, then both time reference systems should be defined in the Common Header with an Example Time Conversion record [HC,1,2,1] that defines the relationship. For example:

```
HC,1,2,0,Time Reference System                            ,1,1, 0.0,UTC,0, ,5
HC,1,2,0,Time Reference System                            ,2,2,15.0,GPS,0,1980:01:06,6
HC,1,2,1,Example Time Conversion                          ,1,1,2011:02:04:13:19:59.0,2,980860814.0
```

2.4. Coordinate Reference Systems [HC,1,3,0 to HC,1,6,1]

2.4.1. Concepts and Definitions

The OGP P formats Common Header allows any coordinate reference system (CRS) in use in the oil and gas industry to be defined in the CRS section. The format follows the classification of coordinate reference systems recommended by the Geodesy Subcommittee of the OGP Geomatics Committee, who maintain the 'EPSG Geodetic Parameter Dataset'. The classification adopts some fundamental premises that are included below as context for the section on CRSs which follows (terms in *italics* are defined in the Glossary):

A *coordinate* is one of a sequence of numbers designating the position of a point in space. A *coordinate tuple* is a sequence of coordinates describing one position.

Coordinates – even latitude and longitude – are ambiguous unless their reference system is known. The same coordinate values can represent different locations. Conversely, to describe location unambiguously, a coordinate tuple must be associated with a reference system definition. Only then will the coordinate tuple describe a location unambiguously.

A *coordinate set* is a collection of coordinate tuples. All coordinate tuples within a coordinate set should be referenced to the same coordinate reference system. For a coordinate set, one CRS identification or definition is associated with the coordinate set. All coordinate tuples in that coordinate set inherit the CRS association.

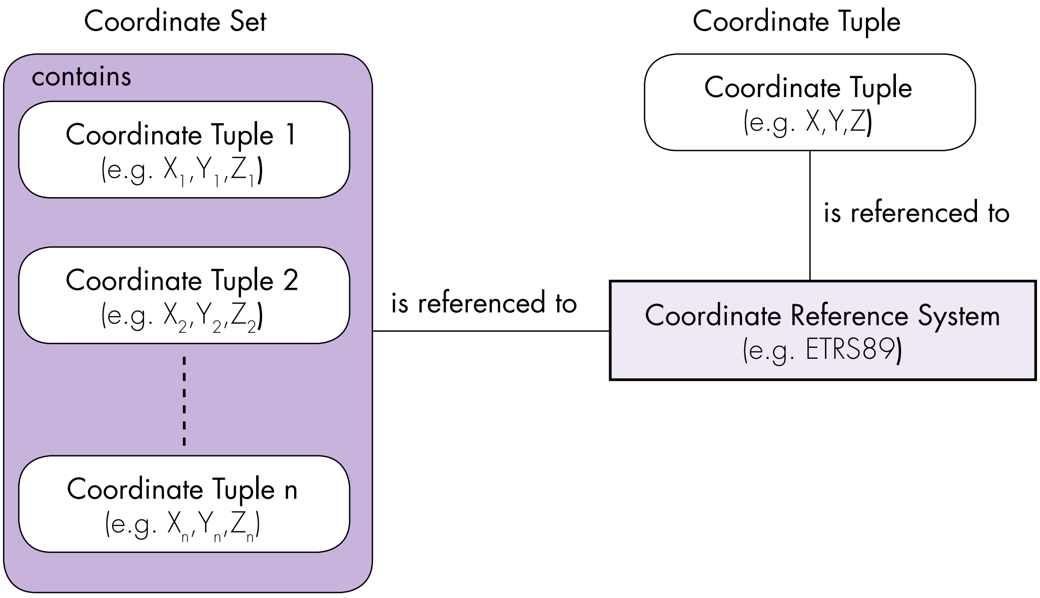

Figure 1 — Conceptual relationship of coordinates to a Coordinate Reference System (CRS)

The P format CRS records draw heavily on the EPSG Geodetic Parameter Dataset, referred to in short as the EPSG Dataset. This in turn is based on ISO 19111 – Spatial referencing by coordinates. To populate these CRS records successfully a working understanding of the data model underpinning the CRS data is desirable. This is documented in OGP Geodesy Subcommittee Guidance Note 7, part 1 ("Using the EPSG Geodetic Parameter Dataset"). The concepts are described in textbooks such as Iliffe and Lott (see reference in Bibliography). In summary:

- Coordinates describe position in a *coordinate system*.
- A coordinate system is a mathematical abstraction with no real world meaning.
- To give real world meaning, coordinate systems are related in position and orientation to an object – usually but not necessarily the Earth – through a *datum*.
- The association of a coordinate system and a datum gives rise to a *coordinate reference system*. Conversely, a coordinate reference system (CRS) is comprised of a datum and a coordinate system.

(Note: the distinction between the terms **coordinate system** and **coordinate reference system** is significant. Beware of the colloquial use of 'coordinate system', which may mean 'coordinate *reference* system').

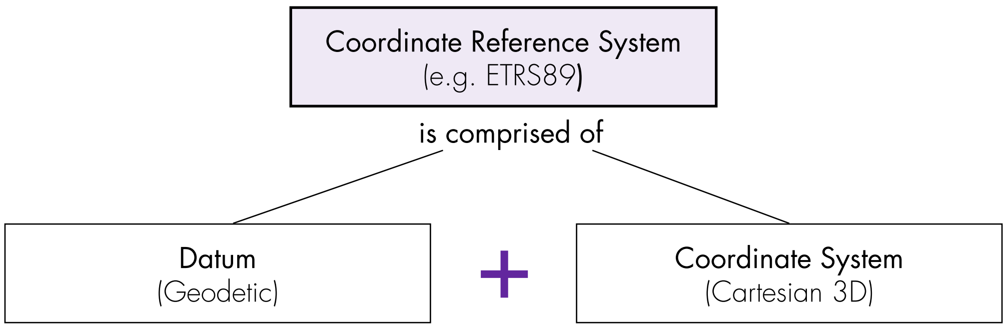

Figure 2 — Conceptual Model of a Coordinate Reference System

A coordinate tuple referenced to one CRS may be changed to being referenced to a second CRS through a coordinate conversion or transformation. ISO 19111 distinguishes between these:

- A *coordinate conversion* changes coordinates between two CRSs referencing the same datum.
- A *coordinate transformation* changes coordinates between two CRSs referencing different datums.

From a purely mathematical perspective these are similar, and are collectively referred to as *coordinate operations*. The coordinate operation acts on coordinates. It changes the CRS to which coordinates are referenced, but it does not change any CRS definitions.

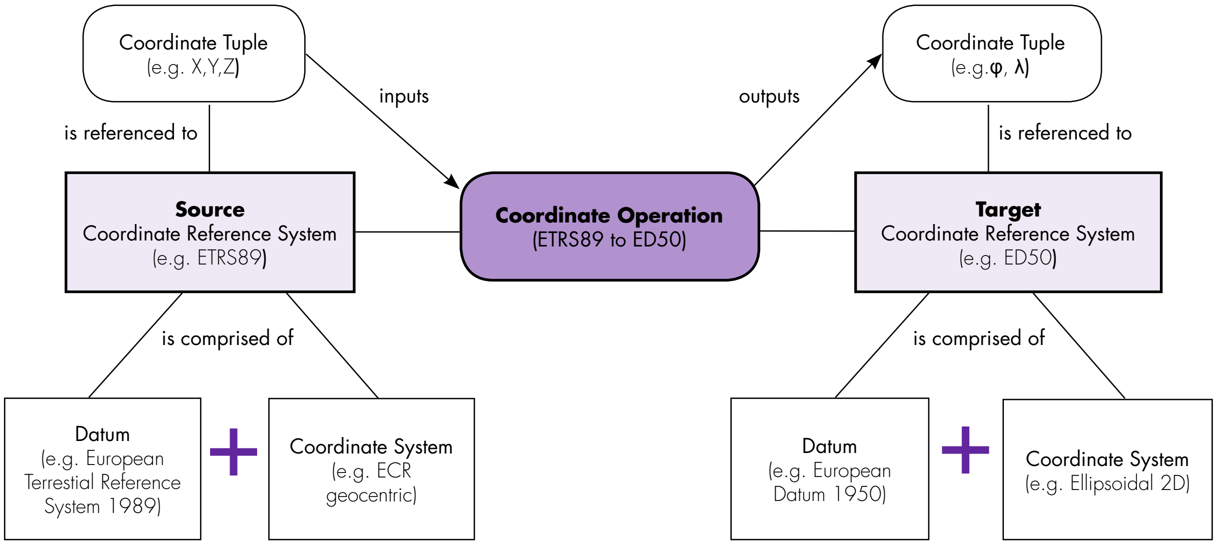

Figure 3 — Conceptual model for spatial referencing by coordinates

For the purposes of the P formats, the 'coordinate reference system' discussion includes:

i) the definition of all CRSs involved in the position data given in the file, and

ii) the definition of all transformations used to change coordinate values between these CRSs.

There is scope in the format for any number of CRSs and transformations to be defined. All data in the position records of a P1/11 file will be referenced to at least one universal CRS, this being the default or the contractually deliverable CRS. This can be a 3-dimensional system or a compound system, or separately defined horizontal and vertical systems. There is scope in the format for position objects to be referenced to up to 3 CRSs.

The CRS section of the Common Header should include the full positional history of the records, for example the field acquisition CRS and the transformation parameters used to convert between this and the client's required delivery CRS. If for regulatory or other reasons the data is later required to be exported to another CRS, details of this should be included in the exported file, with comment records to describe the context and CRS numbering reflecting the chronological sequence of reprocessing.

Complete and correct definition of the coordinate reference system is essential to unambiguously define the coordinates in the P1/11 file. This is done in the CRS section of the Common Header, where all the CRSs relevant to the data in the file shall be *explicitly described* and whenever possible should also be *implicitly identified*.

Explicitly described refers to writing all the CRS defining parameters and associated values to the file header in records [HC,1,4,0] through [HC,1,6,0].

Implicitly identified refers to writing the associated EPSG code and name for the CRS to the file header in record [HC,1,3,0]. The EPSG Dataset includes definitions for the vast majority of CRSs used in the oil and gas industry, but occasionally a proprietary CRS not in the EPSG Dataset will be encountered and in these circumstances implicit identification cannot be made[1]. However the [HC,1,3,0] header record is still required by the format and should be populated to the extent possible.

Coordinate transformation parameters are similarly explicitly described in records [HC,1,8,n] and implicitly identified in [HC,1,7,0].

Map projections are a subset of coordinate operations, but shall not be described through [HC,1,7,0] and [HC,1,8,n] records. Instead they form part of a projected CRS description and are explicitly described through [HC,1,5,n] records.

The [HC,1,9,0] record allows examples of conversions and transformations to be supplied.

2.4.2. CRS Implementation Strategy

When populating explicit descriptions, some artefacts of the data model need to be understood. These are highlighted below.

Derived Coordinate Reference Systems

The ISO 19111 and EPSG data models include a concept of a 'derived coordinate reference system'. This is a data modelling convenience used to associate CRSs together. A derived CRS is related to a 'base CRS' through a coordinate conversion. There are two areas of note:

i) Geodetic CRSs are subdivided in EPSG into three subtypes: geocentric, geographic 3D and geographic 2D. For older geodetic systems only the geographic 2D subtype will exist. But for modern systems the three subtypes are related together through the geographic 3D CRS being derived from the geocentric CRS (the base CRS), and in turn the geographic 2D CRS being derived from the geographic 3D CRS (the base CRS). Through this modelling the geodetic datum and its components (ellipsoid, prime meridian) for the geocentric CRS are inherited by the two geographic CRSs, but the CRSs have different coordinate systems.

   The geodetic datum and its components must be documented as part of all geodetic CRS descriptions, in [HC,1,4,4] through [HC,1,4,6]. In general, when describing or identifying a derived geodetic CRS, it is not necessary to document its base CRS or the conversion used in its derivation. However when the file specifies the explicit use of both base and related derived geodetic CRSs, for example where raw position is being logged in the base geodetic CRS (say WGS 84 geographic 3D) and being transformed through the derived CRS (WGS 84 geographic 2D), it is essential to document both base and derived geodetic CRS and to document the conversion between them using [HC,1,7,0] and [HC,1,8,n] records.

ii) Projected CRSs – sometimes colloquially referred to as 'map grids' – are derived from a base Geographic 2D CRS, defined in [HC,1,4,3]. The derivation is through a special case of a coordinate conversion, a map projection. However this is not described as a coordinate operation between base geographic CRS and derived projected CRS as described in figure 3 above. Conceptually a projected CRS is considered to have three components – datum, coordinate system and map projection – and all three are considered part of the projected CRS definition. In this special case the model of a CRS as shown in figure 2 is modified as shown in figure 4.

[1] Should this be the case, users should consider making a request for the CRS to be included in future releases of the EPSG Dataset, at http://www.epsg.org/Comms/Comment.asp

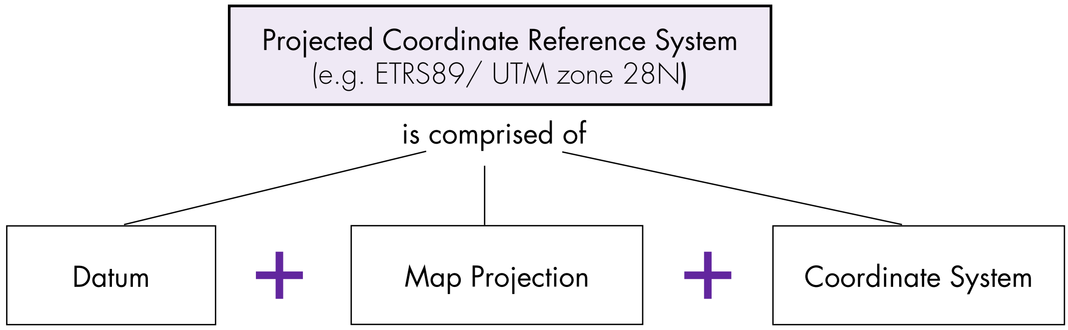

Figure 4 — Conceptual Model of a Projected Coordinate Reference System

When describing a projected CRS, the attributes inherited from the base CRS (the geodetic datum and its components) shall be documented as part of the projected CRS description [HC,1,4,4 through HC,1,4,6]. So too should the map projection, for projections can use different methods and these methods have different parameters, the values of which define the map projection. The projection is documented as part of the CRS definition (in [HC,1,5,n], *not* through [HC,1,7,0] and [HC,1,8,n] coordinate transformation records). However it is also a requirement to document the base CRS of each projected CRS. This geographic 2D CRS is identified as part of the projected CRS definition in header record [HC,1,4,3], but must then be separately fully defined as a different CRS. This allows a file CRS number (CRSREF) to be assigned so that example conversions between geographic and map grid coordinates can be included in the file (in [HC,1,9,0]).If several projected CRSs share the same base geographic 2D CRS, the geographic 2D CRS description should be made only once.

When populating the CRS records in the Common Header, these requirements will be adhered to by following the conditionality for each record and its fields. Conditionality statements are placed immediately after each section header in section 5.3 of the P1/11 Format Description, and appear as shown in the following example:

HC,1,4,3: Base Geographic CRS Details

Mandatory when CRS type is projected. Shall not be given for any other CRS type.

Coordinate Operation Method Formula

A coordinate operation is determined by its formula. Names alone are ambiguous: for example the map projection name "Oblique Stereographic" is associated with different formula, these resulting in output coordinates being significantly different (can be 100's of metres). These outputs are not right or wrong, they are just different. But what is erroneous is to apply one of these formulas to an area where the other formula has been adopted. The EPSG Dataset and OGP Geomatics Guidance Note 7 part 2 (see Bibliography) have formally documented the formula for each method, including the parameters that are variables in the formulae, and coordinate conversion and coordinate transformation parameter values in the EPSG Dataset are consistent with the documented method.

Although the EPSG Dataset includes most geodetic data required for oil and gas operations worldwide, because it cannot be guaranteed to carry everything, the P formats allow user-defined map projections and coordinate transformations. When documenting such data:

- the operation's method including its formula and its parameters shall be taken from the EPSG Dataset. In this case, the EPSG coordinate operation method code and coordinate operation parameter code must be included in the relevant CRS header records. It is the responsibility of the file creator to ensure that the map projection or coordinate transformation method parameters and values are genuinely consistent with the EPSG method.

- In the unlikely event that a coordinate operation method code or coordinate operation parameter code is not available in the EPSG Dataset, it cannot be directly or immediately supported. Inclusion of the new method in the EPSG Dataset can be requested through the OGP Geodesy Subcommittee at http://www.epsg.org/Comms/Comment.asp or by general enquiry to the OGP Geomatics Committee at http://info.ogp.org.uk/geomatics.

Coordinate Operation Reversibility

Most, but not all, coordinate operation methods allow for coordinates to be changed in both directions, i.e. from CRS A to CRS B and from CRS B to CRS A. These are 'reversible'. In some reversible methods, the values of the parameters may require their sign to be changed for the reverse direction. These reversibility data are attributes of the coordinate operation method. They are included in the definitions of methods supported by the EPSG Dataset.

Map projection method formulae of relevance to the oil and gas industry are always documented for both forward and reverse calculations, with the formulae structured such that the map projection parameter values can be used for both forward and reverse calculations. As such the reversibility of the method itself and of signs of parameter values do not need documenting in map projection definitions, including user-defined map projections.

Coordinate Operation Accuracy

In addition to whether or not a change of datum is involved, coordinate conversions and coordinate transformations differ in another important aspect. Transformation parameters are empirically determined and thus subject to measurement error. The consequence of this is that by applying a coordinate transformation to a set of coordinates, any error in the transformation will be inherited by the output coordinates. The 'transformation accuracy' is the error in position that is introduced in a set of coordinates considered to be errorless through the application of the coordinate transformation. Whenever known, this should be documented as it adds to the error budget of positions. Field 9 in [HC,1,8,0] is provided for this purpose. The transformation description allows for a single generic value that is representative of the transformation throughout its area of derivation. If applied well outside of this area, this error estimate may be unrealistic.

In contrast, the parameters for a coordinate conversion (including map projection) are chosen. As such they are by definition error free. The application of a conversion does not add any inaccuracy to output coordinates, (conditional on there being sufficient expansion terms in the conversion algorithm and staying within the limits of the projection zone). As such, no provision for conversion accuracy is necessary.

Concatenated Coordinate Operations

The ISO 19111 and EPSG data models allow for the concept of *concatenated coordinate operations*. These document a series of coordinate operations that are chained together. Coordinates referenced to CRS A will be first changed to be referenced to CRS B and then immediately changed to be referenced to CRS C, and the concatenated operation documents a change from CRS A to CRS C.

There is no provision for this construct in the P format records. Should it be required to document such an operation, each of the individual steps and any intermediate CRSs (such as CRS B in this case) should be individually documented.

EPSG Dataset Storage of Coordinate Transformations

Strategies applied during data population of the EPSG Dataset are described in OGP Geomatics Guidance Note 7 part 1 (see Bibliography). The following aspect of these strategies impacts the P format use of EPSG data:

Coordinate operation methods operate across various coordinate domains, e.g. between geocentric CRSs, between geographic 2D CRSs, between projected CRSs, etc. For historic reasons and backward compatibility, in the EPSG Dataset any coordinate transformations between geodetic CRSs (geocentric, geographic 3D or geographic 2D) are always documented with geographic 2D CRSs as the source and target CRS, regardless of the actual domain in which the transformation operates. Applications are expected to deal with this through the implicit concatenated operation technique described in OGP Geomatics Guidance Note 7 part 1 (see Bibliography). However, the strategy for populating CRSs is to give all three subtypes of geodetic CRS when they are part of a modern ITRS-related CRS, and only the geographic 2D CRS for classical survey control networks. When it comes to documenting CRS and transformation data in the P format records, then:

- The geodetic CRS to be documented is that actually used in the data record coordinate fields.
- The coordinate transformation's source and target CRS to be documented are those as given in the EPSG Dataset.

Thus the source or target geodetic CRS of a documented transformation may not match the CRS's coordinate system. For example, assume a survey was acquired using GPS in WGS 84 in geocentric Cartesian coordinates (EPSG CRS code 4978, allocated (say) file CRSREF number 1). The coordinates were then transformed to a classical system (say ED50, EPSG CRS code 4230, file CRSREF number 2). In the P format position records, CRSREF 1 coordinates will be geocentric Cartesian, CRSREF 2 coordinates will be geographic 2D, and the header descriptions for CRSREF 1 and 2 will give the EPSG CRS codes as 4978 and 4230 respectively, and the CRS types as 'geocentric' and 'geographic 2D' respectively. However the transformation's source EPSG CRS code will be given as 4326, the code for the geographic 2D form of the WGS 84 CRS, in which case this geographic 2D form (4326) must also be documented and defined with a CRSREF integer code.

Conversely, if the transformation operated in the geocentric CRS domain (for example it used the geocentric translations method) and the source or target CRS were a classical system such as ED50, there will be no entry in the EPSG Dataset for ED50 datum associated with a geocentric 3D Cartesian coordinate system. Such system is assumed to be internal to the transformation application. In such circumstances there is no requirement for the implicitly used CRS, ED50 geocentric, to be documented in the P format header records.

2.4.3. Control of Positional Integrity

As has been emphasised, it is recommended that where a CRS used in a survey is included in the EPSG Dataset, appropriate reference should be made to it in this section of the Common Header. Furthermore, this should not preclude the full exposition of all the coordinate reference system parameters in the header. It is recognized that although the EPSG dataset is stable and items are not removed only deprecated, it is subject to proprietary usage and content. Provision is made to reference the name of the geodetic parameter dataset and its versioning to further clarify CRS definitions. While the use of EPSG coding is inherent, provision of explicit definitions is required as well as additional versioning support. Regardless of the coordinates in a P1/11 file, the full set of survey geodetic information shall be retained in the Common Header to ensure that any transformation back to a common or original CRS (such as WGS 84) uses the correct parameters.

It is critical that the explicit (expounds all parameters and values) and implicit (EPSG code only) definitions of the CRS do not conflict in any of their components. The onus is on the party responsible for writing or checking the P1/11 file to employ adequate quality control to ensure no such conflict arises. The format requires the inclusion of both the projected CRS grid position and base geographic CRS lat/long coordinate values of the projected CRS, to be present in the data records. Cross-conversion between these may assist in distinguishing the correct definition of each CRS if the implicit and explicit definitions disagree in either CRS. A further provision is made in the format to resolve such a discrepancy, by which a position record can additionally be written in the original or hub geographical CRS, such as WGS 84. This would not be necessary if WGS 84 was already defined as the primary or contractual CRS. Such repetition of positions should never substitute for fully expounded definitions in the file header. **The file header should never be separated from the data.**

2.4.4. Coordinate Reference Systems Coding Summary

The CRS section of the Common Header consists of the following blocks:

HC,1,3,0	CRS implicit identification
HC,1,4,n through HC1,6,n	CRS details (explicit definition), with:
HC,1,4,n	CRS information and datum details
HC,1,5,n	Map projection details
HC,1,6,n	Coordinate System and axis definitions
HC,1,7,0	Coordinate transformation implicit identification
HC,1,8,n	Coordinate transformation details (explicit definition)
HC,1,9,0	Example point conversions/transformations

2.5. Coordinate Reference Systems – Worked Examples

ISO 19111 identifies several types of coordinate reference system. Those relevant to the P formats and the coordinate fields required for each category are given in Table 9 in the P1/11 Format Description.

The following examples demonstrate the flexibility of the P1/11 format to cater for any CRS or combination of CRSs (see CRSTYPEREF Table 10 in P1/11 Format Description):

1) Projected
2) Geographic 2D
3) Geographic 3D (vertical dimension is ellipsoidal height)
4) Geocentric
5) Vertical
6) Engineering
7) Compound

For the examples that follow, descriptions of the contents of each field can be found in the corresponding section of the P1/11 Format Description.

HC,1,3,0: Coordinate Reference System Implicit Identification

Common Header record [HC,1,3,0] presents an at-a-glance summary of all the CRSs used in the file, as they are listed en bloc in the order in which they are defined in the header. Field 6 identifies the CRS internal file Reference Number (CRSREF) and if this designation follows a chronological sequence this block of records is representative of the derivation of the data.

A representative example of each of the above 7 CRS types would appear in record [HC,1,3,0] as follows:

```
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,1,32631,  WGS 84 / UTM zone 31N,7.6,2010:11:02,EPSG,EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,2, 4326,                 WGS 84,7.6,2010:11:02,EPSG,EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,3, 4979,                 WGS 84,7.6,2010:11:02,EPSG,EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,4, 4978,                 WGS 84,7.6,2010:11:02,EPSG,EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,5, 5715,              MSL depth,8.0,2012:08:10,EPSG,EPSG_v8_0.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,6, 5818,OGP P6 seismic bin grid,8.0,2012:08:10,EPSG,EPSG_v8_0.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,7, 5498,  NAD83 + NAVD88 height,8.0,2012:08:10,EPSG,http://www.
        epsg-registry.org/
```

HC,1,4,0: Coordinate Reference System Details

Common Header record [HC,1,4,0] identifies the CRS type in field 8 (CRSTYPEREF) and is the first record in the block containing each CRS explicit definition (grouped together here only for demonstration purposes):

```
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 1,32631,1,    projected,       WGS 84 / UTM zone 31N
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 2, 4326,2,geographic 2D,                      WGS 84
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 3, 4979,3,geographic 3D,                      WGS 84
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 4, 4978,4,   geocentric,                      WGS 84
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 5, 5715,5,     vertical,                   MSL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 6, 5818,6,  engineering,      OGP P6 seismic bin grid
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 7, 5498,7,     compound,        NAD83 + NAVD88 height
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 8,     ,7,     compound,  WGS 84 / UTM zone 31N + MSL
         depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    , 9, 4269,2,geographic 2D,                       NAD83
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,10, 5703,5,     vertical,               NAVD88 height
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,11,26782,1,    projected,      NAD27 / Louisiana South
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,12, 4267,2,geographic 2D,                       NAD27
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,13,27572,1,    projected,NTF (Paris) / Lambert zone II
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,14, 4807,2,geographic 2D,                  NTF (Paris)
```

Where examples below further expound the CRSs listed above, the CRSREF number is written in green font.

HC,1,4,1: Compound CRS - Horizontal CRS Identification [Compound CRS Only]

The horizontal CRS of a Compound CRS may be a projected or geographic 2D CRS. An example of each type would appear in record [HC,1,4,1] as follows:

```
HC,1,4,1,Compound Horizontal CRS                   ,7,9,                 NAD83
HC,1,4,1,Compound Horizontal CRS                   ,8,1,WGS 84 / UTM zone 31N
```

HC,1,4,2: Compound CRS - Vertical CRS Identification [Compound CRS Only]

The vertical CRS details of a compound CRS would appear in record [HC,1,4,2] as follows:

```
HC,1,4,2,Compound Vertical CRS                     ,7,10,NAVD88 height
HC,1,4,2,Compound Vertical CRS                     ,8, 5,    MSL depth
```

HC,1,4,3: Base Geographic CRS Details [Projected CRS Only]

The record defining the base geographic CRS of the projected CRSs would appear in [HC,1,4,3] as follows:

```
HC,1,4,3,Base Geographic CRS                       , 1, 2,4326
HC,1,4,3,Base Geographic CRS                       ,11,12,4267
HC,1,4,3,Base Geographic CRS                       ,13,14,4807
```

HC,1,4,4: Geodetic Datum Details

The example shows how a geodetic datum would appear in record [HC,1,4,4]. It is required for geodetic (geocentric and geographic) and projected CRS types. It is not required for vertical, engineering or compound CRS types. (For compound CRSs the component horizontal and vertical CRSs are individually described and their details such as geodetic datum are given in those other descriptions).

```
HC,1,4,4,Geodetic Datum                        , 1,6326,World Geodetic System 1984
HC,1,4,4,Geodetic Datum                        , 2,6326,World Geodetic System 1984
HC,1,4,4,Geodetic Datum                        , 3,6326,World Geodetic System 1984
HC,1,4,4,Geodetic Datum                        , 4,6326,World Geodetic System 1984
HC,1,4,4,Geodetic Datum                        , 9,6269, North American Datum 1983
HC,1,4,4,Geodetic Datum                        ,11,6267, North American Datum 1927
```

HC,1,4,5: Prime Meridian Details

In the majority of cases the prime meridian will be Greenwich, in which case this record is considered implicit and is not essential to be recorded. 'Greenwich' is a general term taken to mean any prime meridian approximately passing through Greenwich, including the IERS Reference

Meridian (IRM). A prime meridian other than 'Greenwich' must be described and would appear in record [HC,1,4,5] as follows:

```
HC,1,4,5,Prime Meridian                                     ,14,8903,Paris,2.5969213,5,grads
```

HC,1,4,6: Ellipsoid Details

The record containing the ellipsoid dimensions for a geographic CRS such as WGS84 or ED50 would appear in [HC,1,4,6] as follows:

```
HC,1,4,6,Ellipsoid                                     ,1,7030,          WGS 84,6378137,1,metre,298.25722356
HC,1,4,6,Ellipsoid                                     ,2,7022,International 1924,6378388,1,metre,         297
```

Notes:

i) *In the EPSG Dataset ellipsoids may be defined using the semi-major axis (a) and semi-minor axis (b). If this is the case use the formula 1/f = a/(a-b) to calculate the value to be inserted into field 12.*

ii) *In the EPSG Dataset ellipsoids may be defined as a sphere. If this is the case a=b and 1/f is indeterminate. The artificial value 0 should be written into field 12. Reading applications must recognise that if the value of 1/f =0, the model of the earth is a sphere rather than an ellipsoid.*

HC,1,4,7: Vertical Datum Details [Vertical CRS Only]

The following example contains the vertical datum details as they would appear in record [HC,1,4,7]:

```
HC,1,4,7,Vertical Datum                                     , 5,5100,                  Mean Sea Level
HC,1,4,7,Vertical Datum                                     ,10,5103,North American Vertical Datum 1988
HC,1,4,7,Vertical Datum                                     ,15,    ,          Lowest Astronomical Tide
```

HC,1,4,8: Engineering Datum Details

The following example contains the details for a seismic bin grid (which is classified as an engineering datum) as they would appear in record [HC,1,4,8]:

```
HC,1,4,8,Engineering Datum                                  ,6,9315,Seismic bin grid datum
```

HC,1,5,0: Map Projection Details [Projected CRS Only]

The record containing the explicit description of the projected CRS's map projection would appear in [HC,1,5,0] as follows:

```
HC,1,5,0,Map Projection                                     ,1,16031,                         UTM zone 31N
HC,1,5,0,Map Projection                                     ,2,16061,Universal Polar Stereographic North
HC,1,5,0,Map Projection                                     ,3,19894,                           Borneo RSO
```

HC,1,5,1: Projection Method Details [Projected CRS Only]

The record containing the method details of the projected CRSs would appear in [HC,1,5,1] as follows:

```
HC,1,5,1,Projection Method                                  ,1,9807,               Transverse Mercator,5
HC,1,5,1,Projection Method                                  ,2,9810,    Polar Stereographic (Variant A),5
HC,1,5,1,Projection Method                                  ,3,9812,Hotine Oblique Mercator (Variant A),7
```

In the event that a coordinate operation method code (Field 7) is not available in the EPSG Dataset, (unlikely as the EPSG dataset supports nearly all methods currently in use in the oil and gas industry) the projection and projected CRS cannot be directly supported. Inclusion of the new method in the EPSG Dataset can be requested through the OGP Geodesy Subcommittee at http://www.epsg.org/Comms/Comment.asp or by general enquiry to the OGP Geomatics Committee at http://info.ogp.org.uk/geomatics.

HC,1,5,2: Projection Parameter Details [Projected CRS Only]

Header records [HC,1,5,2] contain the defining parameters as required by the projection operation method. For example, five parameters are required for the **Transverse Mercator** map projection method and those for the UTM zone 31N projection would be:

```
HC,1,5,2,Latitude of natural origin                          ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                         ,1,8802,     3,3,degree
HC,1,5,2,Scale factor at natural origin                      ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                       ,1,8806,500000,1, metre
HC,1,5,2,False northing                                      ,1,8807,     0,1, metre
```

The **Lambert Conic Conformal (1SP)** and **(2SP)** map projection methods require 5 and 6 parameters respectively and the [HC,1,5,2]records for France Lambert zone II and US Louisiana State Plane CS27 South Zone would be:

```
HC,1,5,2,Latitude of natural origin                          ,13,8801,        52,5, grad
HC,1,5,2,Longitude of natural origin                         ,13,8802,         0,5, grad
HC,1,5,2,Scale factor at natural origin                      ,13,8805,0.99987742,4,unity
HC,1,5,2,False easting                                       ,13,8806,    600000,1,metre
HC,1,5,2,False northing                                      ,13,8807,   2200000,1,metre

HC,1,5,2,Latitude of false origin                            ,11,8821,   28.4,6,sexagesimal DMS
HC,1,5,2,Longitude of false origin                           ,11,8822,  -91.2,6,sexagesimal DMS
HC,1,5,2,Latitude of 1st standard parallel                   ,11,8823,  29.18,6,sexagesimal DMS
HC,1,5,2,Latitude of 2nd standard parallel                   ,11,8824,  30.42,6,sexagesimal DMS
HC,1,5,2,Easting at false origin                             ,11,8826,2000000,7, US survey foot
HC,1,5,2,Northing at false origin                            ,11,8827,2000000,7, US survey foot
```

The **Polar Stereographic (Variant A)** operation method requires 5 parameters in record [HC,1,5,2] and those for Universal Polar Stereographic North projection would be:

```
HC,1,5,2,Latitude of natural origin                          ,1,8801,     90,3,degree
HC,1,5,2,Longitude of natural origin                         ,1,8802,      0,3,degree
HC,1,5,2,Scale factor at natural origin                      ,1,8805,  0.994,4, unity
HC,1,5,2,False easting                                       ,1,8806,2000000,1, metre
HC,1,5,2,False northing                                      ,1,8807,2000000,1, metre
```

The **Hotine Oblique Mercator (Variant A)** operation method requires 7 parameters and those for the Borneo RSO projection would be:

```
HC,1,5,2,Latitude of projection centre                       ,1,8811,            4,3,         degree
HC,1,5,2,Longitude of projection centre                      ,1,8812,          115,3,         degree
HC,1,5,2,Azimuth of initial line                             ,1,8813,53.185691582,7,sexagesimal DMS
HC,1,5,2,Angle from Rectified to Skew Grid                   ,1,8814, 53.07483685,7,sexagesimal DMS
HC,1,5,2,Scale factor on initial line                        ,1,8815,     0.99984,4,          unity
HC,1,5,2,False easting                                       ,1,8806,            0,1,          metre
HC,1,5,2,False northing                                      ,1,8807,            0,1,          metre
```

The next two header records describe the coordinate system type in the CRS [HC,1,6,0] and define the axes [HC,1,6,1]. Table 11 in the P1/11 Format Description contains a list of coordinate system types (CSTYPEREF) supported by the 'P' formats. The distinction between different coordinate system types is based on differences in their axial systems. Ellipsoidal, Cartesian and vertical are three types of coordinate system commonly used in the oil & gas industry.

HC,1,6,0: Coordinate System Details (not required for Compound CRS type)

The following descriptors are required in the P1/11 Common Header for certain commonly-encountered coordinate system types:

```
HC,1,6,0,Coordinate System                                   , 1,4400,             Cartesian 2D CS,2,  Cartesian,2
HC,1,6,0,Coordinate System                                   , 2,6422,           Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,0,Coordinate System                                   , 3,6423,           Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,0,Coordinate System                                   , 4,4400,             Cartesian 3D CS,2,  Cartesian,3
HC,1,6,0,Coordinate System                                   , 5,6498,                 Vertical CS,5,   vertical,1
HC,1,6,0,Coordinate System                                   ,10,6499,                 Vertical CS,5,   vertical,1
HC,1,6,0,Coordinate System                                   ,15,1026,Cartesian 2D CS for UPS north,2,  Cartesian,2
```

HC,1,6,1: Coordinate Axis Details

The coordinate axis defines the meaning of coordinate values in data records. The coordinate order is an integer from 1 onwards with which the "Coordinate n" value in the data records shall be consistent. "Coordinate n" in a data record references coordinate axis n.

Coordinate axis definitions would appear in the P1/11 Common Header as follows:

Ellipsoidal CS (for 2D & 3D geographic CRS):

```
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 1                           ,3,1,108, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,3,2,109,Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                           ,3,3,110,Ellipsoidal height,   up,   h,3,degree
```

Cartesian (for projected CRS):

```
HC,1,6,1,Coordinate System Axis 1                           ,1,1,1, Easting, east,E,1,metre
HC,1,6,1,Coordinate System Axis 2                           ,1,2,2,Northing,north,N,1,metre
```

Vertical CS (for offshore/ land vertical CRS):

```
HC,1,6,1,Coordinate System Axis 1                           , 5,1,113,                 Depth,down,D,1,metre
HC,1,6,1,Coordinate System Axis 1                           ,10,1,114,Gravity-related height,  up,H,1,metre
```

As vertical coordinate systems are one-dimensional the value in the Coordinate Order field will always be 1. In records in the data section of the file coordinates are ordered in accordance with Table 9 of the format specification; a vertical coordinate is always in the *third* field of the coordinate tuple.

2.6. Coordinate Transformations – Worked Examples

Sections [HC,1,7,0 and HC,1,8,n] contain the parameters required to transform coordinates between the coordinate reference systems defined in the Common Header. The direction of transformation is fixed by defining source CRS and target CRS for each transformation in [HC,1,8,1].

HC,1,7,0: Coordinate Transformation Implicit Identification

Common Header record [HC,1,7,0] presents an at-a-glance summary of all the coordinate transformations used in the file, as they are listed en bloc in the order in which they are defined in the header. Field 6 identifies the coordinate transformation internal file reference number (COTRANSREF) and if this designation follows a chronological sequence this block of records is representative of the derivation of the data. If an EPSG code is given for the coordinate transformation (field 7), the corresponding EPSG transformation name should be used in [HC,1,7,0] and [HC,1,8,0]. The third transformation listed below is not available in the EPSG Geodetic Parameter Dataset (at time of writing). It has however been named in field 8 in accordance with the EPSG naming convention by quoting the direction from local to reference CRS. For consistency it is strongly recommended that this practice is followed whenever naming a coordinate transformation that is not in the EPSG Dataset. The implicit identification of 3 coordinate transformations would appear in the P1/11 Common Header as follows:

```
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,1,15593,    geog3D to geog2D,7.4.1,2010:02:01,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,2, 1613, ED50 to WGS 84 (24),7.4.1,2010:02:01,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,3,     ,ED50 to WGS 84 (JGI),     ,          ,    ,
```

HC,1,8,0: Coordinate Transformation Name

Common Header record [HC,1,8,0] is the first record in the block containing each coordinate transformation explicit definition (grouped together here only for demonstration purposes):

```
HC,1,8,0,Transformation Number/EPSG Code/Name                   ,1, 1613,ED50 to WGS 84 (24),1
HC,1,8,0,Transformation Number/EPSG Code/Name                   ,2,15593,   geog3D to geog2D,0
HC,1,8,0,Transformation Number/EPSG Code/Name                   ,3, 1241, NAD27 to NAD83 (1),5
```

HC,1,8,1: Coordinate Transformation CRS Details

Definition of the source and target CRS for each coordinate transformation is provided in the P1/11 Common Header [HC,1,8,1] as follows (source in blue, target in red).

```
HC,1,8,1,Source CRS/Target CRS/Version                          ,1, 2,4326,WGS 84,17,4230,  ED50,EPSG-Nor S62 2001
HC,1,8,1,Source CRS/Target CRS/Version                          ,2, 3,4979,WGS 84, 2,4326,WGS 84,
HC,1,8,1,Source CRS/Target CRS/Version                          ,3,12,4267, NAD27, 9,4269, NAD83,1
```

This header record assigns the source and target CRSs as defined by the actual direction of implementation of the coordinate transformation. The first example above (COTRANSREF = 1) is available in the EPSG Dataset as coordinate operation code 1613, ED50 to WGS 84 (24), but in this instance is used to convert coordinates from WGS 84 (the source CRS) to ED50 (the target CRS).

HC,1,8,2: Coordinate Transformation Method Details

The transformation method is defined in the Common Header [HC,1,8,2] as follows:

```
HC,1,8,2,Transformation Method                                  ,1,9606,Position Vector (geog2D domain),1,7
HC,1,8,2,Transformation Method                                  ,2,9659,  Geographic3D to 2D conversion,1,0
HC,1,8,2,Transformation Method                                  ,3,9613,                         NADCON,1,2
```

In the event that a coordinate operation method code (Field 7) is not available in the EPSG Dataset, (unlikely as the EPSG dataset supports nearly all methods currently in use in the oil and gas industry) the coordinate transformation cannot be directly supported. Inclusion of the new method in the EPSG Dataset can be requested through the OGP Geodesy Subcommittee at http://www.epsg.org/Comms/Comment.asp or by general enquiry to the OGP Geomatics Committee at http://info.ogp.org.uk/geomatics.

HC,1,8,3 Transformation Parameter File Details

Where transformation is carried out by means of parameter files (such as NADCON), these are defined in the Common Header [HC,1,8,3] as follows:

```
HC,1,8,3,Latitude difference file                               ,3,8657,conus.las,1
HC,1,8,3,Longitude difference file                              ,3,8658,conus.los,1
```

HC,1,8,4: Transformation Parameter Details

A 7-parameter transformation would be defined in the Common Header as follows, repeating [HC,1,8,4] for each parameter:

```
HC,1,8,4,X-axis translation                                     ,1,8605, -90.365,1,          metre,1
HC,1,8,4,Y-axis translation                                     ,1,8606, -101.13,1,          metre,1
HC,1,8,4,Z-axis translation                                     ,1,8607,-123.384,1,          metre,1
HC,1,8,4,X-axis rotation                                        ,1,8608,   0.333,5,     arc-second,1
HC,1,8,4,Y-axis rotation                                        ,1,8609,   0.077,5,     arc-second,1
HC,1,8,4,Z-axis rotation                                        ,1,8610,   0.894,5,     arc-second,1
HC,1,8,4,Scale difference                                       ,1,8611,   1.994,6,parts per million,1
```

If an EPSG code is given for the transformation in [HC,1,7,0], the signs of the parameters shall be the same as quoted for this transformation in the EPSG Dataset. If an EPSG-compliant database is not referenced by the transformation, the signs of the parameters shall be correct for that operation method in the direction inferred by the name of the transformation cited in [HC,1,7,0].

HC,1,9,0: Example Point Conversions

The [HC,1,9,0] record is used to give test point coordinates for coordinate conversions and transformations. It should be used for:

- Each projected CRS. Map grid easting and northing coordinates and equivalent ellipsoidal coordinates (latitude and longitude) for the projected CRS's base geographic 2D CRS.
- Each coordinate transformation. Coordinates for the source and target CRSs.

For each coordinate conversion and transformation, it is recommended that at least 2 test points should be listed. Ideally it is desirable to use three test points, widely separated, away from the CRS origin, with one pair of points in a north-south alignment and another pair of points in an east-west alignment. Fields 8 onwards can be repeated as required, or the record repeated. For each point the coordinates should be listed in at least two CRSs.

2.7. Record Grouping in the CRS Section

For clarity it is recommended to group the CRS data (including coordinate transformations) in the Common Header as follows:

i) all CRS implicit identification records, followed by

ii) all CRS explicit definition records, followed by

iii) all coordinate transformation implicit identification records, followed by

iv) all coordinate transformation explicit definition records.

[HC,1,3,0] is the implicit identification statement of all the CRSs associated with the survey and should be repeated for as many CRSs as are involved from preplot through acquisition to re-processing. The integer number (field 6) assigned to each CRS is a matter for the end-user to decide. It may be decided that the contractual deliverable CRS is assigned CRSREF 1. There may also be merit in reflecting as far as possible the chronological sequence of the data process flow; for example, survey acquired on WGS84 (1), converted on-line to ED50 (2) and to ED50 / UTM zone 31N (3), depth data reduced to Mean Sea Level (4). However it is important to synchronise the P1 with the P2 file for the same survey, in which it will be necessary to document the raw position data CRS, the geographic 3D version of the WGS84 CRS say, which chronologically would be first. At a later date the position records may need to be exported in another CRS which should also be numbered to preserve the sequential order in the file.

This block should be sorted by CRS number (field 6 of the [HC,1,3,0] record). For example, the following header records would appear together in a block:

```
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,1, 4326,            WGS 84,7.6,2010:11:02,EPSG,Loaded from EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,2, 4230,              ED50,7.6,2010:11:02,EPSG,Loaded from EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,3,23031,ED50 / UTM zone 31N,7.6,2010:11:02,EPSG,Loaded from EPSG_v7_6.mdb
HC,1,3,0,CRS Number/EPSG Code/Name/Source…,4, 5100,     Mean Sea Level,7.6,2010:11:02,EPSG,Loaded from EPSG_v7_6.mdb
```

Once the CRS sequence has been given as above, explicit definitions of all CRSs shall be given in [HC,1,4,n through HC 1,6,n] records. For each CRS, all component records shall be kept as a block, ordered as in the format document (i.e. sorted alphabetically by header record code in fields 1 through 4). Then each CRS block shall be given sorted by CRS number (field 6 of the [HC,1,3,0] record). For example:

```
HC,1,4,0,CRS Number/EPSG Code/Type/Name                   ,1, 4326,2,geographic 2D,            WGS 84
HC,1,4,4,Geodetic Datum                                   ,1,6326,World Geodetic System 1984
HC,1,4,6,Ellipsoid                                        ,1,7030,            WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                ,1,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                         ,1,1,106,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                         ,1,2,107,   Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                   ,2, 4230,2,geographic 2D,              ED50
HC,1,4,4,Geodetic Datum                                   ,2,6230,       European Datum 1950
HC,1,4,6,Ellipsoid                                        ,2,7022,International 1924,6378388,1,metre,          297
HC,1,6,0,Coordinate System                                ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
```

```
HC,1,6,1,Coordinate System Axis 1             ,2,1,106,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2             ,2,2,107,   Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name       ,3,23031,1,    projected,ED50 / UTM zone 31N
HC,1,4,3,Base Geographic CRS                  ,3,2,4320
HC,1,4,4,Geodetic Datum                       ,3,6230,       European Datum 1950
HC,1,4,6,Ellipsoid                            ,3,7022,International 1924,6378388,1,metre,         297
HC,1,5,0,Map Projection                       ,3,16031,UTM zone 31N
HC,1,5,1,Projection Method                    ,3,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin           ,3,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin          ,3,8802,     3,3,degree
HC,1,5,2,Scale factor at natural origin       ,3,8805,0.9996,4, unity
HC,1,5,2,False easting                        ,3,8806,500000,1, metre
HC,1,5,2,False northing                       ,3,8807,     0,1, metre
HC,1,6,0,Coordinate System                    ,3,4400,  Cartesian 2D CS,2,  cartesian,2
HC,1,6,1,Coordinate System Axis 1             ,3,1,  1,             Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2             ,3,2,  2,            Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name       ,4, 5715,5,     vertical,          MSL depth
HC,1,4,7,Vertical Datum                       ,4,5100,Mean Sea Level
HC,1,6,0,Coordinate System                    ,4,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1             ,4,1,113,               Depth, down,   D,1, metre
```

The next block of data should be the implicit identification statement of all the coordinate transformations between CRSs associated with the survey [HC,1,7,0], and should be repeated for as many coordinate transformations that are involved from preplot through acquisition to re-processing. It is recommended that the integer Coordinate Transformation Number (field 6) assigned to each transformation should reflect the history of the data. For example, for a survey acquired on WGS 84 and transformed on-line to ED50 for UK North Sea (Transformation 1), then at a later date transformed to ED50 for Norway south of 62°N (Transformation 2), the following header records would appear together in a block:

```
HC,1,7,0,Transformation Number/EPSG Code/Name/Source      ,1,1311,ED50 to WGS 84 (18),7.4.1,2010:02:01,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source      ,2,1613,ED50 to WGS 84 (24),7.4.1,2010:02:01,EPSG,
```

The original header will contain the transformation parameters necessary to reverse the first transformation and provide coordinates in the correct source CRS to enable the second transformation to be applied.

Following this, explicit definitions of all coordinate transformations shall be given [HC,1,8,n]. For each transformation, all geodetic component records shall be kept as a block, ordered as in the format description document (i.e. sorted alphabetically by header record code in fields 1 through 4). Then each transformation block shall be given, sorted by Coordinate Transformation Number (field 6 of the [HC,1,7,0] record). For example:

```
HC,1,8,0,Transformation Number/EPSG Code/Name       ,1,1311,ED50 to WGS 84 (18),1
HC,1,8,1,Source CRS/Target CRS/Version              ,1,1,4326,WGS 84,2,4230,ED50,         UKOOA-CO
HC,1,8,2,Transformation Method                      ,1,9606,Position Vector (geog2D domain),1,7
HC,1,8,4,X-axis translation                         ,1,8605,   -89.5,1,          metre,1
HC,1,8,4,Y-axis translation                         ,1,8606,   -93.8,1,          metre,1
HC,1,8,4,Z-axis translation                         ,1,8607,  -123.1,1,          metre,1
HC,1,8,4,X-axis rotation                            ,1,8608,       0,5,     arc-second,1
HC,1,8,4,Y-axis rotation                            ,1,8609,       0,5,     arc-second,1
HC,1,8,4,Z-axis rotation                            ,1,8610,  -0.156,5,     arc-second,1
HC,1,8,4,Scale difference                           ,1,8611,     1.2,6,parts per million,1
HC,1,8,0,Transformation Number/EPSG Code/Name       ,2,1613,ED50 to WGS 84 (24),1
HC,1,8,1,Source CRS/Target CRS/Version              ,2,1,4326,WGS 84,2,4230,ED50,EPSG-Nor S62 2001
HC,1,8,2,Transformation Method                      ,2,9606,Position Vector (geog2D domain),1,7
HC,1,8,4,X-axis translation                         ,2,8605, -90.365,1,          metre,1
HC,1,8,4,Y-axis translation                         ,2,8606, -101.13,1,          metre,1
HC,1,8,4,Z-axis translation                         ,2,8607,-123.384,1,          metre,1
HC,1,8,4,X-axis rotation                            ,2,8608,   0.333,5,     arc-second,1
HC,1,8,4,Y-axis rotation                            ,2,8609,   0.077,5,     arc-second,1
HC,1,8,4,Z-axis rotation                            ,2,8610,   0.894,5,     arc-second,1
HC,1,8,4,Scale difference                           ,2,8611,   1.994,6,parts per million,1
```

The relationship of the current default CRS of the data records to the original CRS is thereby preserved.

It is important to note that although record [HC,1,8,1] gives the direction of the transformation as from WGS 84 to ED50 (survey operation source and target CRSs respectively), the transformation parameters in [HC,1,8,4] are always quoted for the direction defined by the EPSG transformation, in this case from ED50 to WGS 84.

3. Common Header: Survey Configuration

This section of the Common Header contains details of the production and receiving components of a geophysical data acquisition system. Both marine and land acquisition systems can be described in the format. The first record in this section [HC,2,0,0] is a summary which provides the number of production & receiving systems present and the number of objects being positioned.

3.1. Production System Information

A production system in the context of this format is any computer system used in the acquisition of geophysical data, and can be either an integrated navigation system or a seismic recording system. The first record in this section [HC,2,1,0] is used to identify the production systems and some key properties such as software version:

```
HC,2,1,0,Integrated Navigation and Positioning System      ,1,Navigation,STARNAV 4.1    ,Update 21,2012:06:01
HC,2,1,0,Seismic Recording System                          ,2,Recording ,Sercel SN408UL,1.0      ,2010:01:01
```

The following records [HC,2,1,1] and [HC,2,1,2] enable the inclusion of any attribute information about the production system, using either a format-defined (see Table 12 in the P1/11 Format Description) or user-defined attribute code (PSATTREF).

3.2. Receiver Information

[HC,2,2,0] and [HC,2,2,1] contain basic details of the type of receiver used in the survey and can be used to record attribute information in either format-defined (see Table 13 in the P1/11 Format Description) or user-defined codes (RXATTREF). The term 'inline' implies the direction parallel to the direction in which the data were acquired as defined by the receivers. In marine seismic data, the inline direction is that in which the recording vessel tows the streamers. 'Crossline' implies in the direction *perpendicular* to the inline direction.

4. Common Header: Positioning Objects

P1/11 introduces the concept of a positioning object. Refer to Section 6.4 of the P1/11 Format Description for more detail. An object in this sense is any object or node for which a position can be generated. The key positioning objects in seismic acquisition are the source and receiver. Positioning objects are defined in Common Header record [HC,2,3,0]. (Note that a positioning object which is a receiver is defined in the [HC,2,2,0] record). Each object is given a unique reference number [OBJREF] and a short name [OBJNAME] for ease of readability. A list of object types (OBJTYPEREF codes) is prescribed (see Table 14 in the P1/11 Format Description) but the user may add additional types if required (OBJTYPEREF = 21 onwards). Objects can be defined with a nominal position relative to another object using across, along, above offsets in the right-handed Cartesian coordinate frame of the parent object, which allows the survey configuration to be described. Table 15 in the P1/11 Format Description contains a list of prescribed object attributes for use in [HC,2,3,1], but the user is also able to add additional user-defined attributes (OBJATTREF = 100 onwards).

The examples below demonstrate how to construct a positioning object [HC,2,3,0] header record. The first object has a pre-defined OBJTYPEREF code (1) and OBJTYPE (Vessel) (from Table 14). The second example has a user-defined OBJTYPEREF code (21) and OBJTYPE (SV Sensor).

```
HC,2,3,0,MV SeisFinder                                      , 1,  V1, 1,   Vessel,   ,1&2, ,  ,   ,  ,      NRP,8,3,6
HC,2,3,0,Continuous Sound Velocity Profiler                 ,15,SVP1,21,SV Sensor,MVP,   ,1,10,-30,-4,Aft crane, , ,
```

5. Comment Records

Additional information not captured by standard records in the Common Header and data record sections of the document can be added using the prefix 'CC'. They should be included as close as possible to the data items to which they refer. The use of reserved characters (, ; : &) is not allowed in a comment record. See Section 7 of the P1/11 Format Description for a definition of the required comment record format.

6. P1 Format-specific Header

The Common Header is followed by a P1-specific header (see Section 9 of the P1/11 Format Description), denoted by the prefix 'H1'. This contains basic information about the position records, such as contents and processing descriptions (entered as free text), and attribute information stored with the position records. (See Table 16 in the P1/11 Format Description). It also contains key metadata about the position records themselves and their geodetic identity.

6.1. P1 Header: Position Record Definitions

The P1/11 format defines the following five position record types:

- S1 for a fired energy source position
- R1 for a single receiver position
- P1 for any other positioning object
- N1 for preplot positions
- M1 for survey perimeter positions

Each of these position records is linked to a position record type defined in the file header in which the coordinate and time reference systems written into all position records in the file, and the number and description of record extension fields for the record, are identified.

For S1 this is defined .... at [H1,1,0,0]

For R1 .... at [H1,2,0,0]

For P1 .... at [H1,1,0,0]

For N1 .... at [H1,4,0,0]

For M1 .... at [H1,5,0,0]

The format supports recording up to 3 coordinate tuples per position record, each of which requires defining in the P1-specific part of the file header. As well as position type-specific information, there may in fact be multiple and differing position types added, which may be unrelated to seismic acquisition, however they must be in one of the explicitly defined CRS definitions.

6.1.1. Position Record Definitions: Record Extension Fields

The format allows for extensions to the content of data records. This is done through a standard Record Extension Field for data records which is defined in Section 2.7 of the P1/11 Format Description. Each of the above H1 header records defines (a) the number of record extension fields which are written into each position record, and (b) the content of the extension. Use of the record extension capability is described further in sections 8 and 9 of this User Guide.

6.1.2. Position Record Definitions: Quality Definition

The P1/11 format supports the writing of quality measures against each position record. File header record [H1,1,0,1] contains the definition of each quality measure recorded with position data (S1 & P1) and [H1,2,0,1] for receiver (R1) data. As standard, each position record allows for the recording of a 2-dimensional error ellipse or 3-dimensional ellipsoid, and supports the recording of any supplementary quality attributes which are relevant to the position. These would be defined by the writer or end-user of the P1/11 file, using standard record extension fields. Some examples of these would be Unit Variance (as an indication that the error ellipses are appropriately scaled), degrees of freedom, number of observations, etc. They should be selected sensibly and assigned to a relevant record type. By way of example, the header for a position record quality definition where unit variance is recorded in a record extension field would appear as follows (user-defined record extension identifiers for quality measures number from 100):

```
H1,1,0,1,Position Record Quality Definition:            ,1,95,Absolute
             Error Ellipses,1,3,1,100;;Unit Variance;4
```

Once defined in the appropriate header record, their values are stored as a field list in the Additional Quality Measures (field 25) of the P1/S1/R1 position record.

6.2. P1 Header: X1 Relation Record Definition

In situations where there is some independence of the source and receiver positions within a shot and it is necessary to link them together in processing, the relational record (X1) together with index numbers in the data records (field 7 of S1 and R1 position records) provide the means of position indexing and hence the appropriate grouping of source and receivers belonging to the same source event. P1 header [H1,3,0,0] sets up definitions for storage of required record extension fields in the relational records.

6.3. P1 Header: N1 Preplot Position Record Definitions

The P1/11 format supports the exchange of preplot information, enabling preplots to be imported directly into the integrated navigation system. Header record [H1,4,0,0] contains the defining metadata for a preplot (N1) record, including the definition of 2 CRSs for storage of the position data in a projected or compound CRS (CRS#1) and the base geographic CRS of CRS#1. The format supports preplots where point data are required (such as for a 4D survey) or where various line types (straight line segments, arc and spiral segments) are sufficient. Options for additional preplot requirements can be defined by using record extension fields in the header.

The preplot coordinates can be linked to a physical position (the object's OBJREF reference) or a logical position, being a non-specific reference such as the midpoint between two source arrays.

6.4. P1 Header: M1 Survey Perimeter Position Definition

There is scope in the P1/11 format to describe the areal limits of a survey, or any other polygon. This can be either an intended limit of some kind as part of the preplot definition, or an actual surveyed area to be combined with the 'postplot' data. Header record [H1,5,0,0] contains the defining metadata for a survey perimeter record (M1). Certain perimeter types are prescribed by the format such as full-fold coverage, others such as a polygon representing the oil-water contact can be user-defined (code 7 onwards). As for the preplot definition, 2 CRSs should be defined in the survey perimeter header record. Note that the P6/11 format contains the same capability for storing survey perimeter details as the P1/11 format, as M6 position records.

7. P1 Data Records

7.1. A Note on Data Resolution

Any data generated by processing input data – be it processed data or processed positions – should be written to a resolution commensurate with its accuracy. The P1/11 format does not prescribe the precision with which position records can be written. The decision therefore rests with the users of the format. The precision to which coordinates are recorded depends on a number of factors and a number of rules. Valid precision should not be lost by recording to insufficient decimal places. Similarly valid precision should not be allowed to be compromised by cross-conversion between the geographical and projected CRS. Eight decimal places are recommended for the lat/long positions in decimal degrees and two decimal places for the grid position in metres, which should retain such position 'creep' to the centimetre level. Given that the P1 position records are often the output of a network adjustment, for which the input raw measurements have been prepared in some way, sufficient precision should be retained in these preparation and computation stages such that the resulting position records retain a precision which is commensurate with the quality of the raw observables. The general rule of not to round until the last stage in the computation process should be observed.

For data recorded in the field from new projects, the resolution should be agreed by the end-user and the acquisition entity before the start of the project. The end-user checklist in Appendix F in this document can be used for this purpose. For data converted from legacy formats the resolution should be selected such that it is no less than the resolution of the original data.

For common position units of measure, the recommended resolutions (decimal places of the unit) commensurate with various data accuracies are given in the table below:

	Accuracy			
Unit of Measure, Distance	**1m**	**0.1m**	**0.01m (1cm)**	**0.001m (1mm)**
decimal degrees (Lat, Long)	6	7	8	9
sexagesimal degrees (degrees, minutes and seconds – resolution applies to seconds)	2	3	4	5
metres [all versions]	0	1	2	3
feet [all versions]	0	1	2	3
yards [all versions]	0	1	2	3
fathoms	1	2	3	4
kilometres	3	4	5	6
miles [all versions]	4	5	6	7
Unit of Measure, Angles	**1 Degree**	**0.1 Degrees**	**0.01 Degrees**	**0.001 Degrees**
degrees	0	1	2	3
radians	7	8	9	10
grads	6	7	8	9

Table 2: Recommended resolutions for various accuracies

7.2. P1 Data Records: P1/S1 Position Record

See Section 10 of the P1/11 Format Description. P1/S1 position records consist of prescribed data fields which should all be populated if the data is available, including record identifier (P1 or S1), line name, point number, event time, position object details, position coordinates referred to 3 CRSs, and position quality. The format allows for additional user-defined parameters to be written into the record using record extension fields.

7.2.1. Positioning Object Details

The object positioned can be real or virtual. In the example below the first 3 data records are position records for a physical object, and the following records are for virtual positions between 2 positioning objects. Fields 9 (OBJREF) and 10 (Object Short Name) are underlined. Text has been allowed to wrap round/inset for readability:

```
S1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3,G2,1,,391297.20,4092985.70,,36.97671040,-
        16.22131009,,36.97671040,-16.22131009,, 2.2,1.2,154.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,2,G1,1,,391341.10,4092961.70,,36.97649917,-
        16.22081351,,36.97649917,-16.22081351,, 2.8,1.1,164.4,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3,G2,1,,391297.20,4092985.70,,36.97671040,-
        16.22131009,,36.97671040,-16.22131009,, 2.1,1.4,174.7,0.9,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&4,G2&S1,1,,391436.30,4092730.50,,36.97442649,-
        16.21971087,,36.97442649,-16.21971087,, 2.2,1.2,184.1,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&5,G2&S2,1,,391392.60,4092755.00,,36.97464225,-
        16.22020526,,36.97464225,-16.22020526,, 2.4,1.2,194.8,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&6,G2&S3,1,,391349.00,4092779.40,,36.97485712,-
        16.22069852,,36.97485712,-16.22069852,, 2.5,1.3,204.4,1.4,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&7,G2&S4,1,,391305.30,4092803.90,,36.97507287,-
        16.22119292,,36.97507287,-16.22119292,, 2.1,1.1,214.5,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&8,G2&S5,1,,391261.60,4092828.30,,36.97528773,-
        16.22168731,,36.97528773,-16.22168731,, 2.3,1.0,224.5,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&9,G2&S6,1,,391218.00,4092852.70,,36.97550259,-
        16.22218057,,36.97550259,-16.22218057,, 2.2,1.2,234.8,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&10,G2&S7,1,,391174.40,4092877.20,,36.97571835,-
        16.22267386,,36.97571835,-16.22267386,, 2.2,1.2,154.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&11,G2&S8,1,,391130.70,4092901.70,,36.97593410,-
        16.22316827,,36.97593410,-16.22316827,, 2.8,1.1,164.4,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&12,G2&S9,1,,391087.00,4092926.10,,36.97614894,-
        16.22366266,,36.97614894,-16.22366266,, 2.1,1.4,174.7,0.9,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&13,G2&S10,1,,391043.40,4092950.60,,36.97636469,-
        16.22415595,,36.97636469,-16.22415595,, 2.2,1.2,184.1,1.1,,
```

7.2.2. Position Coordinates

Each position record provides fields for the positioning object referenced to 3 CRSs. The meaning of coordinate values in position records is defined through CRS coordinate axis records in the Common Header [HC,1,6,1]. It is a requirement of the format for position records of positioning objects that the first CRS (fields 13-15) is the projected CRS (or compound CRS encompassing the projected CRS), and the second CRS (fields 16-18) is the base geographic CRS of the first, expressed in decimal degrees (recommended to 8 decimal places). It is recommended that the third position reference is the original or hub CRS of the acquisition phase. This provides a compatibility check between the coordinate transformation details defined in the Common Header and the coordinates in the second and third CRS positions.

7.2.3. Position Quality

This section refers equally to R1 receiver records (see section 7.3). For offshore or land acquisition it is required that as a minimum the following quality measures are written to the data records, namely:

- The 2D error ellipse or 3D error ellipsoid as a precision measure for offshore data
- The radial and height error estimates for land data

Additional quality values can be added using user-defined record extension fields.

Note on Land Data Quality Measures

On land, unlike marine, there is no network being continually adjusted. Instead every source and receiver point is usually individually measured. This means that the error ellipse parameters are not normally a deliverable. The latitude, longitude and vertical error estimates obtained directly from the GNSS receiver plus estimates of the errors in measuring the antenna phase centre / measurement point vector are used. Error ellipses may be recorded for analysis purposes but typically the required deliverable is a 95% probability radial error estimate generated from the latitude & longitude standard deviations, and a similar vector error estimate for ellipsoidal height. This corresponds directly with the geophysically-driven positioning tolerance. Consequently, for land data records, the error ellipse semi-major axis is substituted by the radial error estimate and the error ellipse vertical axis (optional for marine records) is substituted by the height error estimate (mandatory for land records). Other fields in the position records remain blank.

Consideration of inconsistencies in the error estimates generated by GNSS receivers from different manufacturers is ongoing. For this reason, at this stage the theoretically correct detail of arriving at the 95% radial estimates is currently beyond the scope of this format, but may be introduced in the future.

Note on Marine Data Quality Measures

The error ellipse is considered to be the minimum requirement for all nodes in a network, and therefore for new acquisition is mandatory. Assuming systematic biases have been removed the error ellipse indicates the size of random errors in the position and also the direction in which the errors are occurring. Error ellipses or ellipsoids are used in order to depict uncorrelated standard deviations in two or three dimensions. Therefore for new acquisition it is mandatory to include a positional error estimate for each node that has a position record, such as vessel CRP, sources, receivers, tail buoys etc, as defined below:

2D *a posteriori* error ellipse

- Semi-Major axis
- Semi-Minor axis
- Theta (orientation of ellipse major axis in relevant CRS)

Where appropriate and for a position record for a node where a vertical dimension is recorded the following is recommended:

3D *a posteriori* error ellipsoid

- Horizontal semi-major axis
- Horizontal semi-minor axis
- Vertical semi-major axis
- Theta (orientation of ellipsoid horizontal major axis in relevant CRS)

The recommended confidence level for the error ellipse/ellipsoid is 95%.

General Comment on Quality Measures

For the general 2-dimensional case an error ellipse is an approximate graphical representation of the standard deviation in two directions. The semi-major axis of this ellipse lies in the direction of lowest precision (highest standard deviation) and conversely the semi-minor axis shows the direction in which the fix is strongest. These directions do not necessarily coincide with the directions of the coordinate axes (eg north-south and east-west). Ideally, the ratio between semi-major and semi-minor axes should not exceed two. Note that the probability figure associated with a one sigma ellipse is 39.4%, which is significantly smaller than the 68.26% associated with a 'one dimensional' standard deviation. The reason for this is that error ellipses are making statements about the precision of the position in two dimensions.

Error ellipse axes are commonly drawn at a scale 2.448 times their one sigma values and are referred to as being 95% *confidence regions*. When the error ellipse is drawn at a confidence level of 95% (the recommended value) then there is 95% chance that the estimated position lies within the ellipse which is centred at the true position.

It should be emphasised that standard deviations and error ellipses are not measures of the actual errors, they simply describe the populations from which the errors come. They therefore should only change suddenly when that population changes, for example, if a new satellite is tracked. Otherwise they should change only very slowly – reflecting the gradual change in the geometry of the satellite constellation with respect to the receiver's antenna, or the source/receiver network in response to dynamic motion of the spread. This is not to say that certain test statistics cannot vary in a random manner.

The following settings are recommended for the statistical testing of the least squares estimation and the scaling and aspect ratio of the resulting error ellipse. The actual values used will be stored in the header record [H1,0,2,0], 'File Contents Attributes':

Parameter	Recommended value
Level of significance (α_0)	1%
Detection power ($\gamma_0 = 1 - \beta_0$)	80%
Critical value w-test	2.576
Scale factor 95% error ellipse (2D)	2.448
Scale factor 95% error ellipsoid (3D)	2.796

P1/11 broadens the scope of integrity checking and quality measures in comparison with earlier P-formats by allowing for the recording of a horizontal error ellipse along with optional additional definitions permitting the recording of any supplemental quality attributes relevant to the position in each record. It is recognised that quality measures for a single point have limitations depending on the sensors and methodology adopted and time of their use. It is also recognised that in marine towed streamer acquisition the positioning network solution inevitably forms a representation of the towed spread around the time of the source firing rather than at any simultaneous occurrence.

Whilst it is appreciated that it may never be possible to make like-with-like comparisons between all surveys as this would require standardisation and potentially stifle innovation, the differential between events will nonetheless remain useful. It is intended that these error ellipses be as close to absolute values as is feasible and that key factors that dominate the dimensioning of the ellipses such as the *a priori* SDs of the contributing observations are properly assessed and applied. There is scope in the P2/11 format to record these and the number of absolute positioning systems used at the hub of the network. Interpolated positions (particularly useful for OBC receivers), extrapolated positions and general node redundancy levels can also be flagged/recorded in the

P1/11 quality measure record extension field. Propagation of quality measures from the nearest network node is taken as read as is the fact that few if any other than error ellipse dimensions will reflect their remoteness from nodes.

Since the methodology used may be both retrospective (i.e. a reprocessing technique) and piecemeal involving only part of a file, it is anticipated that error ellipses may not be in total sympathy in terms of technique throughout that file. Comment records ('CC') should be used in the header to clearly state shot point ranges and the relevant processing contractor/software details and be amended as appropriate as and when any changes are made. In the case of any block shift or any methodology potentially throwing uncertainty on archived quality figures then an appropriate comment flag should be inserted in the header and such reservations preferably be echoed in the additional quality measure definition. The user-defined additional quality parameters numbering from 100 are available for this.

It is accepted that it is impractical to account for all eventualities regarding the determination of quality measures, particularly in these scenarios, but this should in no way be allowed to detract from the overall value of their inclusion.

See first example in Appendix C for an example of the utilisation of position record quality measures and additional quality field extensions for a marine towed streamer P1/11.

7.3. P1 Data Records: R1 Receiver Position Record

See Section 10.2 of the P1/11 Format Description. The first receiver in a position record contains the same fields as P1/S1 position records, and these should be populated to the extent the data is available. For subsequent receivers in the same record (before the carriage return/line feed) only the first coordinate tuple is required and its associated quality attributes. The P1/11 Format Description contains full details of which fields are repeated for subsequent receivers.

7.4. P1 Data Records: X1 Relational Record

See Section 10.3 of the P1/11 Format Description. Relation records define which receiver groups were being recorded into which recording channels at a specific shot. For each source event there is at least one relation record. Each of these records specifies a section of consecutively numbered channels and receiver groups. After a numbering gap or a change in line name for the receiver groups a new relation record has to be given (see example in section 10.3 of the P1/11 Format Description).

7.5. P1 Data Records: N1 Preplot Position Record

See Section 10.4 of the P1/11 Format Description. Each block of position records is preceded by a record [N1,0] containing the line details (name, first & last point number etc). Preplot position records are prefixed by the identifier [N1,n], where 'n' is an identifier referring to the preplot line type. Preplot line types have the following identifiers, recorded in field 2 of the position record:

1) Point record:
2) Straight line segment record:
3) Arc segment record
4) Spiral segment record

Examples of use of each type are given in the P1/11 Format Description in section 11.3.

7.6. P1 Data Records: M1 Survey Perimeter Position Record

See Section 10.5 of the P1/11 Format Description. This record can be used for defining the perimeter of the survey area and any other relevant polygon. Each data record contains a point number, an identifier defining the type of line joining it to the next point, and coordinate tuples in CRS 1 & 2. The second coordinate tuple is a requirement for the first point and optional for the second and subsequent points in the perimeter. The meaning of coordinate values in data records is defined through CRS coordinate axis records in the Common Header [HC,1,6,1]. For coordinate n, the order and units shall be as given in the axis record order n. Multiple areas can also be defined as part of the same perimeter, for example if the survey area is divided into discrete blocks, using the point group number in field 4. Note that the P6/11 format contains the same capability for storing survey perimeter details as the P1/11 format, as M6 position records.

8. Data Record Extension

A standard Record Extension Field for data records is described in Section 2.7 of the P1/11 Format Description. The ability to add additional information relating to a data record is one of the key enhancements in the P1/11 format. While the original design and support for seismic acquisition is still fundamental, adding additional elements as data moves through processing and ultimately to archive is now supported without a format re-versioning or modification. Maximum flexibility is built into the format by the use of data record extensions, in which any requirement for data storage not explicitly written into the format can be handled without the need for future redefinition. This future-proofs the format to the maximum extent possible.

The number of extension attributes that are added to P1/S1, R1, X1, N1 and M1 data records are defined in header records [H1,1,0,0], [H1,2,0,0], [H1,3,0,0], [H1,4,0,0] and [H1,5,0,0] respectively. These header records also carry the definition of each extension. As described in Section 2.7 of the P1/11 Format Description, a standard record extension definition consists of a block of four sub-fields separated by semi-colons:

- A unique identifier for the extension;
- A conditional additional parameter required by some extension data, usually the coordinate reference system internal code (CRSREF);
- The name of the data value;
- The data value unit code (UNITREF)

Then in the data record the values of each extension attribute are given in the last field of the record in a block separated by semi-colons.

To allow flexibility in extension records, for example adding one attribute for source location and zero or more different attributes for a different positioning object, the OBJREF code in [HC,2,3,0] and the [H1,1,0,0] header record field 6, which requires a unique record type identifier, P1TYPEREF, to be defined, together provide a unique identification of a positioning object in the data records. In a similar manner, receiver records can be differentiated in the position records by their OBJREF[RX] code in [HC,2,2,0] and P1RXTYPEREF identifier in [H1,2,0,0]. This may be important in a transition zone survey where receivers of different types are deployed with different record extension fields and quality measures applicable to each. Similar record type identifiers are required for the [H1,4,0,0] (PREPLOTTYPEREF) and [H1,5,0,0] (PERIMREF) header records.

Identifiers and descriptions for some frequently required extension data types are defined in Table 17 in the P1/11 Format Description. These go into the header record extension block in sub-fields 1 (identifier) and 3 (description) respectively.

The conditionality of whether and if so by what the second sub-field is required to be populated is defined in column 3 in Table 17 in the P1/11 Format Description. When a parameter requires a CRSREF reference, the value in the data record is to be the units described in the CRS definition. The fourth sub-field of the extension header description which contains the UNITREF identifier must infer the same units as the CRSREF.

For example, to add water depth at the shotpoint location as an attribute for a marine seismic survey, the airgun array is the positioning object and its 3-dimensional location would be stored in the standard position record (with its depth in the vertical CRS as the vertical coordinate of a compound CRS), and the water depth at the array's position stored in a record extension field (reduced to the vertical datum surface defined in the extension definition block). Water depth is one of the pre-defined extension types (extension identifier 1). The following records demonstrate this arrangement:

```
HC,1,3,0,CRS Number/EPSG Code/Name/Source…      ,1,23031,            ED50 / UTM zone 31N,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source…      ,2, 4230,                               ED50,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source…      ,3, 5715,                          MSL depth,8.0,2012:08:10,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source…      ,4,     ,ED50 / UTM zone 31N + MSL depth,,,,
```

```
HC,1,3,0,CRS Number/EPSG Code/Name/Source…      ,5, 4326,                         WGS 84,7.6,2010:11:02,EPSG,
.
.
HC,2,3,0,Source Array G1…                       ,1,G1,4,Air Gun,,,,,,,,,,[Note OBJREF in green/underlined]
.
.
CC,1,0,0 Record extension field definition for Water Depth with Position Record Type = 1:
H1,1,0,0,Position Record Type Definition…       ,1,4,2,5,1,1,1;3;Water Depth;1[Note P1TYPEREF in red/underlined]
.
.
S1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,1,G1,1,,356383.46,6542889.15,6.5,59.00000000,0.500000
        00,,58.99940028,0.49833833,,,,,,,150.4
```

Many of the pre-defined extension data types are depth-related. A discussion on handling the vertical dimension is given in section 9 below.

To describe two user-defined attributes, for example water temperature and salinity measurements, as position record extensions would require the following header records.

1) Definition of the units of measure:

```
HC,1,1,0,Unit of Measure… ,17,   degrees Celsius,thermodynamic temperature,
       2,16,273.15,    1,1,0,     Temperature scale,,POSC UOM Dictionary,2.2,degC
HC,1,1,0,Unit of Measure… ,19,parts per thousand,    volumic concentration,
       2,18,     0,0.001,1,0,Dimensionless fraction,,POSC UOM Dictionary,2.2, ppk
.
.
```

2) Definition of the positioning object (if the temperature/salinity measurements are to be assigned to the position of the sensor probe). 10 is its OBJREF (a counter) and 21 is its user-defined OBJTYPEREF:

```
HC,2,3,0,Temperature Salinity Probe,10,TSDip,21,Sensor Probe,Valeport,,1,10,-20,-4,Aft Crane,,,
```

3) Record extension field definition in the position record type header:

```
H1,1,0,0,Position Record Type Definition…  ,1,1,2,3,1,1,2,100;;water temperature;17,101;;salinity;19
```

In the data records…

```
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,2, G1,1,,391341.12,4092961.71,…   ,15.5;35
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3, G2,1,,391297.20,4092985.78,…   ,15.5;35
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,25,T1,1,,388911.73,4087063.99,…   ,15.5;35
```

9. Handling the Vertical Dimension

In seismic acquisition there is usually a requirement to document the location of the seismic object – source, receiver, etc. – together with additional positional attributes such as water depth at the source location, depth of seismic charge below land surface, etc.

The vertical position of an object can be expressed as:

1) a coordinate;
2) a measurement or offset relative to a reference surface;
3) a measurement or offset relative to an irregular or variable surface such as the land topographical surface or instantaneous sea level in a tidal environment.

Attributes at the object location such as water depth or charge depth must be given as measurements in extension fields, not as object coordinates. For example in a bathymetric survey the echo sounder may be the positioning object but the depth measured at the echo-sounder position after reduction to a vertical CRS is stored as a measurement (Water Depth), not as the vertical coordinate of the echo-sounder. The record extension field definition would be written as for example [1;3;Water Depth;1], where the second sub-field (3 in this case) is the CRSREF code for the reference vertical CRS. The '1' in the fourth sub-field is the UNITREF for the units of measure, which must be the same as the axis units defined for CRSREF 1.

The following vertical measurement attributes are pre-defined in Table 17:

Extension attribute description	Comment
Water Depth (record extension identifier = 1)	This is not the raw measurement (see P2/11 format) but the measurement after correction and reduction to a vertical reference surface. The reference surface CRSREF is required in the second sub-field of the extension definition, and this must have been defined in the [HC,1,3,0] through [HC,1,6,n] header records.
Point Depth (record extension identifier = 3)	This is a measured depth below a vertical reference surface. The reference surface CRSREF is required in the second sub-field of the extension definition, and must have been defined in the [HC,1,3,0] through [HC,1,6,n] header records.
Note on use of Water Depth and Point Depth: *Instantaneous water level in a tidal marine environment is a special case of a variable surface unsuitable in the true CRS sense as a reference surface. It has been defined as a CRS in the EPSG Dataset (EPSG::5831 Instantaneous Water Level depth) specifically to support the P formats. It therefore may be used as a CRSREF to support Water Depth and Point Depth extension records.*	
Vertical CRS Difference (record extension identifier =2)	The Vertical CRS Difference extension is suitable for tidal corrections and other time-variant values. It requires the source (from) and target (to) CRSREFs to be given in the second sub-field of the extension definition, in that order, separated by an ampersand (&). One of these may be the Instantaneous Water Level depth CRS. Although the Vertical CRS Difference mechanism could be used to record the difference between any vertical CRSs, it should only be used when the difference cannot be described using a coordinate transformation, for example one using the EPSG Vertical Offset method

Seismic Datum Offset (record extension identifier =5)	Seismic Datum Offset should be defined as an offset from another surface, for example MSL. It is an offset between two fixed surfaces, and therefore is a constant for a survey, expressed in the units of the referenced vertical CRS. The parameter in the second sub-field of the extension definition is the CRSREF of the referenced Vertical CRS. The sign of the offset is determined by the vertical axis orientation definition of the referenced Vertical CRS in [HC,1,6,1]. So if MSL height is the referenced vertical CRS, a seismic datum offset of -ve 100m places the seismic datum surface below MSL.
Charge Depth (record extension identifier = 9)	For measured heights above or depths below a variable or irregular surface such as land topographic surface or seabed, which in a CRS sense cannot be used as a reference surface, a CRSREF reference cannot be given. The Water Depth and Point Depth extension types then cannot be used. To add the charge depth to a source record the pre-defined Charge Depth extension definition should be provided in [H1,1,0,0]; for this the second sub-field of the extension definition should be unpopulated, but the record commented appropriately*.

Table 3: Vertical measurements in record extension fields

*A header record that defines a position record type (P1TYPEREF) for a dynamite charge would be suitably commented as follows:

```
CC,1,0,0,Position record type for dynamite charge with record extension field for charge depth
       below topographic surface:
H1,1,0,0,Position Record Type Definition,…   1,1,2,3,1,1,1,9;;Charge Depth,1
```

Any correction used to convert between vertical datum surfaces can be logged in a record extension field. As shown in Table 3, the P1/11 format reserves an extension identifier ('2') for 'Vertical CRS Difference'. For example, the surface elevation required to be recorded for OBC work is the difference between Sea Level (EPSG::5113) and MSL (EPSG::5100) vertical datums, where the difference is **from** Sea Level **to** Mean Sea Level, positive when Sea Level is above MSL (both CRSs having positive down vertical axes). The vertical datums must be listed in the From>To order in the second sub-field of the record extension block.

The following [H1,1,0,0] header record describes the construction required to add 3 additional vertical measurements to a position record, namely water depth, tidal elevation and point depth:

```
H1,1,0,0,Position Record Type Definition…       ,1,1,2,3,1,1,3,1;5;Water
       Depth;1,2;5&4;Vertical CRS Difference;1,3;5;Point Depth;1
```

The first field extension block [1; 5;Water Depth;1] is instantaneous water depth, where CRSREF 5 is Instantaneous Water Level depth.

The second field extension block [2;5&4;Vertical CRS Difference;1] is the offset from sea level (CRSREF 5) to MSL (CRSREF 4), i.e. the tidal height.

The third field extension block [3;5;Point Depth;1] is the depth of the position object below instantaneous sea level.

The Vertical CRS Difference field extension could also be used in non-tidal waters, for example in the Caspian Sea where there is a seasonal variation in the sea level with respect to the Caspian Sea Datum surface.

Offshore vertical relationships are demonstrated in the following diagram:

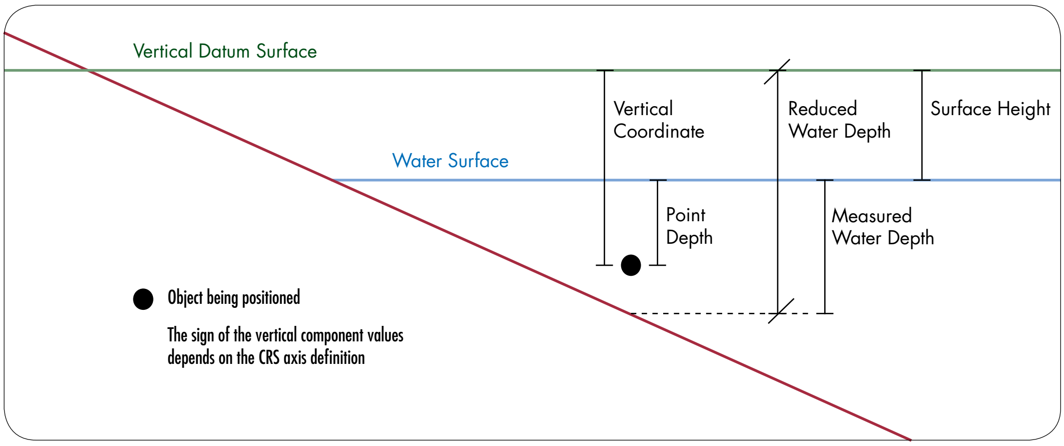

Figure 5: Marine Vertical Datum Relationships

Onshore/nearshore relationships are demonstrated in the following diagram:

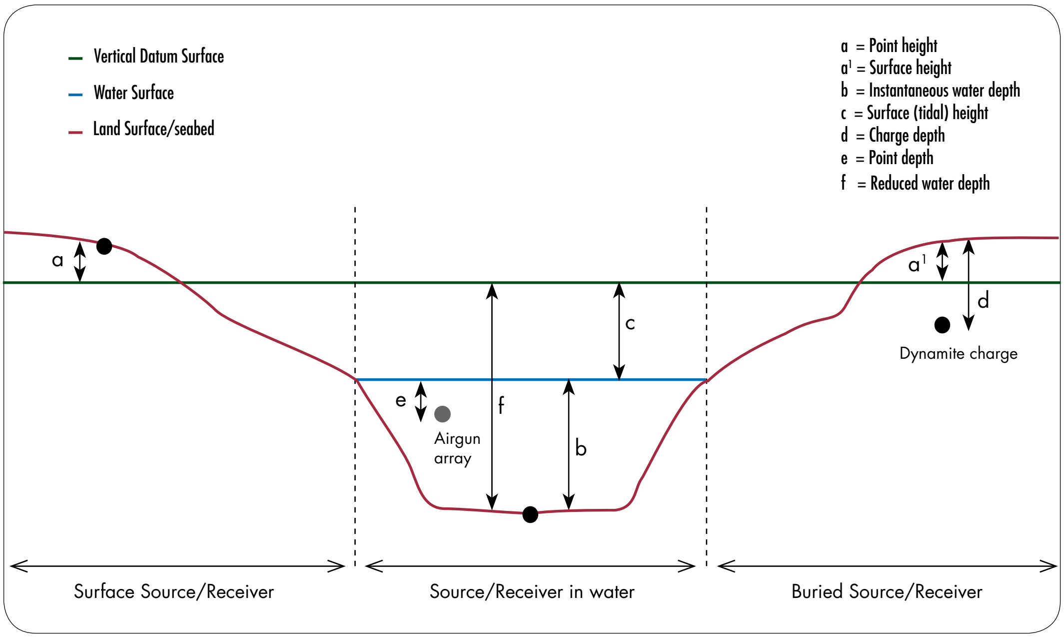

Figure 6: Land/TZ Vertical Datum Relationships

Figure 6 depicts a transition zone survey where the acquisition technique goes from vibroseis on the left (surface source) to OBC, to buried source (dynamite) along the same seismic line. On land it is required to record surface height ('a') at the vibroseis point, depth below topographic surface of the dynamite charge ('d') and surface height at the charge position ('a1'). In the nearshore section it is required to record water depth at the receiver ('b') and water surface (tidal) elevation ('c'), both at time of recording, and the airgun array depth ('e' - Point depth) also at time of recording. The vertical offsets required for the nearshore section would be handled using the record extension field definition just described (above Figure 5), selecting the appropriate vertical CRSREF for the reference surface in sub-field 2. For the onshore sections a compound CRS can be defined in the Common Header to provide for the land surface height ('a' and 'a1'), and a standard record extension field definition will be required for the charge depth ('d'). In the Common Header, the [HC,2,3,0] record defines the positioning objects, assigning **OBJREF** numbers (field 6) to each source type (underlined):

```
HC,2,3,0,Land Source 1 Surface Position                  ,1,Vib,6,Vibroseis VP,,,,,,,,,1,
HC,2,3,0,Land Source 2 Surface Position                  ,2,SP ,7,Dynamite SP ,,,,,,,,,,,
```

In the P1-specific header, the [H1,1,0,0] record defines the CRS and TRS of each source type through the **P1TYPEREF** number (field 6) (underlined), where CRSREF 1 is a compound CRS:

```
H1,1,0,0,Position Record Type Definition                 ,1,1,2,,1,1,0,
H1,1,0,0,Position Record Type Definition                 ,2,1,2,,1,1,1,9;;Charge Depth;1
```

Charge depth has a pre-defined record extension identifier (9). A comment record would be required to define the measurement orientation because it is not referenced to a vertical datum. In the data records, (Section 10 of the P1/11 Format Description) the source type and CRS/TRS combination are linked through inclusion of OBJREF (field 9) and P1TYPEREF (field 11) identifiers respectively, as shown by the arrows in the example below. For ease of reading the records have been wrapped and inset onto the next line. Land surface elevation in red text, charge depth in blue text:

```
S1,0,T21021P1002,,1001,,1,2002:088:05:05:50.0,1,Vib,1,,655603.40,9737243.40,6.6,-
       2.37651470,133.39942456,,,,,1.5,,,0.5,,
S1,0,T21021P1002,,1002,,1,2002:088:05:06:07.0,1,Vib,1,,655626.30,9737233.30,4.4,-
       2.37660584,133.39963056,,,,,1.5,,,0.5,,
S1,0,T21021P1002,,1003,,1,2002:088:05:06:24.0,1,Vib,1,,655644.30,9737214.40,2.2,-
       2.37677661,133.39979258,,,,,1.5,,,0.5,,
S1,0,T21021P1002,,1007,,1,2002:088:05:07:26.0,2,SP ,2,,655720.90,9737150.00,1.8,-
       2.37735837,133.40048194,,,,,1.0,,,0.5,,10.0
S1,0,T21021P1002,,1008,,1,2002:088:05:07:41.0,2,SP ,2,,655742.00,9737136.90,3.9,-
       2.37747666,133.40067178,,,,,1.0,,,0.5,,10.0
S1,0,T21021P1002,,1009,,1,2002:088:05:07:57.0,2,SP ,2,,655762.80,9737122.10,6.0,-
       2.37761033,133.40085894,,,,,1.0,,,0.5,,10.0
```

Notes:

i) *In a transition zone survey land surface elevations can be recorded as positive up and water depths as positive down, as defined by the parameters of the vertical axis of their respective CRS in the Common Header.*

ii) *In the above examples only 2 coordinate tuples are given. This is acceptable when the second CRS (geographic CRS) is already in the hub or reference CRS (such as WGS 84).*

Appendix A: Minimum Requirements by Records Group

1) Minimum file content requirements by records group for new acquisition

Records Group	Records	New Marine Acquisition	New Land Acquisition	New TZ/OBC Acquisition
OGP Record	OGP	Mandatory	Mandatory	Mandatory
Survey Definition	HC,0,x,x	Mandatory	Mandatory	Mandatory
Reference Systems Summary Information	HC,1,0,0	Mandatory	Mandatory	Mandatory
Unit Reference Systems	HC,1,1,x	Mandatory	Mandatory	Mandatory
Time Reference Systems	HC,1,2,x	Mandatory	Mandatory	Mandatory
Coordinate Reference Systems	HC,1,3-9,x	Mandatory	Mandatory	Mandatory
Survey Configuration	HC,2,0,0	Mandatory	Mandatory	Mandatory
Production System Information	HC,2,1,x	Mandatory	Mandatory	Mandatory
Receiver Information	HC,2,2,x	Mandatory	Mandatory	Mandatory
Object Information	HC,2,3,x	Mandatory	Mandatory	Mandatory
Comments	CC,x,x,x	Optional	Optional	Optional
P1 Header: Content Definition	H1,0,x,x	Mandatory	Mandatory	Mandatory
P1 Header: Position Definitions	H1,1-2,x,x	Mandatory	Mandatory	Mandatory
Relation Definition + Records	H1,3,0,0 X1	Optional	Optional	Optional
Preplot Definition + Records	H1,4,0,0 N1	Optional	Optional	Optional
Perimeter Definition + Records	H1,5,0,0 M1	Recommended	Recommended	Recommended
P1 Data Records	S1,P1,R1	Mandatory	Mandatory	Mandatory
Quality Measures	Defined in File Header. Recorded in P1 position records	Mandatory	Mandatory	Mandatory

2) Minimum file content requirements by records group for legacy data

Records Group	Records	Conversion of Legacy Marine Data	Conversion of Legacy Land Data	Conversion of Legacy TZ/OBC Data
OGP Record	OGP	Mandatory	Mandatory	Mandatory
Survey Definition	HC,0,x,x	Mandatory	Mandatory	Mandatory
Reference Systems Summary Information	HC,1,0,0	Mandatory	Mandatory	Mandatory
Unit Reference Systems	HC,1,1,x	Mandatory	Mandatory	Mandatory
Time Reference Systems	HC,1,2,x	Mandatory	Mandatory	Mandatory
Coordinate Reference Systems	HC,1,3-9,x	Mandatory	Mandatory	Mandatory
Survey Configuration	HC,2,0,0	Mandatory	Mandatory	Mandatory
Production System Information	HC,2,1,x	Conditional Mandatory	Conditional Mandatory	Conditional Mandatory
Receiver Information	HC,2,2,x	Mandatory for HC,2,2,0	Mandatory for HC,2,2,0	Mandatory for HC,2,2,0
Object Information	HC,2,3,x	Mandatory	Mandatory	Mandatory
Comments	CC,x,x,x	Optional	Optional	Optional
P1 Header: Content Definition	H1,0,x,x	Mandatory	Mandatory	Mandatory
P1 Header: Position Definitions	H1,1-2,x,x	Mandatory	Mandatory	Mandatory
Relation Definition + Records	H1,3,0,0 X1	Conditional Mandatory	Conditional Mandatory	Conditional Mandatory
Preplot Definition + Records	H1,4,0,0 N1	(Not applicable)	(Not applicable)	(Not applicable)
Perimeter Definition + Records	H1,5,0,0, M1	Recommended	Recommended	Recommended
P1 Data Records	S1,P1,R1	Mandatory	Mandatory	Mandatory
Quality Measures	Defined in File Header. Recorded in P1 position records	Conditional Mandatory[1]	Conditional Mandatory[1]	Conditional Mandatory[1]

The "Records Group" column generally defines all relevant records in that group.

Conditional Mandatory = Mandatory if available in original data.

[1]*In some cases the quality measures may be subjective, based on the data conversion process.*

Appendix B: Coordinate Reference System and Coordinate Transformation Examples

Number	Example	Details
1	Projected CRS - Transverse Mercator (Metres) - Position Vector transformation	- ED50 / UTM zone 31N (urn:ogc:def:crs:EPSG::23031) - reduced depths referred to MSL (urn:ogc:def:crs:EPSG::5715) - coordinate transformation: Common Offshore (urn:ogc:def:coordinateOperation:EPS::1311

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HC,1,0,0,Reference Systems Summary                         ,6,0,6,2
HC,1,1,0,Unit of Measure                                   ,1,            metre,length,2, , ,           ,       , ,             metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                   ,2,           radian, angle,2, , ,           ,       , ,            radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                   ,3,           degree, angle,2,2,0,3.141592654,    180,0,            degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                   ,4,            unity, scale,2, , ,           ,       , ,             unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                   ,5,       arc-second, angle,2,2,0,3.141592654, 648000,0,        arc-second,9104,EPSG Dataset,7.6,9104
HC,1,1,0,Unit of Measure                                   ,6,parts per million, scale,2,4,0,         1,1000000,0,parts per million,9202,EPSG Dataset,7.6,9202
HC,1,1,1,Example Unit Conversion                           ,1,2,1,3,57.295779513,5,206264.806247097
HC,1,1,1,Example Unit Conversion                           ,2,4,1,6,     1000000
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,1,23031,           ED50 / UTM zone 31N,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,2, 4230,                          ED50,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,3, 5715,                     MSL depth,8.0,2012:08:10,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,4,      ,ED50 / UTM zone 31N + MSL depth,    ,          ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,5, 4326,                        WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,6, 4979,                        WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,1,23031,1,    projected,           ED50 / UTM zone 31N
HC,1,4,3,Base Geographic CRS                               ,1,2,4230
HC,1,4,4,Geodetic Datum                                    ,1,6230,       European Datum 1950
HC,1,4,5,Prime Meridian                                    ,1,8901,Greenwich,0,3,degree
CC,1,0,0,Because the prime meridian is Greenwich the HC,1,4,5 record above is optional and may be omitted
HC,1,4,6,Ellipsoid                                         ,1,7022,International 1924,6378388,1,metre,         297
HC,1,5,0,Projection                                        ,1,16031,UTM zone 31N
HC,1,5,1,Projection Method                                 ,1,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                        ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                       ,1,8802,     3,3,degree
HC,1,5,2,Scale factor at natural origin                    ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                     ,1,8806,500000,1, metre
HC,1,5,2,False northing                                    ,1,8807,     0,1, metre
HC,1,6,0,Coordinate System                                 ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,1,1,  1,             Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                          ,1,2,  2,            Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,2, 4230,2,geographic 2D,                            ED50
HC,1,4,4,Geodetic Datum                                    ,2,6230,       European Datum 1950
HC,1,4,5,Prime Meridian                                    ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,2,7022,International 1924,6378388,1,metre,         297
HC,1,6,0,Coordinate System                                 ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,2,1,106,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,2,2,107,   Geodetic longitude, east,Long,3,degree
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HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,3, 5715,5,     vertical,                    MSL depth
HC,1,4,7,Vertical Datum                                    ,3,5100,Mean Sea Level
HC,1,6,0,Coordinate System                                 ,3,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                          ,3,1,113,                Depth, down,   D,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,4,      ,6,     compound,ED50 / UTM zone 31N + MSL depth
HC,1,4,1,Compound Horizontal CRS                           ,4,1,ED50 / UTM zone 31N
HC,1,4,2,Compound Vertical CRS                             ,4,3,MSL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,5, 4326,2,geographic 2D,                       WGS 84
HC,1,4,4,Geodetic Datum                                    ,5,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,5,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,5,7030,           WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                 ,5,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,5,1,106,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,5,2,107,   Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,6, 4979,3,geographic 3D,                       WGS 84
HC,1,4,4,Geodetic Datum                                    ,6,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,6,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,6,7030,           WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                 ,6,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                          ,6,1,108,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,6,2,109,   Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                          ,6,3,110,   Ellipsoidal height,   up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,1, 1311,         ED50 to WGS 84 (18),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,2,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name              ,1, 1311,         ED50 to WGS 84 (18),1
HC,1,8,1,Source CRS/Target CRS/Version                     ,1,2,4230,  ED50,5,4326,WGS 84,UKOOA-CO
HC,1,8,2,Transformation Method                             ,1,9606,Position Vector transformation (geog2D domain),1,7
HC,1,8,4,X-axis translation                                ,1,8605, -89.5,1,           metre,1
HC,1,8,4,Y-axis translation                                ,1,8606, -93.8,1,           metre,1
HC,1,8,4,Z-axis translation                                ,1,8607,-123.1,1,           metre,1
HC,1,8,4,X-axis rotation                                   ,1,8608,     0,5,       arc-second,1
HC,1,8,4,Y-axis rotation                                   ,1,8609,     0,5,       arc-second,1
HC,1,8,4,Z-axis rotation                                   ,1,8610,-0.156,5,       arc-second,1
HC,1,8,4,Scale difference                                  ,1,8611,   1.2,6,parts per million,1
HC,1,8,0,Transformation Number/EPSG Code/Name              ,2,15593,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                     ,2,6,4979,WGS 84,5,4326,WGS 84,
HC,1,8,2,Transformation Method                             ,2,9659,                Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                          ,1,,6,52.8000000,3.00000000,0.0,1,500091.87,5850233.06,,2,52.80078563,3.00136267,,5,52.8000000,3.00000000,
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Number	Example	Details
2	Projected (including Compound) CRS - Transverse Mercator (US survey feet) - NADCON transformation	- NAD27 / BLM zone 16N (ftUS) (urn:ogc:def:crs:EPSG::32066) - reduced depths referred to MSL (urn:ogc:def:crs:EPSG::5715) - coordinate transformation: NADCON Conus (urn:ogc:def:coordinateOperation:EPSG::1241)

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HC,1,0,0,Reference Systems Summary                          ,5,0,7,3
HC,1,1,0,Unit of Measure                                    ,1,         metre,length,2, , ,           ,     , ,        metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                    ,2,        radian, angle,2, , ,           ,     , ,       radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                    ,3,        degree, angle,2,2,0,3.141592654,  180,0,       degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                    ,4,         unity, scale,2, , ,           ,     , ,        unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                    ,5,US survey foot,length,2,1,0,        12,39.37,0,US survey foot,9003,EPSG Dataset,7.6,9003
HC,1,1,1,Example Unit Conversion                            ,1,1,1,5, 3.280833333
HC,1,1,1,Example Unit Conversion                            ,2,2,1,3,57.295779513
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,1,32066,           NAD27 / BLM 16N (ftUS),7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,2, 4267,                            NAD27,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,3, 5715,                        MSL depth,8.0,2012:08:10,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,4,     ,NAD27 / BLM 16N (ftUS) + MSL depth,   ,          ,    ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,5, 4269,                            NAD83,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,6, 4326,                           WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,7, 4979,                           WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,1,32066,1,    projected,           NAD27 / BLM 16N (ftUS)
HC,1,4,3,Base Geographic CRS                                ,1,2,4267
HC,1,4,4,Geodetic Datum                                     ,1,6267, North American Datum 1927
HC,1,4,5,Prime Meridian                                     ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7008,Clarke 1866,6378206.4,1,metre,           0
HC,1,5,0,Projection                                         ,1,15916,BLM zone 16N (US survey feet)
HC,1,5,1,Projection Method                                  ,1,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                         ,1,8801,         0,3,        degree
HC,1,5,2,Longitude of natural origin                        ,1,8802,       -87,3,        degree
HC,1,5,2,Scale factor at natural origin                     ,1,8805,    0.9996,4,         unity
HC,1,5,2,False easting                                      ,1,8806,1640416.67,5,US survey foot
HC,1,5,2,False northing                                     ,1,8807,         0,5,US survey foot
HC,1,6,0,Coordinate System                                  ,1,4497,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                           ,1,1, 37,              Easting, east,   X,5,US survey foot
HC,1,6,1,Coordinate System Axis 2                           ,1,2, 38,             Northing,north,   Y,5,US survey foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,2, 4267,2,geographic 2D,                            NAD27
HC,1,4,4,Geodetic Datum                                     ,2,6267, North American Datum 1927
HC,1,4,5,Prime Meridian                                     ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,2,7008,Clarke 1866,6378206.4,1,metre,           0
HC,1,6,0,Coordinate System                                  ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106,    Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,   Geodetic longitude, east,Long,3,        degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,3, 5715,5,     vertical,                        MSL depth
HC,1,4,7,Vertical Datum                                     ,3,5100,Mean Sea Level
HC,1,6,0,Coordinate System                                  ,3,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                           ,3,1,113,                Depth, down,   D,1,         metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,4,     ,6,     compound,NAD27 / BLM 16N (ftUS) + MSL depth
HC,1,4,1,Compound Horizontal CRS                            ,4,1,NAD27 / BLM 16N (ftUS)
HC,1,4,2,Compound Vertical CRS                              ,4,3,MSL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,5, 4269,2,geographic 2D,                            NAD83
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HC,1,4,4,Geodetic Datum                                   ,5,6269, North American Datum 1983
HC,1,4,5,Prime Meridian                                   ,5,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                        ,5,7019,   GRS 1980,  6378137,1,metre,298.257222101
HC,1,6,0,Coordinate System                                ,5,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                         ,5,1,106,    Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                         ,5,2,107,   Geodetic longitude, east,Long,3,        degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                   ,6, 4326,2,geographic 2D,                            WGS 84
HC,1,4,4,Geodetic Datum                                   ,6,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                   ,6,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                        ,6,7030,     WGS 84,  6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                ,6,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                         ,6,1,106,    Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                         ,6,2,107,   Geodetic longitude, east,Long,3,        degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                   ,7, 4979,3,geographic 3D,                            WGS 84
HC,1,4,4,Geodetic Datum                                   ,7,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                   ,7,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                        ,7,7030,     WGS 84,  6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                ,7,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                         ,7,1,108,    Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                         ,7,2,109,   Geodetic longitude, east,Long,3,        degree
HC,1,6,1,Coordinate System Axis 3                         ,7,3,110,   Ellipsoidal height,   up,   h,1,         metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source      ,1, 1241,          NAD27 to NAD83 (1),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source      ,2, 1188,         NAD83 to WGS 84 (1),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source      ,3,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name             ,1, 1241,          NAD27 to NAD83 (1),0.15
HC,1,8,1,Source CRS/Target CRS/Version                    ,1,2,4267, NAD27,5,4269, NAD83,NGS-Usa Conus
HC,1,8,2,Transformation Method                            ,1,9613,                                NADCON,1,2
HC,1,8,3,Latitude difference file                         ,1,8657,conus.las,1
HC,1,8,3,Longitude difference file                        ,1,8658,conus.los,1
HC,1,8,0,Transformation Number/EPSG Code/Name             ,2, 1188,         NAD83 to WGS 84 (1),   4
HC,1,8,1,Source CRS/Target CRS/Version                    ,2,5,4269, NAD83,6,4326,WGS 84,     DMA-N Am
HC,1,8,2,Transformation Method                            ,2,9603,Geocentric translations (geog2D domain),1,3
HC,1,8,4,X-axis translation                               ,2,8605,0,1,metre,1
HC,1,8,4,Y-axis translation                               ,2,8606,0,1,metre,1
HC,1,8,4,Z-axis translation                               ,2,8607,0,1,metre,1
HC,1,8,0,Transformation Number/EPSG Code/Name             ,3,15593,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                    ,3,7,4979,WGS 84,6,4326,WGS 84,
HC,1,8,2,Transformation Method                            ,3,9659,         Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                         ,1,,1,843588.45,10896474.66,,2,29.99979780,-89.51772720,,5,30.00000000,-89.51777780,,6,30.00000000,-89.51777780,
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Number	Example	Details
3	Projected CRS - Hotine Oblique Mercator - Geocentric translations transformation	-Timbalai 1948 / RSO Borneo (m) (urn:ogc:def:crs:EPSG::29873) - RSO Borneo Grid (m) - coordinate transformation: urn:ogc:def:coordinateOperation:EPSG::1592

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HC,1,0,0,Reference Systems Summary                          ,5,0,4,2
HC,1,1,0,Unit of Measure                                    ,1,        metre,length, 2, , ,            ,   , ,         metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                    ,2,       radian, angle, 2, , ,            ,   , ,        radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                    ,3,       degree, angle, 2,2,0,3.141592654,180,0,         degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                    ,4,        unity, scale, 2, , ,            ,   , ,         unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                    ,5,sexagesimal DMS, angle,29,3,0,          0,  0,0,sexagesimal DMS,9110,EPSG Dataset,7.6,9110
HC,1,1,1,Example Unit Conversion                            ,1,2,1,3,57.295779513
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,1,29873,Timbalai 1948 / RSO Borneo (m),7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,2, 4298,                 Timbalai 1948,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,3, 4326,                        WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,4, 4979,                        WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,1,29873,1,    projected,Timbalai 1948 / RSO Borneo (m)
HC,1,4,3,Base Geographic CRS                                ,1,2,4298
HC,1,4,4,Geodetic Datum                                     ,1,6298,            Timbalai 1948
HC,1,4,5,Prime Meridian                                     ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7016,Everest 1830 (1967 Definition),6377298.556,1,metre,     300.8017
HC,1,5,0,Projection                                         ,1,19958,Rectified Skew Orthomorphic Borneo Grid (metres)
HC,1,5,1,Projection Method                                  ,1,9815,Hotine Oblique Mercator (variant B),7
HC,1,5,2,Latitude of projection centre                      ,1,8811,          4,5,sexagesimal DMS
HC,1,5,2,Longitude of projection centre                     ,1,8812,        115,5,sexagesimal DMS
HC,1,5,2,Azimuth of initial line                            ,1,8813,53.18569537,5,sexagesimal DMS
HC,1,5,2,Angle from Rectified to Skew Grid                  ,1,8814,53.07483685,5,sexagesimal DMS
HC,1,5,2,Scale factor on initial line                       ,1,8815,    0.99984,4,          unity
HC,1,5,2,Easting at projection centre                       ,1,8816,  590476.87,1,          metre
HC,1,5,2,Northing at projection centre                      ,1,8817,  442857.65,1,          metre
HC,1,6,0,Coordinate System                                  ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                           ,1,1,  1,           Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                           ,1,2,  2,          Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,2, 4298,2,geographic 2D,                 Timbalai 1948
HC,1,4,4,Geodetic Datum                                     ,2,6298,            Timbalai 1948
HC,1,4,5,Prime Meridian                                     ,2,8901,Greenwich,0,3,degree
HC,1,4,6,E nate System                                      ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,3, 4326,2,geographic 2D,                        WGS 84
HC,1,4,4,Geodetic Datum                                     ,3,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                     ,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,3,7030,                        WGS 84,    6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                  ,3,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,3,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,3,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,4, 4979,3,geographic 3D,                        WGS 84
HC,1,4,4,Geodetic Datum                                     ,4,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                     ,4,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,4,7030,                        WGS 84,    6378137,1,metre,298.257223563
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HC,1,6,0,Coordinate System                              ,4,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                       ,4,1,108, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                       ,4,2,109,Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                       ,4,3,110,Ellipsoidal height,   up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source    ,1, 1592, Timbalai 1948 to WGS 84 (2),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source    ,2,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name           ,1, 1592, Timbalai 1948 to WGS 84 (2),5
HC,1,8,1,Source CRS/Target CRS/Version                  ,1,2,4298,Timbalai 1948,3,4326,WGS 84,BSP-Brn
HC,1,8,2,Transformation Method                          ,1,9603,Geocentric translations (geog2D domain),1,3
HC,1,8,4,X-axis translation                             ,1,8605,-678,1,metre,1
HC,1,8,4,Y-axis translation                             ,1,8606, 670,1,metre,1
HC,1,8,4,Z-axis translation                             ,1,8607, -48,1,metre,1
HC,1,8,0,Transformation Number/EPSG Code/Name           ,2,15593,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                  ,2,4,4979,       WGS 84,3,4326,WGS 84,
HC,1,8,2,Transformation Method                          ,2,9659,          Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                       ,1,,1,589781.44,663998.87,,2,6.00000000,115.00000000,,3,5.99906770,115.00299260,
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Number	Example	Details
4	Projected CRS - Polar Stereographic (variant B)	- WGS 84 / Arctic Polar Stereographic

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HC,1,0,0,Reference Systems Summary                          ,4,1,3,1
HC,1,1,0,Unit of Measure                                    ,1, metre,length, 2, , ,            ,   , ,   metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                    ,2,radian, angle, 2, , ,            ,   , ,  radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                    ,3,degree, angle, 2,2,0,3.141592654,180,0,  degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                    ,7,second,  time,12, , ,            ,     , ,second,    ,POSC UoM Dictionary,2.2,s
HC,1,1,1,Example Unit Conversion                            ,1,2,1,3,57.295779513
HC,1,2,0,Time Reference System                              ,1,1,0,UTC,0,,7
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,1,3995,WGS 84 / Arctic Polar Stereographic,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,2,4326,                             WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,3,4979,                             WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,1,3995,1,    projected,WGS 84 / Arctic Polar Stereographic
HC,1,4,3,Base Geographic CRS                                ,1,2,4326
HC,1,4,4,Geodetic Datum                                     ,1,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                     ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,5,0,Projection                                         ,1,19842,Arctic Polar Stereographic
HC,1,5,1,Projection Method                                  ,1,9829,Polar Stereographic (variant B),1,4
HC,1,5,2,False easting                                      ,1,8806, 0,1, metre
HC,1,5,2,False northing                                     ,1,8807, 0,1, metre
HC,1,5,2,Latitude of standard parallel                      ,1,8832,71,3,degree
HC,1,5,2,Longitude of origin                                ,1,8833, 0,3,degree
HC,1,6,0,Coordinate System                                  ,1,4469,Cartesian 2D CS for north polar azimuthal long 0E,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                           ,1,1,187,           Easting, South along 90E,   X,1, metre
HC,1,6,1,Coordinate System Axis 2                           ,1,2,188,          Northing,South along 180E,   Y,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,2,4326,2,geographic 2D,                         WGS 84
HC,1,4,4,Geodetic Datum                                     ,2,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                     ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                  ,2,6422,                                Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106, Geodetic latitude,           north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,Geodetic longitude,            east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,3,4979,3,geographic 3D,                         WGS 84
HC,1,4,4,Geodetic Datum                                     ,3,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                     ,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,3,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                  ,3,6423,                                Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                           ,3,1,108, Geodetic latitude,           north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,3,2,109,Geodetic longitude,            east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                           ,3,3,110,Ellipsoidal height,              up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source        ,1,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Type/Name          ,1,15593,2,conversion,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                      ,1,3,4979,WGS 84,2,4326,WGS 84,
HC,1,8,2,Transformation Method                              ,1,9659,Geographic3D to 2D conversion,1,0
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Number	Example	Details
5	Projected CRS - Lambert Conic Conformal 2SP - US State Plane grid	- NAD27 / Louisiana CS27 South (US survey feet)

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HC,1,0,0,Reference Systems Summary                          ,6,0,4,2
HC,1,1,0,Unit of Measure                                    ,1,          metre,length, 2, , ,            ,     , ,          metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                    ,2,         radian, angle, 2, , ,            ,     , ,         radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                    ,3,         degree, angle, 2,2,0,3.141592654,  180,0,         degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                    ,4,          unity, scale, 2, , ,            ,     , ,          unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                    ,5, US survey foot,length, 2,1,0,         12,39.37,0, US survey foot,9003,EPSG Dataset,7.6,9003
HC,1,1,0,Unit of Measure                                    ,6,sexagesimal DMS, angle,29,3,0,          0,    0,0,sexagesimal DMS,9110,EPSG Dataset,7.6,9110
HC,1,1,1,Example Unit Conversion                            ,1,1,1,5, 3.280833333
HC,1,1,1,Example Unit Conversion                            ,2,2,1,3,57.295779513
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,1,26782,NAD27 / Louisiana South,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,2, 4267,                  NAD27,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,3, 4326,                 WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,4, 4979,                 WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,1,26782,1,    projected,NAD27 / Louisiana South
HC,1,4,3,Base Geographic CRS                                ,1,2,4267
HC,1,4,4,Geodetic Datum                                     ,1,6267, North American Datum 1927
HC,1,4,5,Prime Meridian                                     ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7008,Clarke 1866,6378206.4,1,metre,           294.9787
HC,1,5,0,Projection                                         ,1,11702,Louisiana CS27 South zone
HC,1,5,1,Projection Method                                  ,1,9802,Lambert Conic Conformal (2SP),6
HC,1,5,2,Latitude of false origin                           ,1,8821,   28.4,6,sexagesimal DMS
HC,1,5,2,Longitude of false origin                          ,1,8822,  -91.2,6,sexagesimal DMS
HC,1,5,2,Latitude of 1st standard parallel                  ,1,8823,  29.18,6,sexagesimal DMS
HC,1,5,2,Latitude of 2nd standard parallel                  ,1,8824,  30.42,6,sexagesimal DMS
HC,1,5,2,Easting at false origin                            ,1,8826,2000000,5, US survey foot
HC,1,5,2,Northing at false origin                           ,1,8827,      0,5, US survey foot
HC,1,6,0,Coordinate System                                  ,1,4497,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                           ,1,1, 37,          Easting, east,   X,5,US survey foot
HC,1,6,1,Coordinate System Axis 2                           ,1,2, 38,         Northing,north,   Y,5,US survey foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,2, 4267,2,geographic 2D,                NAD27
HC,1,4,4,Geodetic Datum                                     ,2,6267, North American Datum 1927
HC,1,4,5,Prime Meridian                                     ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,2,7008,Clarke 1866,6378206.4,1,metre,           294.9787
HC,1,6,0,Coordinate System                                  ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106, Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,Geodetic longitude, east,Long,3,        degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,3, 4326,2,geographic 2D,               WGS 84
HC,1,4,4,Geodetic Datum                                     ,3,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                     ,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,3,7030,     WGS 84,  6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                  ,3,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,3,1,106, Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                           ,3,2,107,Geodetic longitude, east,Long,3,        degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,4, 4979,3,geographic 3D,               WGS 84
HC,1,4,4,Geodetic Datum                                     ,4,6326,World Geodetic System 1984
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HC,1,4,5,Prime Meridian                               ,4,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                    ,4,7030,     WGS 84,  6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                            ,4,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                     ,4,1,108, Geodetic latitude,north, Lat,3,        degree
HC,1,6,1,Coordinate System Axis 2                     ,4,2,109,Geodetic longitude, east,Long,3,        degree
HC,1,6,1,Coordinate System Axis 3                     ,4,3,110,Ellipsoidal height,   up,   h,1,         metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source  ,1, 1530,        NAD27 to WGS 84 (30),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source  ,2,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name         ,1, 1530,        NAD27 to WGS 84 (30),3
HC,1,8,1,Source CRS/Target CRS/Version                ,1,2,4267, NAD27,3,4326,WGS 84,ICH-Cub
HC,1,8,2,Transformation Method                        ,1,9603,Geocentric translations (geog2D domain),1,3
HC,1,8,4,X-axis translation                           ,1,8605, -4.2,1,metre,1
HC,1,8,4,Y-axis translation                           ,1,8606,135.4,1,metre,1
HC,1,8,4,Z-axis translation                           ,1,8607,181.9,1,metre,1
HC,1,8,0,Transformation Number/EPSG Code/Name         ,2,15593,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                ,2,4,4979,WGS 84,3,4326,WGS 84,
HC,1,8,2,Transformation Method                        ,2,9659,          Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                     ,1,,1,1477744.46,852351.55,,2,31.00000000,-93.00000000,,3,31.00018900,-93.00015560,
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Number	Example	Details
6	Projected CRS - Transverse Mercator - US State Plane grid - NADCON transformation	- Alaska NAD83 / TM State Plane zone 4 (US survey feet) - transformation: NADCON Alaska

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HC,1,0,0,Reference Systems Summary                ,6,1,4,1
HC,1,1,0,Unit of Measure                          ,1,         metre,length, 2, , ,             ,     , ,         metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                          ,2,        radian, angle, 2, , ,             ,     , ,        radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                          ,3,        degree, angle, 2,2,0,3.141592654,  180,0,        degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                          ,4,         unity, scale, 2, , ,             ,     , ,         unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                          ,7         second,  time,12, , ,             ,     , ,        second,     ,POSC UoM Dictionary,2.2,s
HC,1,1,0,Unit of Measure                          ,8,US survey foot,length, 2,1,0,         12,39.37,0,US survey foot,9003,EPSG Dataset,7.6,9003
HC,1,1,1,Example Unit Conversion                  ,2,2,1,3,57.295779513
HC,1,2,0,Time Reference System                    ,1,1,0,UTC,0,,7
HC,1,3,0,CRS Number/EPSG Code/Name/Source         ,1,26934,NAD83 / Alaska zone 4,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source         ,2, 4269,                NAD83,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source         ,3, 4267,                NAD27,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source         ,4,26734,NAD27 / Alaska zone 4,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name           ,1,26934,1,    projected,NAD83 / Alaska zone 4
HC,1,4,3,Base Geographic CRS                      ,1,2,4269
HC,1,4,4,Geodetic Datum                           ,1,6269,North American Datum 1983
HC,1,4,5,Prime Meridian                           ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                ,1,7019,    GRS 1980,  6378137,1,metre,298.257222101
HC,1,5,0,Projection                               ,1,15034,SPCS83 Alaska zone 4 (meters)
HC,1,5,1,Projection Method                        ,1,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin               ,1,8801,    54,3,degree
HC,1,5,2,Longitude of natural origin              ,1,8802,  -150,3,degree
HC,1,5,2,Scale factor at natural origin           ,1,8805,0.9999,4, unity
HC,1,5,2,False easting                            ,1,8806,500000,1, metre
HC,1,5,2,False northing                           ,1,8807,     0,1, metre
HC,1,6,0,Coordinate System                        ,1,4499,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                 ,1,1, 41,           Easting, east,   X,1, metre
HC,1,6,1,Coordinate System Axis 2                 ,1,2, 42,          Northing,north,   Y,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name           ,2, 4269,2,geographic 2D,                NAD83
HC,1,4,4,Geodetic Datum                           ,2,6269,North American Datum 1983
HC,1,4,5,Prime Meridian                           ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                ,2,7019,    GRS 1980,  6378137,1,metre,298.257222101
HC,1,6,0,Coordinate System                        ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                 ,2,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                 ,2,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name           ,3, 4267,2,geographic 2D,                NAD27
HC,1,4,4,Geodetic Datum                           ,3,6267,North American Datum 1927
HC,1,4,5,Prime Meridian                           ,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                ,3, 7008,Clarke 1866,6378206.4,1,metre,    294.9787
HC,1,6,0,Coordinate System                        ,3,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                 ,3,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                 ,3,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name           ,4,26734,1,    projected,NAD27 / Alaska zone 4
HC,1,4,3,Base Geographic CRS                      ,4,3,4267
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HC,1,4,4,Geodetic Datum                                    ,4,6267,North American Datum 1927
HC,1,4,5,Prime Meridian                                    ,4,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,4, 7008,Clarke 1866,6378206.4,1,metre,    294.9787
HC,1,5,0,Projection                                        ,4,15004,Alaska CS27 zone 4
HC,1,5,1,Projection Method                                 ,4,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                        ,4,8801,    54,3,        degree
HC,1,5,2,Longitude of natural origin                       ,4,8802,  -150,3,        degree
HC,1,5,2,Scale factor at natural origin                    ,4,8805,0.9999,4,         unity
HC,1,5,2,False easting                                     ,4,8806,500000,8,US survey foot
HC,1,5,2,False northing                                    ,4,8807,     0,8,US survey foot
HC,1,6,0,Coordinate System                                 ,4,4497,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,4,1, 37,           Easting, east,   X,8,US survey foot
HC,1,6,1,Coordinate System Axis 2                          ,4,2, 38,          Northing,north,   Y,8,US survey foot
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,1,1243,NAD27 to NAD83 (2),7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Type/Name         ,1,1243,1,transformation,NAD27 to NAD83 (2),0.5
HC,1,8,1,Source CRS/Target CRS/Version                     ,1,3,4267,NAD27,2,4269,NAD83,NGS-Usa AK
HC,1,8,2,Transformation Method                             ,1,9613,NADCON,1,2
HC,1,8,3,Latitude difference file                          ,1,8657,alaska.las
HC,1,8,3,Longitude difference file                         ,1,8658,alaska.los
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Number	Example	Details
7	Projected CRS - American Polyconic	- Brazil - SAD69 / Brazil Polyconic

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HC,1,0,0,Reference Systems Summary                         ,4,0,4,2
HC,1,1,0,Unit of Measure                                   ,1, metre,length,2, , ,           ,   , , metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                   ,2,radian, angle,2, , ,           ,   , ,radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                   ,3,degree, angle,2,2,0,3.141592654,180,0,degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                   ,4, unity, scale,2, , ,           ,   , , unity,9201,EPSG Dataset,7.6,9201
HC,1,1,1,Example Unit Conversion                           ,1,2,1,3,57.295779513
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,1,29101,SAD69 / Brazil Polyconic,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,2, 4618,                   SAD69,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,3, 4326,                  WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,4, 4979,                  WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,1,29101,1,    projected,SAD69 / Brazil Polyconic
HC,1,4,3,Base Geographic CRS                               ,1,2,4618
HC,1,4,4,Geodetic Datum                                    ,1,6618, South American Datum 1969
HC,1,4,5,Prime Meridian                                    ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,1,7050,GRS 1967 Modified,6378160,1,metre,       298.25
HC,1,5,0,Projection                                        ,1,19941,Brazil Polyconic
HC,1,5,1,Projection Method                                 ,1,9818,American Polyconic,4
HC,1,5,2,Latitude of natural origin                        ,1,8801,       0,3,degree
HC,1,5,2,Longitude of natural origin                       ,1,8802,     -54,3,degree
HC,1,5,2,False easting                                     ,1,8806, 5000000,1, metre
HC,1,5,2,False northing                                    ,1,8807,10000000,1, metre
HC,1,6,0,Coordinate System                                 ,1,4499,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,1,1, 41,          Easting, east,   X,1, metre
HC,1,6,1,Coordinate System Axis 2                          ,1,2, 42,         Northing,north,   Y,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,2, 4618,2,geographic 2D,                  SAD69
HC,1,4,4,Geodetic Datum                                    ,2,6618, South American Datum 1969
HC,1,4,5,Prime Meridian                                    ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,2,7050,GRS 1967 Modified,6378160,1,metre,       298.25
HC,1,6,0,Coordinate System                                 ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,2,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,2,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,3, 4326,2,geographic 2D,                 WGS 84
HC,1,4,4,Geodetic Datum                                    ,3,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,3,7030,           WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                 ,3,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,3,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,3,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,4, 4979,3,geographic 3D,                 WGS 84
HC,1,4,4,Geodetic Datum                                    ,4,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,4,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,4,7030,           WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                 ,4,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                          ,4,1,108, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,4,2,109,Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                          ,4,3,110,Ellipsoidal height,   up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,1, 1864,         SAD69 to WGS 84 (1),7.6,2010:11:02,EPSG,
```

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HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,2,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name              ,1, 1864,         SAD69 to WGS 84 (1),19
HC,1,8,1,Source CRS/Target CRS/Version                     ,1,2,4618, SAD69,3,4326,WGS 84,DMA-mean
HC,1,8,2,Transformation Method                             ,1,9603,Geocentric translations (geog2D domain),1,3
HC,1,8,4,X-axis translation                                ,1,8605,-57,1,metre,1
HC,1,8,4,Y-axis translation                                ,1,8606,  1,1,metre,1
HC,1,8,4,Z-axis translation                                ,1,8607,-41,1,metre,1
HC,1,8,0,Transformation Number/EPSG Code/Name              ,2,15593,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                     ,2,4,4979,WGS 84,3,4326,WGS 84,
HC,1,8,2,Transformation Method                             ,2,9659,          Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                          ,1,,1,4778202.13,9446775.26,,2,-5.00000000,-56.00000000,,3,-5.00037840,-56.00047790,
```

Number	Example	Details
8	Projected CRS - Transverse Mercator - NTv2 transformation	- NAD27 / Alberta 3-degree TM - transformation: NTv2 Canada

```
HC,1,0,0,Reference Systems Summary                          ,4,0,3,1
HC,1,1,0,Unit of Measure                                    ,1, metre,length,2, , ,            ,   , , metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                    ,2,radian, angle,2, , ,            ,   , ,radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                    ,3,degree, angle,2,2,0,3.141592654,180,0,degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                    ,4, unity, scale,2, , ,            ,   , , unity,9201,EPSG Dataset,7.6,9201
HC,1,1,1,Example Unit Conversion                            ,1,2,1,3,57.295779513
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,1,3771,NAD27 / Alberta 3TM ref merid 111 W,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,2,4267,                             NAD27,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,3,4269,                             NAD83,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,1,3771,1,    projected,NAD27 / Alberta 3TM ref merid 111 W
HC,1,4,3,Base Geographic CRS                                ,1,2,4267
HC,1,4,4,Geodetic Datum                                     ,1,6267,North American Datum 1927
HC,1,4,5,Prime Meridian                                     ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7008,Clarke 1866,6378206.4,1,metre,            0
HC,1,5,0,Projection                                         ,1,17722,Alberta 3-degree TM reference meridian 111 W
HC,1,5,1,Projection Method                                  ,1,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                         ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                        ,1,8802,  -111,3,degree
HC,1,5,2,Scale factor at natural origin                     ,1,8805,0.9999,4, unity
HC,1,5,2,False easting                                      ,1,8806,     0,1, metre
HC,1,5,2,False northing                                     ,1,8807,     0,1, metre
HC,1,6,0,Coordinate System                                  ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                           ,1,1,  1,           Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                           ,1,2,  2,          Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,2,4267,2,geographic 2D,                              NAD27
HC,1,4,4,Geodetic Datum                                     ,2,6267,North American Datum 1927
HC,1,4,5,Prime Meridian                                     ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,2,7008,Clarke 1866,6378206.4,1,metre,            0
HC,1,6,0,Coordinate System                                  ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,3,4269,2,geographic 2D,                              NAD83
HC,1,4,4,Geodetic Datum                                     ,3,6269,North American Datum 1983
HC,1,4,5,Prime Meridian                                     ,3,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,3,7019,   GRS 1980,  6378137,1,metre,298.257222101
HC,1,6,0,Coordinate System                                  ,3,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,3,1,106, Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,3,2,107,Geodetic longitude, east,Long,3,degree
HC,1,7,0,Transformation Number/EPSG Code/Name/Source        ,1,1313,NAD27 to NAD83 (4),7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name               ,1,1313,NAD27 to NAD83 (4),1.5
HC,1,8,1,Source CRS/Target CRS/Version                      ,1,2,4267,NAD27,3,4269,NAD83,GC-Can NT2
HC,1,8,2,Transformation Method                              ,1,9615,NTv2,1,1
HC,1,8,3,Latitude and longitude difference file             ,1,8656,NTv2_0.gsb,1
HC,1,9,0,Example Point Conversion                           ,1,,1,57524.33,6542218.84,,2,58.99983910,-109.99906600,,3,59.00000000,-110.00000000,
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Appendix C: P1/11 Format Header Examples

Number	Mode	Details
1	Marine	Marine Towed Streamer 3D

(Quality records at end of example are indented for clarity but should normally be written on one line each.)

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OGP,OGP P1,1,1,1,2011:11:04,21:23:52,CSL-T21021P1002.p111,OGP
HC,0,1,0,Project Name                                      ,Test,TEST01,2011:11:04,2011:11:05
HC,0,2,0,Survey Description                                ,Marine 3D Towed Streamer,1 VESSEL 2 SOURCE 10 STREAMER,North Block 21,690,SYC
HC,0,3,0,Approximate Data Location                         ,37.038,36.974,-16.178,-16.223
HC,0,4,0,Client                                            ,Oil Company Limited
HC,0,5,0,Geophysical Contractor                            ,Oil Finder Inc
HC,0,6,0,Positioning Contractor                            ,General Positioning Limited
HC,0,7,0,Position Processing Contractor                    ,Position Processing Limited
HC,1,0,0,Reference Systems Summary                         ,5,1,8,2
HC,1,1,0,Unit of Measure                                   ,1, metre,length,2, , ,           ,   , , metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                   ,2,radian, angle,2, , ,           ,   , ,radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                   ,3,degree, angle,2,2,0,3.141592654,180,0,degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                   ,4, unity, scale,2, , ,           ,   , , unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                   ,5,second,  time,12, , ,          ,   , ,second,    ,POSC UOM Dictionary,2.2,   s
HC,1,1,1,Example Unit Conversion                           ,1,3,1,2,0.017453293
HC,1,2,0,Time Reference System                             ,1,1,0,UTC,0,,5
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,1,23028,            ED50 / UTM zone 28N,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,2, 4230,                           ED50,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,3, 5715,                      MSL depth,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,4,     ,ED50 / UTM zone 28N + MSL depth,   ,          ,   ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,5,     ,                       SL Depth,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,6,     , ED50 / UTM zone 28N + SL Depth,   ,          ,   ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,7, 4326,                         WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,8, 4979,                         WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,1,23028,1,    projected,           ED50 / UTM zone 28N
HC,1,4,3,Base Geographic CRS                               ,1,2,4230
HC,1,4,4,Geodetic Datum                                    ,1,6230,       European Datum 1950
HC,1,4,5,Prime Meridian                                    ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,1,7022,International 1924,6378388,1,metre,          297
HC,1,5,0,Projection                                        ,1,16028,UTM zone 28N
HC,1,5,1,Projection Method                                 ,1,9807,Transverse Mercator,1,5
HC,1,5,2,Latitude of natural origin                        ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                       ,1,8802,   -15,3,degree
HC,1,5,2,Scale factor at natural origin                    ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                     ,1,8806,500000,1, metre
HC,1,5,2,False northing                                    ,1,8807,     0,1, metre
HC,1,6,0,Coordinate System                                 ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,1,1,  1,              Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                          ,1,2,  2,             Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,2, 4230,2,geographic 2D,                  ED50
HC,1,4,4,Geodetic Datum                                    ,2,6230,       European Datum 1950
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HC,1,4,5,Prime Meridian                                 ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                      ,2,7022,International 1924,6378388,1,metre,          297
HC,1,6,0,Coordinate System                              ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                       ,2,1,106,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                       ,2,2,107,   Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                 ,3, 5715,5,     vertical,                      MSL depth
HC,1,4,7,Vertical Datum                                 ,3,5100,Mean Sea Level
HC,1,6,0,Coordinate System                              ,3,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                       ,3,1,113,                Depth, down,   D,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                 ,4,     ,6,     compound,ED50 / UTM zone 28N + MSL depth
HC,1,4,1,Compound Horizontal CRS                        ,4,1,ED50 / UTM zone 28N + MSL depth
HC,1,4,2,Compound Vertical CRS                          ,4,3,ED50 / UTM zone 28N + MSL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                 ,5,     ,5,     vertical,                       SL depth
HC,1,4,7,Vertical Datum                                 ,5,5113,     Sea Level
HC,1,6,0,Coordinate System                              ,5,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                       ,5,1,113,                Depth, down,   D,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                 ,6,     ,6,     compound, ED50 / UTM zone 28N + SL depth
HC,1,4,1,Compound Horizontal CRS                        ,6,1, ED50 / UTM zone 28N + SL depth
HC,1,4,2,Compound Vertical CRS                          ,6,5, ED50 / UTM zone 28N + SL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                 ,7, 4326,2,geographic 2D,                         WGS 84
HC,1,4,4,Geodetic Datum                                 ,7,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                 ,7,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                      ,7,7030,            WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                              ,7,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                       ,7,1,106,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                       ,7,2,107,   Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                 ,8, 4979,3,geographic 3D,                         WGS 84
HC,1,4,4,Geodetic Datum                                 ,8,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                 ,8,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                      ,8,7030,            WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                              ,8,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                       ,8,1,108,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                       ,8,2,109,   Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                       ,8,3,110,   Ellipsoidal height,   up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source    ,1, 1133,          ED50 to WGS 84 (1),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source    ,2,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Type/Name      ,1, 1133,1,transformation,          ED50 to WGS 84 (1),10
HC,1,8,1,Source CRS/Target CRS/Version                  ,1,2,4230,  ED50,7,4326,WGS 84,DMA-mean
HC,1,8,2,Transformation Method                          ,1,9603,Geocentric translations (geog2D domain),1,3
HC,1,8,4,X-axis translation                             ,1,8605, -87,1,metre,1
HC,1,8,4,Y-axis translation                             ,1,8606, -98,1,metre,1
HC,1,8,4,Z-axis translation                             ,1,8607,-121,1,metre,1
HC,1,8,0,Transformation Number/EPSG Code/Type/Name      ,2,15593,2,    conversion,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                  ,2,8,4979,WGS 84,7,4326,WGS 84,
HC,1,8,2,Transformation Method                          ,2,9659,          Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                       ,1,,8,45.50000000,-13.80000000,0.000,1,593870.32,5039425.61,,2,45.50119287,-13.79851683,,7,45.50000000,-13.80000000,
HC,2,0,0,Survey Configuration                           ,1,0,24,1,metre
HC,2,1,0,Orca                                           ,1,Navigation,Orca,1.8.1,2010:12:02
HC,2,3,0,Train 2                                        , 1,  V1, 1,      Vessel,,,  ,,,,,13,,
HC,2,3,0,Source G1                                      , 2,  G1, 4,     Air Gun,,, 1,,,,,  ,,
HC,2,3,0,Source G2                                      , 3,  G2, 4,     Air Gun,,, 1,,,,,  ,,
HC,2,3,0,Streamer S1                                    , 4,  S1, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S2                                    , 5,  S2, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S3                                    , 6,  S3, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S4                                    , 7,  S4, 2,    Streamer,,, 1,,,,, 1,,
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HC,2,3,0,Streamer S5                                  , 8,  S5, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S6                                  , 9,  S6, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S7                                  ,10,  S7, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S8                                  ,11,  S8, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S9                                  ,12,  S9, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Streamer S10                                 ,13, S10, 2,    Streamer,,, 1,,,,, 1,,
HC,2,3,0,Train 2 Echo 1                               ,14,V1E1,11,Echo Sounder,,, 1,,,,,  ,,
HC,2,3,0,Tailbuoy on S1                               ,25,  T1,10,       Float,,, 4,,,,,  ,,
HC,2,3,0,Tailbuoy on S2                               ,26,  T2,10,       Float,,, 5,,,,,  ,,
HC,2,3,0,Tailbuoy on S3                               ,27,  T3,10,       Float,,, 6,,,,,  ,,
HC,2,3,0,Tailbuoy on S4                               ,28,  T4,10,       Float,,, 7,,,,,  ,,
HC,2,3,0,Tailbuoy on S5                               ,29,  T5,10,       Float,,, 8,,,,,  ,,
HC,2,3,0,Tailbuoy on S6                               ,30,  T6,10,       Float,,, 9,,,,,  ,,
HC,2,3,0,Tailbuoy on S7                               ,31,  T7,10,       Float,,,10,,,,,  ,,
HC,2,3,0,Tailbuoy on S8                               ,32,  T8,10,       Float,,,11,,,,,  ,,
HC,2,3,0,Tailbuoy on S9                               ,33,  T9,10,       Float,,,12,,,,,  ,,
HC,2,3,0,Tailbuoy on S10                              ,34, T10,10,       Float,,,13,,,,,  ,,
CC,1,0,0,SHOOTING POINT V1 MEAN CMP AT (0.0 -100.0)
CC,1,0,0,LINE CSL-T21021P1002  321 SHOTS (1001 TO 1321)
CC,1,0,0,GENERATED BY ORCA 1.8.1 FROM QC (NRT) DATABASE
CC,1,0,0,VESSEL 1 ECHOSOUNDER 1 Echosounder 12 KHz
CC,1,0,0,VELOCITY USED IN VESSEL 1 ECHOSOUNDER 1 1500.000000 M/S
CC,1,0,0,CALIBRATED CORRECTION USED IN VESSEL 1 ECHOSOUNDER 1 0.000000 M/S
CC,1,0,0,CALIBRATED VELOCITY CORRECTION HAS NOT BEEN APPLIED TO WATER DEPTHS
CC,1,0,0,ORCA DOES NOT CORRECT RAW ECHO DATA FOR VESSEL PITCH ROLL AND HEAVE
CC,1,0,0,VESSEL 1 ECHOSOUNDER 1 RAW DATA IS HEAVE COMPENSATED
CC,1,0,0,12 SOURCE MAPPING G2    A 2
CC,1,0,0,12 SOURCE MAPPING G1    B 1
CC,1,0,0,13 STREAMER MAPPING     A 1 S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
H1,0,0,0,File Contents Description                    ,MEAN CMP,Imported from P190
H1,0,1,0,Processing Details                           ,Converted from P190 File
H1,0,2,0,Receiver Groups Per Shot                     ,1,                         4800,,
H1,0,2,0,Original File                                ,2,CSL-T21021P1002.WGS-84.p190,,
H1,1,0,0,Position Record Type Definition              ,1,1,2,7,1,1,0,
H1,1,0,0,Position Record Type Definition              ,2,1,2,7,1,1,1,1;5;Water Depth;1
H1,1,0,1,Position Record Quality Definition           ,1,95,Absolute Error Ellipses,1,3,4,100;;External Reliability;1,101;;Unit Variance;4,102;;Deg. Freedom;4,
         103;;No. observations;4
H1,1,0,1,Position Record Quality Definition           ,2,95,Absolute Error Ellipses,1,3,4,100;;External Reliability;1,101;;Unit Variance;4,102;;Deg. Freedom;4,
         103;;No. observations;4
H1,2,0,0,Receiver Record Type Definition              ,1,1,6,2,7,1,1,1,0,
H1,2,0,1,Receiver Record Quality Definition           ,95,Absolute Error Ellipses,1,3,5,100;;External Reliability;1,101;;Unit Variance;4,102;;Deg. Freedom;4,
         107;;Distance from nearest network node;1,108;;Streamer rotation;3
```

Number	Mode	Details
2	Transition zone	- WGS 84 / TM 132 SE (EPSG::2310) - Source/receivers referenced to Mean Sea Level - OBC receiver depths referenced to MSL depth (EPSG::5715) - Land source/receiver heights referenced to MSL height (EPSG::5714)

```
HC,1,0,0,Reference Systems Summary                         ,5,1,7,1
HC,1,1,0,Unit of Measure                                   ,1, metre,length, 2, , ,           ,   , , metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                   ,2,radian, angle, 2, , ,           ,   , ,radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                   ,3,degree, angle, 2,2,0,3.141592654,180,0,degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                   ,4, unity, scale, 2, , ,           ,   , , unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                   ,7,second,  time,12, , ,           ,   , ,second,    ,POSC UoM Dictionary,2.2,   s
HC,1,1,1,Example Unit Conversion                           ,1,2,1,3,57.295779506
HC,1,2,0,Time Reference System                             ,1,1,0,UTC,0,,7
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,1,2310,            WGS 84 / TM 132 SE,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,2,4326,                        WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,3,5715,                     MSL depth,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,4,    , WGS 84 / TM 132 SE + MSL depth,   ,          ,    ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,5,4979,                        WGS 84,7.6,2010:11 02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,6,5714,                    MSL height,7.6,2010:11 02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,7,    ,WGS 84 / TM 132 SE + MSL height,   ,          ,    ,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,1,2310,1,                     projected,             WGS 84 / TM 132 SE
HC,1,4,3,Base Geographic CRS                               ,1,2,4326
HC,1,4,4,Geodetic Datum                                    ,1,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,1,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,5,0,Projection                                        ,1,16732,TM 132 SE
HC,1,5,1,Projection Method                                 ,1,9807,Transverse Mercator,1,5
HC,1,5,2,Latitude of natural origin                        ,1,8801,       0,3,degree
HC,1,5,2,Longitude of natural origin                       ,1,8802,     132,3,degree
HC,1,5,2,Scale factor at natural origin                    ,1,8805,  0.9996,4, unity
HC,1,5,2,False easting                                     ,1,8806,  500000,1, metre
HC,1,5,2,False northing                                    ,1,8807,10000000,1, metre
HC,1,6,0,Coordinate System                                 ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,1,1,  1,              Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                          ,1,2,  2,             Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,2,4326,2,                geographic 2D,                         WGS 84
HC,1,4,4,Geodetic Datum                                    ,2,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,2,7030,WGS 84,6378137,298.257223563,1,metre
HC,1,6,0,Coordinate System                                 ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,2,1,106,     Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,2,2,107,    Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,3,5715,5,                     vertical,                      MSL depth
HC,1,4,7,Vertical Datum                                    ,3,5100,Mean Sea Level
HC,1,6,0,Coordinate System                                 ,3,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                          ,3,1,113,                Depth, down,   D,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,4,    ,7,Compound Projected and Vertical, WGS 84 / TM 132 SE + MSL depth
HC,1,4,1,Compound Horizontal CRS                           ,4,1,WGS 84 / TM 132 SE
HC,1,4,2,Compound Vertical CRS                             ,4,3, MSL depth
```

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HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,5,4979,3,                  geographic 3D,                         WGS 84
HC,1,4,4,Geodetic Datum                                    ,5,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,5,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,5,7030,WGS 84,6378137,298.257223563,1,metre
HC,1,6,0,Coordinate System                                 ,5,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                          ,5,1,108,     Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,5,2,109,    Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                          ,5,3,110,    Ellipsoidal height,   up,   h,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,6,5714,5,                       vertical,                     MSL height
HC,1,4,7,Vertical Datum                                    ,6,5100,Mean Sea Level
HC,1,6,0,Coordinate System                                 ,6,6499,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                          ,6,1,114,Gravity-related height,   up,   H,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,7,    ,7,Compound Projected and Vertical,WGS 84 / TM 132 SE + MSL height
HC,1,4,1,Compound Horizontal CRS                           ,7,1,WGS 84 / TM 132 SE
HC,1,4,2,Compound Vertical CRS                             ,7,6,MSL height
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,1,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Type/Name         ,1,15593,2,conversion,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                     ,1,5,4979,WGS 84,2,4326,WGS 84,
HC,1,8,2,Transformation Method                             ,1,9659,Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                          ,1,,1,611175.42,9723630.80,,2,-2.50000000,133.0000000,
```

Number	Mode	Details
3	Land	- acquisition CRS: WGS 84 geographic 3D - postplot CRS: ELD79 / UTM zone 32N (EPSG::2077) - reduced heights: orthometric heights above geoid reduced using EGM96 geoid model

```
HC,1,0,0,Reference Systems Summary                          ,6,0,6,3
HC,1,1,0,Unit of Measure                                    ,1,          metre,length,2, , ,            ,      , ,          metre,9001,EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                    ,2,         radian, angle,2, , ,            ,      , ,         radian,9101,EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                    ,3,         degree, angle,2,2,0,3.141592654,    180,0,         degree,9102,EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                    ,4,          unity, scale,2, , ,            ,      , ,          unity,9201,EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                    ,5,     arc-second, angle,2,2,0,3.141592654, 648000,0,     arc-second,9104,EPSG Dataset,7.6,9104
HC,1,1,0,Unit of Measure                                    ,6,parts per million, scale,2,4,0,        1,1000000,0,parts per million,9202,EPSG Dataset,7.6,9202
HC,1,1,1,Example Unit Conversion                            ,1,2,1,3,57.295779513,5,206264.806247097
HC,1,1,1,Example Unit Conversion                            ,2,4,1,6,     1000000
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,1,2077,                 ELD79 / UTM zone 32N,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,2,4159,                                ELD79,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,3,5773,                    EGM96 geoid height,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,4,     ,ELD79 / UTM zone 32N + EGM96 geoid height,   ,          ,    ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,5,4326,                               WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                   ,6,4979,                               WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,1,2077,1,    projected,                     ELD79 / UTM zone 32N
HC,1,4,3,Base Geographic CRS                                ,1,2,4159
HC,1,4,4,Geodetic Datum                                     ,1,6159,European Libyan Datum 1979
HC,1,4,5,Prime Meridian                                     ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,1,7022,International 1924,6378388,1,metre,         297
HC,1,5,0,Projection                                         ,1,16032,UTM zone 32N
HC,1,5,1,Projection Method                                  ,1,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                         ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                        ,1,8802,     9,3,degree
HC,1,5,2,Scale factor at natural origin                     ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                      ,1,8806,500000,1, metre
HC,1,5,2,False northing                                     ,1,8807,     0,1, metre
HC,1,6,0,Coordinate System                                  ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                           ,1,1,  1,              Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                           ,1,2,  2,             Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,2,4159,2,geographic 2D,                                     ELD79
HC,1,4,4,Geodetic Datum                                     ,2,6159,European Libyan Datum 1979
HC,1,4,5,Prime Meridian                                     ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                          ,2,7022,International 1924,6378388,1,metre,         297
HC,1,6,0,Coordinate System                                  ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                           ,2,1,106,     Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                           ,2,2,107,    Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,3,5773,5,     vertical,                        EGM96 geoid height
HC,1,4,7,Vertical Datum                                     ,3,5171,EGM96 geoid
HC,1,6,0,Coordinate System                                  ,3,6499,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                           ,3,1,114,Gravity-related height,    up,   H,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,4,     ,6,     compound,ELD79 / UTM zone 32N + EGM96 geoid height
HC,1,4,1,Compound Horizontal CRS                            ,4,1,ELD79 / UTM zone 32N + EGM96 geoid height
HC,1,4,2,Compound Vertical CRS                              ,4,3,ELD79 / UTM zone 32N + EGM96 geoid height
HC,1,4,0,CRS Number/EPSG Code/Type/Name                     ,5,4326,2,geographic 2D,                                    WGS 84
```

```
HC,1,4,4,Geodetic Datum                              ,5,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                              ,5,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                   ,5,7030,           WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                           ,5,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                    ,5,1,106,     Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                    ,5,2,107,    Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name              ,6,4979,3,geographic 3D,                              WGS 84
HC,1,4,4,Geodetic Datum                              ,6,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                              ,6,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                   ,6,7030,           WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                           ,6,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                    ,6,1,108,     Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                    ,6,2,109,    Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                    ,6,3,110,    Ellipsoidal height,   up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source ,1, 1863,             ELD79 to WGS 84 (5),7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source ,2,15593,    geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,7,0,Transformation Number/EPSG Code/Name/Source ,3,10084,WGS 84 to EGM96 Geoid height (1),7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name        ,1, 1863,             ELD79 to WGS 84 (5),6
HC,1,8,1,Source CRS/Target CRS/Version               ,1,2,4159, ELD79,5,4326,           WGS 84, GMRA-Lby
HC,1,8,2,Transformation Method                       ,1,9607, Coordinate Frame Rotation (geog2D domain),1,7
HC,1,8,4,X-axis translation                          ,1,8605,-389.691,1,           metre,1
HC,1,8,4,Y-axis translation                          ,1,8606,  64.502,1,           metre,1
HC,1,8,4,Z-axis translation                          ,1,8607, 210.209,1,           metre,1
HC,1,8,4,X-axis rotation                             ,1,8608,  -0.086,5,      arc-second,1
HC,1,8,4,Y-axis rotation                             ,1,8609, -14.314,5,      arc-second,1
HC,1,8,4,Z-axis rotation                             ,1,8610,    6.39,5,      arc-second,1
HC,1,8,4,Scale difference                            ,1,8611,  0.9264,6,parts per million,1
HC,1,8,0,Transformation Number/EPSG Code/Name        ,2,15593,    geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version               ,2,6,4979,WGS 84,5,4326,           WGS 84,
HC,1,8,2,Transformation Method                       ,2,9659,            Geographic3D to 2D conversion,1,0
HC,1,8,0,Transformation Number/EPSG Code/Name        ,3,10084,WGS 84 to EGM96 Geoid height (1),1
HC,1,8,1,Source CRS/Target CRS/Version               ,3,6,4979,WGS 84,3,5773,EGM96 geoid height,NGA-World
HC,1,8,2,Transformation Method                       ,3,9661,Geographic3D to GravityRelatedHeight (EGM),0,1
HC,1,8,3,Geoid (height correction) model file        ,3,8666,WW15MGH.GRD,1
HC,1,9,0,Example Point Conversion                    ,1,,6,29.00000000,12.00000000,100.0,4,792352.67,3211891.14,70.92
```

Appendix D: P1/11 Format Data Record Examples

Number	Mode	Details
1	Marine	Marine Towed Streamer (3D) - Source Position Records

This example shows source and float positions in 3 CRSs, with positional quality estimates:

```
S1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3, G2,1,,391297.22,4092985.73,,36.91761093,-16.29212461,,36.97417522,-16.22215758,,2.2,1.2,234.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,2, G1,1,,391341.12,4092961.71,,36.97258981,-16.22807496,,36.97451410,-16.22202793,,2.4,1.2,134.2,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3, G2,1,,391297.20,4092985.78,,36.97631093,-16.22172461,,36.97471522,-16.22257528,,2.2,1.2,234.2,1.0,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,25,T1,1,,388911.73,4087063.99,,36.92244626,-16.24718704,,36.92110146,-16.24849295,,3.1,1.2,154.2,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,26,T2,1,,388824.25,4087112.45,,36.92288594,-16.24815996,,36.92151314,-16.24942887,,3.2,1.1,164.2,1.3,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,27,T3,1,,388737.21,4087161.98,,36.92332562,-16.24914304,,36.92191672,-16.25047226,,3.3,1.1,174.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,28,T4,1,,388650.27,4087211.20,,36.92375972,-16.21501272,,36.92241012,-16.25145264,,3.4,1.0,184.2,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,29,T5,1,,388562.68,4087259.15,,36.98241842,-16.25211176,,36.92281262,-16.25242468,,3.1,1.0,194.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,30,T6,1,,388475.32,4087308.21,,36.92946118,-16.25231047,,36.92321538,-16.25343239,,3.6,1.1,204.2,1.0,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,31,T7,1,,388387.13,4087355.33,,36.92500268,-16.25314017,,36.92361687,-16.25443029,,3.4,1.1,214.2,1.1,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,32,T8,1,,388300.64,4087405.64,,36.92541698,-16.25408500,,36.92411118,-16.25540293,,3.8,1.1,224.2,1.2,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,33,T9,1,,388213.73,4087455.35,,36.92590174,-16.25506268,,36.92451494,-16.25639221,,3.4,1.2,234.2,1.0,,
```

Number	Mode	Details
2	Marine	Marine Towed Streamer (3D) - Receiver Position Records

The first example shows single receiver records per line. It is converted from legacy data which did not include quality parameters:

```
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,480,391575.40,4092475.40,7.50,36.97154255,-16.21804800,,36.97018541,-16.21937761,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,479,391569.90,4092464.10,7.50,36.97144008,-16.21810815,,36.97008294,-16.21943776,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,478,391564.40,4092452.90,7.50,36.97133851,-16.21816832,,36.96998136,-16.21949793,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,477,391558.80,4092441.70,7.50,36.97123692,-16.21822961,,36.96987978,-16.21955921,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,476,391553.30,4092430.40,7.50,36.97113445,-16.21828976,,36.96977731,-16.21961936,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,475,391547.70,4092419.20,7.50,36.97103287,-16.21835105,,36.96967572,-16.21968065,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,474,391542.30,4092408.10,7.50,36.97093221,-16.21841011,,36.96957506,-16.21973971,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,473,391536.80,4092396.80,7.50,36.97082974,-16.21847026,,36.96947259,-16.21979986,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,472,391531.20,4092385.60,7.50,36.97072816,-16.21853154,,36.96937100,-16.21986114,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,471,391525.70,4092374.30,7.50,36.97062569,-16.21859169,,36.96926853,-16.21992129,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,470,391520.20,4092363.10,7.50,36.97052412,-16.21865186,,36.96916696,-16.21998146,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,469,391514.60,4092351.80,7.50,36.97042163,-16.21871313,,36.96906447,-16.22004273,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,468,391509.30,4092341.10,7.50,36.97032459,-16.21877112,,36.96896743,-16.22010072,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,467,391503.80,4092329.80,7.50,36.97022212,-16.21883127,,36.96886496,-16.22016086,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,466,391498.20,4092318.60,7.50,36.97012054,-16.21889256,,36.96876337,-16.22022215,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,465,391492.70,4092307.30,7.50,36.97001806,-16.21895271,,36.96866090,-16.22028230,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,464,391487.20,4092296.10,7.50,36.96991649,-16.21901287,,36.96855933,-16.22034246,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,463,391481.60,4092284.80,7.50,36.96981401,-16.21907414,,36.96845684,-16.22040373,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,462,391476.20,4092273.70,7.50,36.96971335,-16.21913320,,36.96835618,-16.22046279,,,,,,
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,461,391470.70,4092262.50,7.50,36.96961178,-16.21919336,,36.96825461,-16.22052295,,,,,,
```

The second example shows multiple receiver records per line and is the recommended format for writing receiver records into the P1/11 file:

```
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,480,391575.40,4092475.40,7.50,36.97154255,-16.21804800,,36.97018541,-16.21937761,,,,,,,,479,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,450,391410.10,4092139.40,7.50,36.96849539,-16.21985628,,36.96713820,-16.22118586,,,,,,,,449,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,420,391244.90,4091803.90,7.50,36.96545272,-16.22166337,,36.96409547,-16.22299291,,,,,,,,419,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,390,391079.70,4091468.00,7.50,36.96240642,-16.22347026,,36.96104912,-16.22479976,,,,,,,,389,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,360,390914.70,4091132.50,7.50,36.95936372,-16.22527481,,36.95800637,-16.22660429,,,,,,,,359,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,330,390749.40,4090796.70,7.50,36.95631826,-16.22708256,,36.95496085,-16.22841200,,,,,,,,329,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,300,390584.40,4090461.40,7.50,36.95327731,-16.22888686,,36.95191985,-16.23021627,,,,,,,,299,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,270,390419.20,4090125.80,7.50,36.95023361,-16.23069323,,36.94887610,-16.23202260,,,,,,,,269,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,240,390254.30,4089790.60,7.50,36.94719352,-16.23249614,,36.94583596,-16.23382548,,,,,,,,239,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,210,390089.20,4089455.30,7.50,36.94415248,-16.23430114,,36.94279486,-16.23563046,,,,,,,,209,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,180,389924.20,4089120.20,7.50,36.94111323,-16.23610492,,36.93975556,-16.23743419,,,,,,,,179,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,150,389759.00,4088784.70,7.50,36.93807032,-16.23791073,,36.93671260,-16.23923998,,,,,,,,149,…
R1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,4,S1,1,120,389594.00,4088449.80,7.50,36.93503282,-16.23971425,,36.93367505,-16.24104346,,,,,,,,119,…
```

Note that in the above example there are 30 receiver records per line (receivers 480 to 451 in the first line etc). This is indicated in the header section [HC,2,0,0], field 7. The second and subsequent receivers in the same line contain only a position in the first CRS fields, the coordinate tuples in the second and third CRS positions are not repeated.

Appendix E: Examples of Legacy Formats converted to P1/11

These examples are provided in order to demonstrate how legacy formats would appear after conversion to P1/11. If there is a compelling reason to convert a file from a legacy version to the new P1 format, it is recommended this should be done using software and not be attempted manually.

1) P1/90 to OGP P1/11

The header and some source position records extracted from the original P1/90 file is given below:

```
H0100SURVEY AREA                North Block 21
H0101GENERAL SURVEY DETAILS     1 VESSEL, 2 SOURCE,10 STREAMER
H0102VESSEL DETAILS             Train 2                    1
H0103SOURCE DETAILS             G1                         1   1
H0103SOURCE DETAILS             G2                         1   2
H0104STREAMER DETAILS           S1                         1       1   1
H0104STREAMER DETAILS           S2                         1       2   2
H0104STREAMER DETAILS           S3                         1       3   3
H0104STREAMER DETAILS           S4                         1       4   4
H0104STREAMER DETAILS           S5                         1       5   5
H0104STREAMER DETAILS           S6                         1       6   6
H0104STREAMER DETAILS           S7                         1       7   7
H0104STREAMER DETAILS           S8                         1       8   8
H0104STREAMER DETAILS           S9                         1       9   9
H0104STREAMER DETAILS           S10                        1       A   A
H0105OTHER DETAILS              N/A
H0200DATE OF SURVEY             01 August 2010
H0201DATE OF ISSUE POSTPLOT    03 September 2010                             .
H0202TAPE VERSION IDENTIFIER    UKOOA P1/90
H0203LINE PREFIX                OCL-
H0300CLIENT                     Oil Company Limited
H0400GEOPHYSICAL CONTRACTOR     Oil Finder Inc                                 .
H0500POSITIONING CONTRACTOR     General Positioning Limited                   ..
H0600POSITIONING PROCESSING     Position Processing Limited
H0700POSITIONING SYSTEM         Orca Version 1.8.1
H0800SHOTPOINT POSITION         MEAN CMP
H0900OFFSET V1 TO SHOTPOINT        1   2    0.00 -595.00
H2600SHOOTING POINT V1 MEAN CMP AT (0.0, -100.0)
H0901OFFSET V1 TO G1               1   2   25.00 -390.00
H0902OFFSET V1 TO G2               1   2  -25.00 -390.00
H0903OFFSET V1 TO S1               1   2  450.00 -700.00
H0904OFFSET V1 TO S2               1   2  350.00 -700.00
H0905OFFSET V1 TO S3               1   2  250.00 -700.00
H0906OFFSET V1 TO S4               1   2  150.00 -700.00
H0907OFFSET V1 TO S5               1   2   50.00 -700.00
H0908OFFSET V1 TO S6               1   2  -50.00 -700.00
H0909OFFSET V1 TO S7               1   2 -150.00 -700.00
H0910OFFSET V1 TO S8               1   2 -250.00 -700.00
H0911OFFSET V1 TO S9               1   2 -350.00 -700.00
H0912OFFSET V1 TO S10              1   2 -450.00 -700.00
H0913OFFSET V1 TO GPS V1G1         1   2    0.41    0.00
H0914OFFSET V1 TO GPS V1G2         1   2   -0.43    0.00
H0915OFFSET V1 TO GPS V1R1         1   2    0.00    0.00
```

```
H1000CLOCK TIME                 UTC
H1100RECEIVER GROUPS PER SHOT   4800
H1400GEODETIC DATUM (SURVEY)    WGS-84      WGS-84       6378137.000 298.2572236
H1401SURVEY TO WGS-84              0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1500GEODETIC DATUM (POST PLOT) WGS-84      WGS-84       6378137.000 298.2572236
H1501POST PLOT TO WGS-84           0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1510TOWNSHIP SYSTEM DATA FLAG  N/A
H1600SURVEY TO POST PLOT           0.0   0.0   0.0 0.000 0.000 0.000 0.0000000
H1700VERTICAL DATUM             SL                     :ECHOSOUNDER
H1800PROJECTION TYPE            1   UNIVERSAL TRANSVERSE MERCATOR (NORTH)
H1810TOWNSHIP RELATIVE COORDS   N/A
H1900PROJECTION ZONE            28 NORTHERN HEMISPHERE
H1910TOWNSHIP PRINCIPAL MERIDIANN/A
H2000GRID UNIT                  1METRES                   1.000000000000
H2001HEIGHT UNIT                1METRES                   1.000000000000
H2002ANGULAR UNIT               1DEGREES
H2200LONG OF CENTR. MERID       0150000.000W
H2301GRID ORIGIN                0000000.000N0150000.000W
H2302GRID COORD. AT ORIGIN        500000.00E       0.00N
H2401SCALE FACTOR               0.9996000000
H2402LAT/LON WHERE SCALE DEF    0000000.000N0150000.000W
H2600LINE CSL-T21021P1002 : 321 SHOTS (1001 TO 1321)
H2600GENERATED BY ORCA 1.8.1 FROM QC (NRT) DATABASE
H2600 VESSEL 1 ECHOSOUNDER 1 Echosounder 12 KHz
H2600 VELOCITY USED IN VESSEL 1 ECHOSOUNDER 1 1500.000000 M/S
H2600 CALIBRATED CORRECTION USED IN VESSEL 1 ECHOSOUNDER 1 0.000000 M/S
H2600 CALIBRATED VELOCITY CORRECTION HAS NOT BEEN APPLIED TO WATER DEPTHS
H2600 ORCA DOES NOT CORRECT RAW ECHO DATA FOR VESSEL PITCH, ROLL AND HEAVE
H2600 VESSEL 1 ECHOSOUNDER 1 RAW DATA IS HEAVE COMPENSATED
H2600 12 SOURCE MAPPING G2    A 2
H2600 12 SOURCE MAPPING G1    B 1
H2600 13 STREAMER MAPPING     A 1 S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
VT21021P1002    1    1001365847.20N01613 9.03W 391491.54093323.6  17.3246145623
ET21021P1002    1 1  1001365847.98N01613 8.70W 391500.24093347.5  17.3246145623
ZT21021P1002    11   1001365835.40N0161314.93W 391341.14092961.7  17.3246145623
ZT21021P1002    12   1001365836.16N0161316.72W 391297.24092985.7  17.3246145623
ST21021P1002    12   1001365836.16N0161316.72W 391297.24092985.7  17.3246145623
CT21021P1002    121  1001365827.94N0161310.96W 391436.34092730.5  17.3246145623
CT21021P1002    122  1001365828.71N0161312.74W 391392.64092755.0  17.3246145623
CT21021P1002    123  1001365829.49N0161314.52W 391349.04092779.4  17.3246145623
CT21021P1002    124  1001365830.26N0161316.29W 391305.34092803.9  17.3246145623
CT21021P1002    125  1001365831.04N0161318.07W 391261.64092828.3  17.3246145623
CT21021P1002    126  1001365831.81N0161319.85W 391218.04092852.7  17.3246145623
CT21021P1002    127  1001365832.59N0161321.63W 391174.44092877.2  17.3246145623
CT21021P1002    128  1001365833.36N0161323.41W 391130.74092901.7  17.3246145623
CT21021P1002    129  1001365834.14N0161325.18W 391087.04092926.1  17.3246145623
CT21021P1002    12A  1001365834.91N0161326.96W 391043.44092950.6  17.3246145623
TT21021P1002    1 1  1001365523.02N0161450.05W 388911.74087063.9  17.3246145623
TT21021P1002    1 2  1001365524.56N0161453.61W 388824.24087112.4  17.3246145623
TT21021P1002    1 3  1001365526.13N0161457.15W 388737.24087161.9  17.3246145623
TT21021P1002    1 4  1001365527.69N01615 0.70W 388650.24087211.2  17.3246145623
TT21021P1002    1 5  1001365529.22N01615 4.26W 388562.64087259.5  17.3246145623
TT21021P1002    1 6  1001365530.76N01615 7.81W 388475.34087308.1  17.3246145623
TT21021P1002    1 7  1001365532.26N0161511.40W 388387.14087355.3  17.3246145623
TT21021P1002    1 8  1001365533.85N0161514.92W 388300.64087405.6  17.3246145623
TT21021P1002    1 9  1001365535.43N0161518.46W 388213.74087455.3  17.3246145623
TT21021P1002    1 A  1001365536.96N0161522.03W 388126.24087503.6  17.3246145623
```

After conversion to P1/11 format this P1/90 file would appear as follows:

```
OGP,OGP P1,1,1,1,2012:07:13,08:09:31,CSL-T21021P1002.p111,OGP
HC,0,1,0,Project Name                                      ,Test,TEST01,2010:08:01,2010:09:03
HC,0,2,0,Survey Description                                ,Marine 3D Towed Streamer,2 SOURCE 10 STREAMER,North Block 21,578,NOR
HC,0,3,0,Approximate Data Location                         ,-16.222,-16.177,36.976,37.04
HC,0,4,0,Client                                            ,Oil Company Limited
HC,0,5,0,Geophysical Contractor                            ,Oil Finder Inc
HC,0,6,0,Positioning Contractor                            ,General Positioning Limited
HC,0,7,0,Position Processing Contractor                    ,Position Processing Limited
HC,1,0,0,Reference Systems Summary                         ,5,1,7,1
HC,1,1,0,Unit of Measure                                   ,1, metre,length, 2, , ,          ,   , , metre,9001,       EPSG Dataset,7.6,9001
HC,1,1,0,Unit of Measure                                   ,2,radian, angle, 2, , ,          ,   , ,radian,9101,       EPSG Dataset,7.6,9101
HC,1,1,0,Unit of Measure                                   ,3,degree, angle, 2,2,0,3.141592654,180,0,degree,9102,       EPSG Dataset,7.6,9102
HC,1,1,0,Unit of Measure                                   ,4, unity, scale, 2, , ,          ,   , , unity,9201,       EPSG Dataset,7.6,9201
HC,1,1,0,Unit of Measure                                   ,5,second,  time,12, , ,          ,   , ,second,    ,POSC UOM Dictionary,2.2,   s
HC,1,1,1,Example Unit Conversion                           ,1,2,1,3,57.295779513
HC,1,2,0,Time Reference System                             ,1,1,0,UTC,0,,5
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,1,32628,           WGS 84 / UTM zone 28N,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,2, 4326,                          WGS 84,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,3, 5715,                       MSL depth,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,4,     ,WGS 84 / UTM zone 28N + MSL depth,   ,          ,    ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,5,     ,                        SL depth,7.6,2010:11:02,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,6,     , WGS 84 / UTM zone 28N + SL depth,   ,          ,    ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,7, 4979,                          WGS 84,7.6,2010:11:02,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,1,32628,1,    projected,           WGS 84 / UTM zone 28N
HC,1,4,3,Base Geographic CRS                               ,1,2,4326
HC,1,4,4,Geodetic Datum                                    ,1,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,1,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,1,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,5,0,Projection                                        ,1,16028,UTM zone 28N
HC,1,5,1,Projection Method                                 ,1,9807,Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                        ,1,8801,     0,3,degree
HC,1,5,2,Longitude of natural origin                       ,1,8802,   -15,3,degree
HC,1,5,2,Scale factor at natural origin                    ,1,8805,0.9996,4, unity
HC,1,5,2,False easting                                     ,1,8806,500000,1, metre
HC,1,5,2,False northing                                    ,1,8807,     0,1, metre
HC,1,6,0,Coordinate System                                 ,1,4400,  Cartesian 2D CS,2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,1,1,  1,              Easting, east,   E,1, metre
HC,1,6,1,Coordinate System Axis 2                          ,1,2,  2,             Northing,north,   N,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,2, 4326,2,geographic 2D,                          WGS 84
HC,1,4,4,Geodetic Datum                                    ,2,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,2,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,2,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                 ,2,6422,Ellipsoidal 2D CS,3,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,2,1,106,     Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,2,2,107,    Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,3, 5715,5,     vertical,                        MSL depth
HC,1,4,7,Vertical Datum                                    ,3,5100,Mean Sea Level
HC,1,6,0,Coordinate System                                 ,3,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                          ,3,1,113,                Depth, down,   D,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,4,     ,6,     compound,WGS 84 / UTM zone 28N + MSL depth
HC,1,4,1,Compound Horizontal CRS                           ,4,1,WGS 84 / UTM zone 28N
HC,1,4,2,Compound Vertical CRS                             ,4,3,MSL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,5,     ,5,     vertical,                         SL depth
```

```
HC,1,4,7,Vertical Datum                                      ,5,5113,     Sea Level
HC,1,6,0,Coordinate System                                   ,5,6498,      Vertical CS,5,   vertical,1
HC,1,6,1,Coordinate System Axis 1                            ,5,1,113,                Depth, down,   D,1, metre
HC,1,4,0,CRS Number/EPSG Code/Type/Name                      ,6,     ,6,     compound, WGS 84 / UTM zone 28N + SL depth
HC,1,4,1,Compound Horizontal CRS                             ,6,1, WGS 84 / UTM zone 28N
HC,1,4,2,Compound Vertical CRS                               ,6,5, SL depth
HC,1,4,0,CRS Number/EPSG Code/Type/Name                      ,7, 4979,3,geographic 3D,                          WGS 84
HC,1,4,4,Geodetic Datum                                      ,7,6326,World Geodetic System 1984
HC,1,4,5,Prime Meridian                                      ,7,8901,Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                           ,7,7030,WGS 84,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                   ,7,6423,Ellipsoidal 3D CS,3,ellipsoidal,3
HC,1,6,1,Coordinate System Axis 1                            ,7,1,108,    Geodetic latitude,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                            ,7,2,109,   Geodetic longitude, east,Long,3,degree
HC,1,6,1,Coordinate System Axis 3                            ,7,3,110,   Ellipsoidal height,   up,   h,1, metre
HC,1,7,0,Transformation Number/EPSG Code/Name/Source         ,1,15593,geographic3D to geographic2D,7.6,2010:11:02,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name                ,1,15593,geographic3D to geographic2D,
HC,1,8,1,Source CRS/Target CRS/Version                       ,1,7,4979,WGS 84,2,4326,WGS 84,
HC,1,8,2,Transformation Method                               ,1,9659,Geographic3D to 2D conversion,1,0
HC,1,9,0,Example Point Conversion                            ,1,,7,42.00000000,-15.00000000,0.000,1,500000.00,4649776.22,,2,42.00000000,-15.00000000,
HC,2,0,0,Survey Configuration                                ,1,0,24,1,metre
HC,2,1,0,Orca                                                ,1,Navigation,Orca,1.8.1,
HC,2,3,0,Train 2                                             , 1,  V1, 1,      Vessel,,,  ,     ,    ,,,13,,
HC,2,3,0,Source G1                                           , 2,  G1, 4,     Air Gun,,, 1,   25,-390,,,  ,,
HC,2,3,0,Source G2                                           , 3,  G2, 4,     Air Gun,,, 1,  -25,-390,,,  ,,
HC,2,3,0,Streamer S1                                         , 4,  S1, 2,    Streamer,,, 1,  450,-700,,, 1,,
HC,2,3,0,Streamer S2                                         , 5,  S2, 2,    Streamer,,, 1,  350,-700,,, 1,,
HC,2,3,0,Streamer S3                                         , 6,  S3, 2,    Streamer,,, 1,  250,-700,,, 1,,
HC,2,3,0,Streamer S4                                         , 7,  S4, 2,    Streamer,,, 1,  150,-700,,, 1,,
HC,2,3,0,Streamer S5                                         , 8,  S5, 2,    Streamer,,, 1,   50,-700,,, 1,,
HC,2,3,0,Streamer S6                                         , 9,  S6, 2,    Streamer,,, 1,  -50,-700,,, 1,,
HC,2,3,0,Streamer S7                                         ,10,  S7, 2,    Streamer,,, 1, -150,-700,,, 1,,
HC,2,3,0,Streamer S8                                         ,11,  S8, 2,    Streamer,,, 1, -250,-700,,, 1,,
HC,2,3,0,Streamer S9                                         ,12,  S9, 2,    Streamer,,, 1, -350,-700,,, 1,,
HC,2,3,0,Streamer S10                                        ,13, S10, 2,    Streamer,,, 1, -450,-700,,, 1,,
HC,2,3,0,Train 2 Echo 1                                      ,14,V1E1,11,Echo Sounder,,, 1,     ,    ,,,  ,,
HC,2,3,0,GPS V1G1                                            ,15,V1G1,21, GPS Antenna,,, 1, 0.41,   0,,,  ,,
HC,2,3,0,GPS V1G2                                            ,16,V1G2,21, GPS Antenna,,, 1,-0.43,   0,,,  ,,
HC,2,3,0,GPS V1R1                                            ,17,V1R1,21, GPS Antenna,,, 1,    0,   0,,,  ,,
HC,2,3,0,Tailbuoy on S1                                      ,25,  T1,10,       Float,,, 4,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S2                                      ,26,  T2,10,       Float,,, 5,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S3                                      ,27,  T3,10,       Float,,, 6,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S4                                      ,28,  T4,10,       Float,,, 7,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S5                                      ,29,  T5,10,       Float,,, 8,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S6                                      ,30,  T6,10,       Float,,, 9,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S7                                      ,31,  T7,10,       Float,,,10,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S8                                      ,32,  T8,10,       Float,,,11,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S9                                      ,33,  T9,10,       Float,,,12,     ,    ,,,  ,,
HC,2,3,0,Tailbuoy on S10                                     ,34, T10,10,       Float,,,13,     ,    ,,,  ,,
CC,1,0,0,SHOOTING POINT V1 MEAN CMP AT (0.0 -100.0)
CC,1,0,0,LINE CSL-T21021P1002  321 SHOTS (1001 TO 1321)
CC,1,0,0,GENERATED BY ORCA 1.8.1 FROM QC (NRT) DATABASE
CC,1,0,0,VESSEL 1 ECHOSOUNDER 1 Echosounder 12 KHz
CC,1,0,0,VELOCITY USED IN VESSEL 1 ECHOSOUNDER 1 1500.000000 M/S
CC,1,0,0,CALIBRATED CORRECTION USED IN VESSEL 1 ECHOSOUNDER 1 0.000000 M/S
CC,1,0,0,CALIBRATED VELOCITY CORRECTION HAS NOT BEEN APPLIED TO WATER DEPTHS
```

```
CC,1,0,0,ORCA DOES NOT CORRECT RAW ECHO DATA FOR VESSEL PITCH ROLL AND HEAVE
CC,1,0,0,VESSEL 1 ECHOSOUNDER 1 RAW DATA IS HEAVE COMPENSATED
CC,1,0,0,12 SOURCE MAPPING G2    A 2
CC,1,0,0,12 SOURCE MAPPING G1    B 1
CC,1,0,0,13 STREAMER MAPPING     A 1 S1 S2 S3 S4 S5 S6 S7 S8 S9 S10
H1,0,0,0,File Contents Description                         ,MEAN CMP,Imported from P190
H1,0,1,0,Processing Details                                ,Converted from P190 File
H1,0,2,0,Receiver Groups Per Shot                          ,1,                       4800,,
H1,0,2,0,Original File                                     ,2,CSL-T21021P1002.WGS-84.p190,,
H1,1,0,0,Position Record Type Definition                   ,1,   1,2,2,1,1,0,
H1,1,0,0,Position Record Type Definition                   ,2,   1,2,2,1,1,1,1;5;Water Depth;1
H1,1,0,1,Position Record Quality Definition                ,1,0,No Quality Data Recorded,,,0,
H1,1,0,1,Position Record Quality Definition                ,2,0,No Quality Data Recorded,,,0,
H1,2,0,0,Receiver Record Type Definition                   ,1,30,6,2,2,1,1,1,0,
H1,2,0,1,Receiver Record Quality Definition                ,1,0,No Quality Data Recorded,3,1,0,
S1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3,G2,1,,391297.20,4092985.70,,36.97671040,-16.22131009,,36.97671040,-16.22131009,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,2,G1,1,,391341.10,4092961.70,,36.97649917,-16.22081351,,36.97649917,-16.22081351,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3,G2,1,,391297.20,4092985.70,,36.97671040,-16.22131009,,36.97671040,-16.22131009,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&4,G2&S1,1,,391436.30,4092730.50,,36.97442649,-16.21971087,,36.97442649,-16.21971087,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&5,G2&S2,1,,391392.60,4092755.00,,36.97464225,-16.22020526,,36.97464225,-16.22020526,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&6,G2&S3,1,,391349.00,4092779.40,,36.97485712,-16.22069852,,36.97485712,-16.22069852,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&7,G2&S4,1,,391305.30,4092803.90,,36.97507287,-16.22119292,,36.97507287,-16.22119292,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&8,G2&S5,1,,391261.60,4092828.30,,36.97528773,-16.22168731,,36.97528773,-16.22168731,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&9,G2&S6,1,,391218.00,4092852.70,,36.97550259,-16.22218057,,36.97550259,-16.22218057,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&10,G2&S7,1,,391174.40,4092877.20,,36.97571835,-16.22267386,,36.97571835,-16.22267386,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&11,G2&S8,1,,391130.70,4092901.70,,36.97593410,-16.22316827,,36.97593410,-16.22316827,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&12,G2&S9,1,,391087.00,4092926.10,,36.97614894,-16.22366266,,36.97614894,-16.22366266,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,3&13,G2&S10,1,,391043.40,4092950.60,,36.97636469,-16.22415595,,36.97636469,-16.22415595,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,25,T1,1,,388911.70,4087063.90,,36.92306227,-16.24723566,,36.92306227,-16.24723566,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,26,T2,1,,388824.20,4087112.40,,36.92348905,-16.24822497,,36.92348905,-16.24822497,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,27,T3,1,,388737.20,4087161.90,,36.92392490,-16.24920883,,36.92392490,-16.24920883,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,28,T4,1,,388650.20,4087211.20,,36.92435894,-16.25019267,,36.92435894,-16.25019267,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,29,T5,1,,388562.60,4087259.50,,36.92478388,-16.25118311,,36.92478388,-16.25118311,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,30,T6,1,,388475.30,4087308.10,,36.92521155,-16.25217024,,36.92521155,-16.25217024,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,31,T7,1,,388387.10,4087355.30,,36.92562650,-16.25316727,,36.92562650,-16.25316727,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,32,T8,1,,388300.60,4087405.60,,36.92606957,-16.25414569,,36.92606957,-16.25414569,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,33,T9,1,,388213.70,4087455.30,,36.92650718,-16.25512852,,36.92650718,-16.25512852,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,34,T10,1,,388126.20,4087503.60,,36.92693209,-16.25611790,,36.92693209,-16.25611790,,,,,,
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,1,V1,2,,391491.50,4093323.60,,36.97977813,-16.21917611,,36.97977813,-16.21917611,,,,,,17.30
P1,0,T21021P1002,,1001,,1,2010:246:14:56:23.0,14,V1E1,2,,391500.20,4093347.50,,36.97999453,-16.21908181,,36.97999453,-16.21908181,,,,,,17.30
```

Note that for demonstration purposes the third coordinate tuple (the reference CRS) is populated even though it is the same CRS as the second coordinate tuple (WGS 84).

2) SEG-P1 (1983) to OGP P1/11

An extract from the original SEG-P1 file is given below:

```
H Quality Control: EnSoCo, Inc.  Date:    Tue Oct 25 15:08:45 2011
 Used by permission of Seismic Exchange Inc. for purposes of OGP format examples
 PROSPECT    : PA-Westmoreland
 LINE PREFIX :
 LINE        : 5NE-258
 RESHOOT CODE:
 LINE ID     : 567638
 FILE NUMBER : 5NE-258
 LINE LENGTH :     6.726
 LENGTH UOM  :  MI
 PROJECTION  : Lambert Conic Conformal (2SP) EPSG Projection Code :  9802
 GEODETIC DATUM: North American Datum 1927 EPSG Datum Code :  6267
 EPSG GEOGRAPHIC CS: Pennsylvania CS27 South zo EPSG Code: 13702 BASE Code: 4267
 EPSG PROJECTED CS : NAD27 / Pennsylvania South EPSG Code : 32029
 ELLIPSOID    : Clarke 1866 EPSG Code:  7008
 ELLIPSOID SEMIMAJOR : 6378206.400 1/FLATTENING : 294.97869820
 GRID UNITS : USC&GS Feet EPSG UNITS CODE:  9003
 GRID UNITS CONVERSION TO METERS :      0.304800610
 XY & Height/Elev units rounded to nearest whole unit
 < LINE NAME/1D ><POINT >R<  LAT  ><  LONG  ><EAST/X><NRTH/Y><ELE>
 5NE-258               1 40170060N079241692W 1538364  350443 1043    0
 5NE-258               2 40170295N079241612W 1538430  350679 1073    0
 5NE-258               3 40170530N079241530W 1538499  350916 1075    0
 5NE-258               4 40170765N079241447W 1538567  351153 1070    0
 5NE-258               5 40170997N079241355W 1538643  351387 1082    0
 5NE-258               6 40171231N079241264W 1538718  351622 1068    0
 5NE-258               7 40171464N079241172W 1538793  351856 1088    0
 5NE-258               8 40171695N079241080W 1538870  352089 1093    0
 5NE-258               9 40171925N079240972W 1538957  352319 1097    0
 5NE-258              10 40172147N079240840W 1539063  352543 1072    0
 5NE-258              11 40172362N079240694W 1539181  352757 1064    0
 5NE-258              12 40172570N079240532W 1539310  352966 1076    0
 5NE-258              13 40172773N079240359W 1539448  353169 1074    0
 5NE-258              14 40172962N079240162W 1539604  353358 1093    0
 5NE-258              15 40173176N079240005W 1539730  353571 1084    0
 5NE-258              16 40173411N079235936W 1539788  353808 1084    0
 5NE-258              17 40173649N079235990W 1539751  354049 1065    0
 5NE-258              18 40173879N079240093W 1539675  354283 1056    0
 5NE-258              19 40174072N079235924W 1539810  354476 1037    0
 5NE-258              20 40174225N079235679W 1540003  354628 1033    0
```

After conversion to P1/11 format this SEG P1 file would appear as follows:

```
OGP,OGP P1,1, 1.0,1,2012:07:14,20:05:18,SNE-258.p111,EnSoCo Inc
HC,0,1,0,Project Name                                       ,PAWest,PA-Westmoreland,2010:08:01,
HC,0,2,0,Survey Description                                 ,Land Seismic,2D,Pennsylvania USA,840,USA
HC,0,3,0,Approximate Data Location                          ,-79.46,-79.40,40.28,40.38
HC,0,4,0,Client                                             ,Seismic Exchange Inc
HC,0,5,0,Geophysical Contractor                             ,Seismic Exchange Inc
```

```
HC,0,6,0,Positioning Contractor                            ,Seismic Exchange Inc
HC,0,7,0,Position Processing Contractor                    ,Seismic Exchange Inc
HC,1,0,0,Reference Systems Summary                         ,5,0,5,1
HC,1,1,0,Unit of Measure                                   ,1,metre         ,length, 2, ,0,           ,     ,0,metre         ,9001,EPSG Dataset                   ,7.6,9001
HC,1,1,0,Unit of Measure                                   ,2,radian        ,angle , 2, ,0,           ,     ,0,radian        ,9101,EPSG Dataset                   ,7.6,9101
HC,1,1,0,Unit of Measure                                   ,3,degree        ,angle , 2,1,0,3.141592654,  180,0,degree        ,9102,EPSG Dataset                   ,7.6,9102
HC,1,1,0,Unit of Measure                                   ,5,US Survey Foot ,length, 2,3,0,        12,39.37,0,US Survey Foot ,9003,EPSG Dataset                   ,7.6,9003
HC,1,1,0,Unit of Measure                                   ,6,sexagesimal DMS,angle ,29,3,0,         0,    0,0,sexagesimal DMS,9110,EPSG Dataset                   ,7.6,9110
HC,1,1,1,Example Unit Conversion                           ,1,    2,     1,  3, 57.295779506
HC,1,1,1,Example Unit Conversion                           ,2,    1,     1,  5, 3.280833333
HC,1,1,1,Example Unit Conversion                           ,3,    3, 39.56,  6, 39.3336
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,1, 4455,NAD27 / Pennsylvania South                             ,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,2, 4267,NAD27                                                  ,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,3, 5714,Elevation Above Mean Sea Level                         ,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,4,     ,NAD27 / Pennsylvania South + Elevation Above Mean Sea Level,   ,          ,    ,
HC,1,3,0,CRS Number/EPSG Code/Name/Source                  ,5, 4326,WGS 84                                                 ,7.9,2011:08:17,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,1, 4455,1,    Projected,NAD27 / Pennsylvania South
HC,1,4,3,Base Geographic CRS                               ,1,    2, 4267
HC,1,4,4,Geodetic Datum                                    ,1, 6267, North American Datum 1927
HC,1,4,5,Prime Meridian                                    ,1, 8901, Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,1, 7008, Clarke 1866,6378206.4,1,metre,294.97869820
HC,1,5,0,Map Projection                                    ,1, 4436,Pennsylvania CS27 South zone
HC,1,5,1,Projection Method                                 ,1, 9802,Lambert Conic Conformal (2SP),6
HC,1,5,2,Latitude of false origin                          ,1, 8821,    39.2, 6, sexagesimal DMS
HC,1,5,2,Longitude of false origin                         ,1, 8822,  -77.45, 6, sexagesimal DMS
HC,1,5,2,Latitude of 1st standard parallel                 ,1, 8823,   40.58, 6, sexagesimal DMS
HC,1,5,2,Latitude of 2nd standard parallel                 ,1, 8824,   39.56, 6, sexagesimal DMS
HC,1,5,2,Easting at false origin                           ,1, 8826, 2000000, 5, US Survey Foot
HC,1,5,2,False northing                                    ,1, 8827,       0, 5, US Survey Foot
HC,1,6,0,Coordinate System                                 ,1, 4497,  Cartesian 2D CS, 2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                          ,1,    1,      37,  Easting,  east,   X, 5,US Survey Foot
HC,1,6,1,Coordinate System Axis 2                          ,1,    2,      38, Northing, north,   Y, 5,US Survey Foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,2, 4267,2,Geographic 2D,NAD27
HC,1,4,4,Geodetic Datum                                    ,2, 6267, North American Datum 1927
HC,1,4,5,Prime Meridian                                    ,2, 8901, Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,2, 7008, Clarke 1866,6378206.4,1,metre,294.9786982
HC,1,6,0,Coordinate System                                 ,2, 6422, Ellipsoidal 2D CS, 3, ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,2,    1, 106,   Geodetic latitude ,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,2,    2, 107,   Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,3, 5714,5,     Vertical,Mean Sea Level Height
HC,1,4,7,Vertical Datum                                    ,3, 5100, Mean Sea Level
HC,1,6,0,Coordinate System                                 ,3, 6497,      Vertical CS, 5,  vertical,1
HC,1,6,1,Coordinate System Axis 1                          ,3,    1, 112,Gravity-related height, up,   H,5, US Survey Foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,4,     ,7,     Compound,NAD27 / Pennsylvania South + Elevation Above Sea Level
HC,1,4,1,Comppound Horizontal CRS                          ,4,    1, NAD 27 / Pennsylvania South
HC,1,4,2,Compound Vertical CRS                             ,4,    3, Elevation Above Mean Sea Level
HC,1,4,0,CRS Number/EPSG Code/Type/Name                    ,5, 4326,2,Geographic 2D,WGS84
HC,1,4,4,Geodetic Datum                                    ,5, 6326, World Geodetic System 1984
HC,1,4,5,Prime Meridian                                    ,5, 8901, Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                         ,5, 7030, WGS84 ,6378137,1,metre,298.257223563
HC,1,6,0,Coordinate System                                 ,5, 6422, Ellipsoidal 2D CS, 3, ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                          ,5,    1, 106,   Geodetic latitude ,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                          ,5,    2, 107,   Geodetic longitude, east,Long,3,degree
HC,1,7,0,Transformation Number/EPSG Code/Name/Source       ,1, 1174, NAD27 to WGS 84 (5),7.9,2011:08:17,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name              ,1, 1174, NAD27 to WGS 84 (5),11
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HC,1,8,1,Source CRS/Target CRS/Version                    ,1,    2, 4267, NAD27, 5, 4326, WGS84, DMA-ConusE
HC,1,8,2,Transformation Method                            ,1,9603,Geocentric translations (geog2D domain),1,3
HC,1,8,4,X-axis translation                               ,1,8605, -9.0,1,metre,1
HC,1,8,4,Y-axis translation                               ,1,8606,161.0,1,metre,1
HC,1,8,4,Z-axis translation                               ,1,8607,179.0,1,metre,1
HC,1,9,0,Example Point Conversion                         ,1,,    2,40.28349935,-79.40469878,,1,1538368.17,350451.44,,5,40.28354895 ,-79.40445770,
HC,2,0,0,Survey Configuration                             ,1,    0,  1,  5, US Survey Foot
HC,2,1,0,Land Seismic Survey                              ,1, Position Data,Unknown,,
HC,2,3,0,Land Shot Point                                  ,1, SP,7, Explosive,,,,,,,,,
CC,1,0,0, LINE 5NE-258 - 169 SHOTS (1 TO 169)  - 6.726 miles
CC,1,0,0, No date and times were available on SEGP1 input file
H1,0,0,0,File Contents Description                        ,Shot Point,Imported from SEGP1 file
H1,0,1,0,Processing Details                               ,Converted from SEGP1 file
H1,1,0,0,Position Record Type Definition                  ,1,4,2,5,,1,0,
H1,1,0,1,Position Record Quality Definition               ,1,0,No Quality Data Recorded,,,0,
S1,0,5NE-258,,  1,,1,,1,SP,1,,1538369.0,350451.0,1043,40.28349935,-79.40469878,,40.28354895,-79.40445770,,,,,,
S1,0,5NE-258,,  2,,1,,1,SP,1,,1538434.0,350688.0,1073,40.28415317,-79.40448176,,40.28420006,-79.40423699,,,,,,
S1,0,5NE-258,,  3,,1,,1,SP,1,,1538503.0,350924.0,1075,40.28480445,-79.40425033,,40.28485406,-79.40400560,,,,,,
S1,0,5NE-258,,  4,,1,,1,SP,1,,1538571.0,351161.0,1070,40.28545842,-79.40402255,,40.28550802,-79.40377778,,,,,,
S1,0,5NE-258,,  5,,1,,1,SP,1,,1538648.0,351395.0,1082,40.28610462,-79.40376231,,40.28615415,-79.40352109,,,,,,
S1,0,5NE-258,,  6,,1,,1,SP,1,,1538723.0,351631.0,1068,40.28675620,-79.40350937,,40.28680297,-79.40326804,,,,,,
S1,0,5NE-258,,  7,,1,,1,SP,1,,1538797.0,351864.0,1088,40.28739951,-79.40325980,,40.28744904,-79.40301492,,,,,,
S1,0,5NE-258,,  8,,1,,1,SP,1,,1538874.0,352098.0,1093,40.28804570,-79.40299954,,40.28809247,-79.40275456,,,,,,
S1,0,5NE-258,,  9,,1,,1,SP,1,,1538961.0,352328.0,1097,40.28868144,-79.40270317,,40.28872820,-79.40245815,,,,,,
S1,0,5NE-258,, 10,,1,,1,SP,1,,1539068.0,352551.0,1072,40.28929898,-79.40233465,,40.28934841,-79.40209325,,,,,,
S1,0,5NE-258,, 11,,1,,1,SP,1,,1539185.0,352766.0,1064,40.28989509,-79.40192975,,40.28994180,-79.40168465,,,,,,
S1,0,5NE-258,, 12,,1,,1,SP,1,,1539314.0,352975.0,1076,40.29047534,-79.40148143,,40.29052202,-79.40123630,,,,,,
S1,0,5NE-258,, 13,,1,,1,SP,1,,1539452.0,353178.0,1074,40.29103958,-79.40100044,,40.29108623,-79.40075527,,,,,,
S1,0,5NE-258,, 14,,1,,1,SP,1,,1539608.0,353366.0,1093,40.29156357,-79.40045392,,40.29161295,-79.40020879,,,,,,
S1,0,5NE-258,, 15,,1,,1,SP,1,,1539734.0,353579.0,1084,40.29215464,-79.40001660,,40.29220400,-79.39977142,,,,,,
S1,0,5NE-258,, 16,,1,,1,SP,1,,1539792.0,353816.0,1084,40.29280809,-79.39982459,,40.29285742,-79.39957938,,,,,,
S1,0,5NE-258,, 17,,1,,1,SP,1,,1539755.0,354058.0,1065,40.29347039,-79.39997341,,40.29351697,-79.39972812,,,,,,
S1,0,5NE-258,, 18,,1,,1,SP,1,,1539679.0,354292.0,1056,40.29410874,-79.40026148,,40.29415531,-79.40001616,,,,,,
S1,0,5NE-258,, 19,,1,,1,SP,1,,1539814.0,354485.0,1037,40.29464537,-79.39979054,,40.29469192,-79.39954519,,,,,,
S1,0,5NE-258,, 20,,1,,1,SP,1,,1540007.0,354636.0,1033,40.29506971,-79.39910889,,40.29511897,-79.39886357,,,,,,
```

3) SEG SPS001 to OGP P1/11

Extracts from the original SPS001 files are given below:

```
H000SPS format version num.     SPS001,03.01.00;
H010Description of survey area  Alaska,Cook Inlet,TZ2D,00001;
H020Date of survey              04.02.11;
H021Postplot date of issue     07.14.11;
H022Tape/disk identifier        West Foreland 2D Test;
H030Client                      Apache;
H040Geophysical contractor      Northern Exploration Services;
H050Positioning contractor      Extreme Surveys & NCS SubSea;
H060Pos. proc. contractor       Ensoco & NCS SubSea;
H070Field computer system(s)    None,SN428,Manual Entry;
H080Coordinate location         Center of Source and of Receiver Patterns;
H090Offset to coord. location
H100Clock time w.r.t. GMT       -8;
H110Spare
H120Geodetic datum,-spheroid    NAD-27 CLARKE 1866 6378206.4 294.978698214;
H130Spare
H140Geodetic datum parameters   North American Datum 1927 NADCON;
H150Spare
H160Spare
H170Vertical datum description  NGVD29;
H180Projection type             Transverse Mercator;
H190Projection zone             Alaska State Plane,4;
H200Description of grid units   US Survey Ft;
H201Factor to metre             0.3048006096;
H210Lat. of standard parallel(s)540000.00N;
H220Long. of central meridian   1500000.00W;
H231Grid origin                 540000.00N 1500000.00W;
H232Grid coord. at origin       500000.00E 0.00N;
H241Scale factor                0.9999;
H242Lat., long. scale factor
H256Lat., long. initial line
H257Circular bearing of H256
H258Quadrant bearing of H256
H259Angle from skew
H26                             Undefined value is replaced by ___;
H300Project code and descriptionWest Foreland 2D Test,TZ2D;
H310Line number format          Line Number(1:16);
```

```
H400Type,Model,Polarity         1,SN428XL,0001,SEG;
H401Crew name,Comment           1,85;
H402Sample int.,Record Len.     1,2.00 msec,12.00 sec;
H403Number of channels          1,1463;
H404Tape type,format,density    1,HARD DISK,SEG 8058;
H405Filter_alias Hz,dB pnt,slope1,0.8 Nyquist Minimum Phase;
H406Filter_notch Hz,-3dB points
H407Filter_low Hz,dB pnt,slope  1,Out;
H408Time delay FTB-SOD app Y/N  1,0 msec, Not applied;
H409Multi component recording   1,Z;
H410Aux. channel 1 contents     1,Confirmation TB;
H411Aux. channel 2 contents     1,Reference;
H412Aux. channel 3 contents     1,Analog Uphole;
H413Aux. channel 4 contents
H414Spare
H415Spare
H416Spare
H417Spare
H418Spare
H419Spare
H26 Cable Recording Line 111
H600Type,model,polarity         G1,G_LAND,SM-24,SEG;
H601Damp coeff,natural freq.    G1,0.67,10Hz;
H602Nunits,len(X),width(Y)      G1,6,60Ft,0Ft;
H603Unit spacing X,Y            G1,12Ft,0Ft;
H604Spare
H605Spare
H606Spare
H607Spare
H608Spare
H609Spare
H26 Fairfield Z Land Node Line 102
H630Type,model,polarity         G4,G_LAND,GS-30CT,SEG;
H631Damp coeff,natural freq.    G4,0.67,10Hz;
H632Nunits,len(X),width(Y)      G4,1,0Ft,0Ft;
H633Unit spacing X,Y            G4,0Ft,0Ft;
H634Spare
H635Spare
H636Spare
H637Spare
H638Spare
```

```
H639Spare
H26 Cable Recording Line 111 (Sercel 408ULS Multi-Component Hydrophone/Geophone)
H640Type,model,polarity         R1,MULTI,408ULS,SEG;
H641Damp coeff,natural freq.    R1,0.67,10Hz;
H642Nunits,len(X),width(Y)      R1,1,1Ft,1Ft;
H643Unit spacing X,Y            R1,1Ft,1Ft;
H644Spare
H645Spare
H646Spare
H647Spare
H648Spare
H649Spare
H26 Fairfield Z-700 Marine Node Line 102
H26 3 Geophones (Hytec / Omni-directional - 15hz)
H26 1 Hydrophone (Hytec 10hz)
H650Type,model,polarity         R2,MULTI,Z-700,SEG;
H651Damp coeff,natural freq.    R2,0.67,NA;
H652Nunits,len(X),width(Y)      R2,1,1Ft,1Ft;
H653Unit spacing X,Y            R2,1Ft,1Ft;
H654Spare
H655Spare
H656Spare
H657Spare
H658Spare
H659Spare
H700Type,model,polarity         E1,Explosive,OSX 8Z,SEG;
H701Size,vert. stk fold         E1,1.1Lb,1;
H702Nunits,len(X),width(Y)      E1,10,40Ft,10Ft;
H703Unit spacing X,Y            E1,10Ft,10Ft;
H711Nom. shot depth,charge len. E1,8Ft,1Ft;
H712Nom. soil,drill method
H713Weathering thickness
H714Spare
H715Spare
H720Type,model,polarity         E2,Explosive,OSX 8Z,SEG;
H721Size,vert. stk fold         E2,4.4Lb,1;
H722Nunits,len(X),width(Y)      E2,1,0Ft,0Ft;
H723Unit spacing X,Y            E2,0Ft,0Ft;
H731Nom. shot depth,charge len. E2,25Ft,2Ft;
H732Nom. soil,drill method
H733Weathering thickness
```

```
H734Spare
H735Spare
H740Type,model,polarity         E3,Explosive,OSX 8Z,SEG;
H741Size,vert. stk fold         E3,4.4Lb,1;
H742Nunits,len(X),width(Y)      E3,1,0Ft,0Ft;
H743Unit spacing X,Y            E3,0Ft,0Ft;
H751Nom. shot depth,charge len. E3,35Ft,2Ft;
H752Nom. soil,drill method
H753Weathering thickness
H754Spare
H755Spare
H760Type,model,polarity         E4,Explosive,OSX 8Z,SEG;
H761Size,vert. stk fold         E4,8.8Lb,1;
H762Nunits,len(X),width(Y)      E4,1,0Ft,0Ft;
H763Unit spacing X,Y            E4,0Ft,0Ft;
H771Nom. shot depth,charge len. E4,35Ft,4Ft;
H772Nom. soil,drill method
H773Weathering thickness
H774Spare
H775Spare
H780Type,model,polarity         E5,Explosive,OSX 8Z,SEG;
H781Size,vert. stk fold         E5,8.8Lb,1;
H782Nunits,len(X),width(Y)      E5,1,0Ft,0Ft;
H783Unit spacing X,Y            E5,0Ft,0Ft;
H791Nom. shot depth,charge len. E5,45Ft,4Ft;
H792Nom. soil,drill method
H793Weathering thickness
H794Spare
H795Spare
H800Type,model,polarity         E6,Explosive,OSX 8Z,SEG;
H801Size,vert. stk fold         E6,8.8Lb,1;
H802Nunits,len(X),width(Y)      E6,1,0Ft,0Ft;
H803Unit spacing X,Y            E6,0Ft,0Ft;
H811Nom. shot depth,charge len. E6,100Ft,4Ft;
H812Nom. soil,drill method
H813Weathering thickness
H814Spare
H815Spare
H820Type,model,polarity         E7,Explosive,OSX 8Z,SEG;
H821Size,vert. stk fold         E7,4.4Lb,1;
H822Nunits,len(X),width(Y)      E7,1,0Ft,0Ft;
```

```
H823Unit spacing X,Y            E7,0Ft,0Ft;
H831Nom. shot depth,charge len. E7,25Ft,2Ft;
H832Nom. soil,drill method
H833Weathering thickness
H834Spare
H835Spare
H840Type,model,polarity         E8,Explosive,OSX 8Z,SEG;
H841Size,vert. stk fold         E8,8.8Lb,1;
H842Nunits,len(X),width(Y)      E8,1,0Ft,0Ft;
H843Unit spacing X,Y            E8,0Ft,0Ft;
H851Nom. shot depth,charge len. E8,35Ft,4Ft;
H852Nom. soil,drill method
H853Weathering thickness
H854Spare
H855Spare
H990R,S,X file quality control  ;
H991Coord. status final/prov    Final;
H26
H26 Source of coordinates (1st Layout - Index 1)
H26 Land Shots                              Extreme Surveys Postplot
H26 Marine Shots                            Ensoco Postplot
H26 Land Nodes Line 102 Sta 1001-1613       Extreme Surveys Postplot
H26 Marine Nodes Line 102 Sta 1615-1977     Ensoco Postplot
H26 Land Receivers Line 111 Sta 1001-1629   Extreme Surveys Postplot
H26 Marine Receivers Line 111 Sta 1631-1717 Extreme Surveys Postplot
H26 Marine Receivers Line 111 Sta 1719-1975 NCS Drop Locations
H26
H26 Source of coordinates (2nd Layout - Index 2)
H26 Land Shots                              Extreme Surveys Postplot
H26 Marine Shots                            Ensoco Postplot
H26 Land Nodes Line 102 Sta 1001-1613       Extreme Surveys Postplot
H26 Marine Nodes Line 102 Sta 1615-1977     Ensoco Postplot
H26 Land Receivers Line 111 Sta 1001-1629   Extreme Surveys Postplot
H26 Marine Receivers Line 111 Sta 1631-1659 Extreme Surveys Postplot
H26 Marine Receivers Line 111 Sta 1661-1913 Ensoco Postplot
H26
H26 NOTE TO PROCESSORS
H26
H26 An extra FDU was mistakenly inserted between receivers 111-1703 & 111-1705
H26 for FFID 0001-0727.
H26 This FDU has been edited out of the Relational file.
```

```
H26 Note the 2 channel gap between these 2 stations.
H26
H26 NOTE TO PROCESSORS
H26
H26 The extra FDU between receivers 111-1703 & 111-1705 was disabled for FFID
H26 0728-0764.
H26 No editing of the Relational file was required.
H26
H26 NOTE TO PROCESSORS
H26
H26 The marine portion of receiver line 111 (111-1631 and higher) was relaid
H26 between FFID 0765-0769. The initial receiver layout is index 1. After the
H26 cable relay the receiver index is 2. For simplicity the land receiver
H26 positions have been repeated with receiver index 2 even though their
H26 position did not move.
H26
H26 NOTE TO PROCESSORS
H26
H26 Marine Point depth column
H26
H26   Source = height of water above the energy source
H26   at the time of the shot
H26
H26 Marine Water depth column
H26
H26   Source = height of water surface above seafloor
H26   at the time of the shot
H26   Receiver = height of water surface above seafloor
H26   at the time of the receiver lay.
H26   Nikisi, Alaska
H26
H26 NOTE TO PROCESSORS
H26
H26 This is a final version.
H26
H26 USE OF THIS FILE BY THE OGP P1/P2 TASK FORCE
H26 HAS BEEN APPROVED BY APACHE CORP.
H26
H26 567890123456789012345678901234567890123456789012345678901234567890123456789
H26      1         2         3         4         5         6         7         8
```

Sample land source (dynamite) position data from this survey:

S104	11361E2	25	38	146155.2	2497892.5	25.1077141352
S106	11361E4	35	51	146183.3	2497903.5	25.3077141914
S104	13201E2	25	13	151581.4	2483715.8	24.0077152401
S107	13311E5	45	18	151947.4	2482884.0	23.2077153411
S109	13311E7	25	19	151975.5	2482894.9	23.2084152530
S110	13311E8	35	19	151989.8	2482900.3	23.2084152948
S109	13361E7	25	32	152123.2	2482509.4	23.5084153814
S110	13361E8	35	36	152137.3	2482515.0	23.2084154228
S109	13401E7	25	29	152241.3	2482201.7	23.2084154856
S110	13401E8	32	30	152254.8	2482206.8	23.2084155135
S109	16531E7	25	8	161478.0	2458073.9	12.3084155422
S109	13571E7	25	28	152742.6	2480891.8	23.1084160120
S109	16481E7	25	8	161323.6	2458470.0	13.3084160307
S110	13571E8	35	28	152756.7	2480897.1	22.9084160353
S110	16481E8	25	5	161337.7	2458475.6	13.3084160704
S109	13601E7	25	23	152831.5	2480660.2	23.2084160951
S110	13601E8	35	26	152845.2	2480665.8	23.0084161219
S109	13681E7	25	21	153066.8	2480044.2	23.6084162254
S110	13681E8	35	19	153081.1	2480049.5	23.4084162526
S108	13681E6	40	24	153052.6	2480038.5	23.5084162806

Sample marine airgun source position data from this survey :

S101	17851A6	7	51	165018.5	2447784.0	085090954
S101	17841A6	7	51	164987.3	2447860.2	085091008
S101	17831A6	7	51	164964.5	2447938.6	085091021
S101	17821A6	7	52	164947.9	2448020.5	085091034
S101	17811A6	7	52	164937.4	2448104.4	085091047
S101	17801A6	7	52	164927.0	2448188.0	085091100
S101	17791A6	7	52	164913.8	2448272.8	085091113
S101	17781A6	7	54	164895.7	2448354.4	085091126
S101	17771A6	7	56	164872.0	2448432.6	085091140
S101	17761A6	7	59	164840.2	2448509.2	085091154
S101	17751A6	7	60	164806.9	2448585.4	085091208
S101	17741A6	7	61	164774.5	2448660.9	085091222
S101	17731A6	7	61	164744.7	2448737.7	085091236
S101	17721A6	7	60	164715.5	2448815.0	085091250
S101	17711A6	7	57	164684.5	2448891.8	085091304

```
S101                17701A6       7        55 164652.6 2448968.4       085091318
S101                17691A6       7        52 164621.7 2449044.7       085091333
S101                17681A6       7        50 164592.4 2449122.0       085091347
S101                17671A6       7        46 164567.1 2449200.3       085091400
S101                17661A6       7        41 164546.7 2449280.3       085091413
```

Sample land receiver position data from this survey :

```
R111                10011G1                   142195.5 2508346.4 707.6
R111                10031G1                   142253.5 2508192.2 690.2
R111                10051G1                   142312.5 2508038.7 682.2
R111                10071G1                   142371.6 2507883.7 662.1
R111                10091G1                   142430.9 2507729.9 650.4
R111                10111G1                   142489.4 2507576.1 638.0
R111                10131G1                   142548.6 2507421.5 613.4
R111                10151G1                   142607.8 2507267.7 605.7
R111                10171G1                   142667.3 2507113.3 587.5
R111                10191G1                   142725.5 2506959.8 579.6
R111                10211G1                   142784.7 2506805.8 575.4
R111                10231G1                   142843.0 2506651.2 574.4
R111                10251G1                   142902.6 2506497.5 571.8
R111                10271G1                   142961.6 2506342.9 556.2
R111                10291G1                   143020.4 2506188.8 549.3
R111                10311G1                   143078.9 2506035.5 538.7
R111                10331G1                   143138.7 2505880.2 526.6
R111                10351G1                   143197.3 2505726.8 521.6
R111                10371G1                   143256.2 2505572.2 515.2
R111                10391G1                   143315.4 2505418.8 508.3
```

Sample marine receiver position data from this survey :

```
R111                17191R1              19.0 163434.5 2453047.7 -13.3084105520
R111                17211R1              23.0 163502.4 2452899.8 -16.9084105434
R111                17231R1              26.0 163560.2 2452745.5 -20.2084105355
R111                17251R1              29.0 163615.8 2452589.3 -23.2084105310
R111                17271R1              31.0 163681.1 2452438.5 -25.4084105226
R111                17291R1              33.0 163731.2 2452280.7 -27.0084105141
R111                17311R1              34.9 163794.5 2452129.3 -28.9084105050
R111                17331R1              36.9 163791.2 2451951.5 -30.7084104850
```

```
R111                    17351R1                 35.9 163896.1 2451813.7 -29.8084104714
R111                    17371R1                 34.8 163962.0 2451662.0 -29.3084104612
R111                    17391R1                 35.8 164023.9 2451509.2 -29.7084104520
R111                    17411R1                 35.8 164098.7 2451360.9 -29.6084104426
R111                    17431R1                 34.8 164157.4 2451207.3 -28.6084104337
R111                    17451R1                 32.7 164215.8 2451052.6 -27.1084104245
R111                    17471R1                 33.7 164275.3 2450898.7 -27.8084104151
R111                    17491R1                 34.7 164330.4 2450743.3 -28.5084104059
R111                    17511R1                 35.7 164384.2 2450587.2 -29.8084104007
R111                    17531R1                 35.7 164450.8 2450435.5 -30.0084103918
R111                    17551R1                 35.6 164519.0 2450285.1 -29.7084103828
R111                    17571R1                 34.6 164567.2 2450127.5 -28.6084103741
```

Sample relational data from this survey :

```
X1         211104                 11361   1 2831111                           1065     16291
X1         311106                 11361   1 2831111                           1065     16291
X1         411104                 13201   1 2831111                           1065     16291
X1         511107                 13311   1 2831111                           1065     16291
X1        1811109                 13311   1 3151111                           1001     16291
X1        1811109                 13311 316 3892111                           1631     17031
X1        1811109                 13311 392 6172111                           1705     19291
X1        1911110                 13311   1 3151111                           1001     16291
X1        1911110                 13311 316 3892111                           1631     17031
X1        1911110                 13311 392 6172111                           1705     19291
X1        2011109                 13361   1 3151111                           1001     16291
X1        2011109                 13361 316 3892111                           1631     17031
X1        2011109                 13361 392 6172111                           1705     19291
X1        2111110                 13361   1 3151111                           1001     16291
X1        2111110                 13361 316 3892111                           1631     17031
X1        2111110                 13361 392 6172111                           1705     19291
X1        2211109                 13401   1 3151111                           1001     16291
X1        2211109                 13401 316 3892111                           1631     17031
X1        2211109                 13401 392 6172111                           1705     19291
X1        2311110                 13401   1 3151111                           1001     16291
```

After conversion to OGP P1/11 format the above SPS 1.0 file looks like this:

```
OGP,OGP P1,1,1.0,1,2011:11:18,08:54:43,apache_land_marine.p111,EnSoCo Inc
HC,0,1,0,Project Name                                   ,SPSConversion-Alaska,Cook Inlet,2011:04:02,
HC,0,2,0,Survey Description                             ,2D Test TZ2D,Marine/Land Seismic Survey,West Foreland,840,USA
HC,0,3,0,Approximate Data Location                      ,-151.76,-152.05,60.13,60.90
HC,0,4,0,Client                                         ,Apache Alaska Corp.
HC,0,5,0,Geophysical Contractor                         ,SAExploration
HC,0,6,0,Positioning Contractor                         ,Extreme Surveys
HC,0,6,0,Positioning Contractor                         ,NCS Subsea
HC,0,7,0,Position Processing Contractor                 ,EnSoCo Inc
HC,0,7,0,Position Processing Contractor                 ,NCS SubSea
HC,1,0,0,Reference Systems Summary                      ,21,1,7,1
HC,1,1,0,Unit of Measure                                , 1, metre              , length                    , 2,  , ,           ,             , , metre              ,9001,EPSG
        Dataset,7.9, 9001
HC,1,1,0,Unit of Measure                                , 2, radian             , angle                     , 2,  , ,           ,             , , radian             ,9101,EPSG
        Dataset,7.9, 9101
HC,1,1,0,Unit of Measure                                , 3, degree             , angle                     , 2, 2,0,        180, 3.141592654,0, degree             ,9102,EPSG
        Dataset,7.9, 9102
HC,1,1,0,Unit of Measure                                , 4, unity              , scale                     , 2,  , ,           ,             , , unity              ,9201,EPSG
        Dataset,7.9, 9201
HC,1,1,0,Unit of Measure                                , 5, US survey foot     , length                    , 2, 1,0,         12, 39.37       , , US survey foot     ,9003,EPSG
        Dataset,7.9, 9003
HC,1,1,0,Unit of Measure                                , 6, second             , time                      ,11,  , ,           ,             , , second             ,    ,POSC
        Units of Measure Dictionary,2.2, s
HC,1,1,0,Unit of Measure                                , 7, second             , time                      ,12,  , ,           ,             , , second             ,    ,POSC
        Units of Measure Dictionary,2.2, s
HC,1,1,0,Unit of Measure                                , 8, milliseconds       , time                      , 2,11,0,      0.001,            1,0, milliseconds       ,    ,POSC
        Units of Measure Dictionary,2.2, ms
HC,1,1,0,Unit of Measure                                , 9, hertz              , frequency                 , 2,  , ,           ,             , , hertz              ,    ,POSC
        Units of Measure Dictionary,2.2, Hz
HC,1,1,0,Unit of Measure                                ,10, bel                , level of power intensity, 2,  , ,           ,             , , bel                ,    ,POSC
        Units of Measure Dictionary,2.2, B
HC,1,1,0,Unit of Measure                                ,11, decibel            , level of power intensity, 2,10,0,        0.1,            1,0, decibel            ,    ,POSC
        Units of Measure Dictionary,2.2, dB
HC,1,1,0,Unit of Measure                                ,12, bels/octave        , attenuation               , 2,  , ,           ,             , , bels/octave        ,    ,POSC
        Units of Measure Dictionary,2.2, BPO
HC,1,1,0,Unit of Measure                                ,13, decibels/octave    , attenuation               , 2,12,0,        0.1,            1,0, decibels/octave    ,    ,POSC
        Units of Measure Dictionary,2.2, dBPO
HC,1,1,0,Unit of Measure                                ,14, cubic metres       , volume                    , 2,  , ,           ,             , , cubic metres       ,    ,POSC
        Units of Measure Dictionary,2.2, m3
HC,1,1,0,Unit of Measure                                ,15, cubic inch         , volume                    , 2,14,0,0.000016387,            1,0, cubic inch         ,    ,POSC
        Units of Measure Dictionary,2.2, cu_in
HC,1,1,0,Unit of Measure                                ,16, pascals/metre      , force per volume          , 2,  , ,           ,             , , pascals/metre      ,    ,POSC
        Units of Measure Dictionary,2.2, PaPm
HC,1,1,0,Unit of Measure                                ,17, bar per meter      , force per volume          , 2,16,0,     100000,            1,0, bar per meter      ,    ,POSC
        Units of Measure Dictionary,2.2, barPm
HC,1,1,0,Unit of Measure                                ,18, pascal             , force per area            , 2,  , ,           ,             , , pascal             ,    ,POSC
        Units of Measure Dictionary,2.2, Pa
HC,1,1,0,Unit of Measure                                ,19, pounds/square inch, force per area            , 2,18,0,   6894.757,            1,0, pounds/square inch,    ,POSC
        Units of Measure Dictionary,2.2, psi
HC,1,1,0,Unit of Measure                                ,20, kilogram           , mass                      , 2,  , ,           ,             ,0, kilogram           ,    ,POSC
        Units of Measure Dictionary,2.2, kg
HC,1,1,0,Unit of Measure                                ,21, pounds mass        , mass                      , 2,20,0,  0.4535924,            1,0, pounds             ,    ,POSC
        Units of Measure Dictionary,2.2, lbm
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HC,1,1,1,Example Unit Conversion                    ,1, 2,1, 3,    57.29577951
HC,1,1,1,Example Unit Conversion                    ,2, 6,1, 8,           1000
HC,1,1,1,Example Unit Conversion                    ,3,10,1,11,             10
HC,1,1,1,Example Unit Conversion                    ,4,12,1,13,             10
HC,1,1,1,Example Unit Conversion                    ,5,14,1,15,    61023.98243
HC,1,1,1,Example Unit Conversion                    ,6,16,1,17,        0.00001
HC,1,1,1,Example Unit Conversion                    ,7,18,1,19,0.0001450377439
HC,1,1,1,Example Unit Conversion                    ,8, 1,1, 5,3.2808333333333
HC,1,1,1,Example Unit Conversion                    ,9,20,1,21,   2.2046226218
HC,1,2,0,Time Reference System                      ,1,1,0,UTC,0,,7
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,1, 26734 , NAD27 / Alaska zone 4,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,2,  4267 ,               NAD27 ,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,3,  5702 ,        NGVD29 height,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,4,  5831 ,     sea level depth ,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,5,       , NAD27 / Alaska zone 4 +  NGVD29 height,,,,
CC,1,0,0, Note- For Offshore surveys at MSL- NAD83 is considered functionally equivalent to WGS84
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,6,  4269 ,               NAD83 ,7.9,2011:08:17,EPSG,
HC,1,3,0,CRS Number/EPSG Code/Name/Source           ,7,  5715 ,            MSL depth,7.9,2011:08:17,EPSG,
HC,1,4,0,CRS Number/EPSG Code/Type/Name             ,1, 26734 ,  1,    Projected,NAD27 / Alaska zone 4
HC,1,4,3,Base Geographical CRS                      ,1,     2 , 4267
HC,1,4,4,Geodetic Datum                             ,1,  6267 , North American Datum 1927
HC,1,4,5,Prime Meridian                             ,1,  8901 , Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                  ,1,  7008 , Clarke 1866,6378206.4,1,metre,294.97869820
HC,1,5,0,Map Projection                             ,1, 15004 , Alaska CS27 zone 4
HC,1,5,1,Projection Method                          ,1,  9807 , Transverse Mercator,5
HC,1,5,2,Latitude of natural origin                 ,1,  8801 ,     54, 3, degree
HC,1,5,2,Longitude of natural origin                ,1,  8802 ,   -150, 3, degree
HC,1,5,2,Scale factor at natural origin             ,1,  8805 , 0.9999, 4, unity
HC,1,5,2,False easting                              ,1,  8806 , 500000, 5, US survey foot
HC,1,5,2,False northing                             ,1,  8807 ,      0, 5, US survey foot
HC,1,6,0,Coordinate System                          ,1,  4497 ,  Cartesian 2D CS,  2,  Cartesian,2
HC,1,6,1,Coordinate System Axis 1                   ,1,     1 , 37,           Easting, east,   X, 5,US survey foot
HC,1,6,1,Coordinate System Axis 2                   ,1,     2 , 38,          Northing,north,   Y, 5,US survey foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name             ,2,  4267 ,  2,Geographic 2D,    NAD27
HC,1,4,4,Geodetic Datum                             ,2,  6267 , North American Datum 1927
HC,1,4,5,Prime Meridian                             ,2,  8901 , Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                  ,2,  7008 , Clarke 1866,6378206.4,1,metre,294.97869820
HC,1,6,0,Coordinate System                          ,2,  6422 , Ellipsoidal 2D CS, 3 ,ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                   ,2,     1 ,106, Geodetic latitude ,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                   ,2,     2 ,107, Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name             ,3,  5702 ,  5, Vertical, NGVD29 height
HC,1,4,7,Vertical Datum Details                     ,3,  5102 , National Geodetic Vertical Datum 1929
HC,1,6,0,Coordinate System                          ,3,  6497 , Vertical CS Axis-height-Orientation-up UoM-ftUS, 5,  Vertical,1
HC,1,6,1,Coordinate System Axis 1                   ,3,     1 ,112,Gravity-related height, up,   H, 5, US survey foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name             ,4,       ,  5, Vertical, Sea Level Depth
HC,1,4,7,Vertical Datum Details                     ,4,  5113 , Sea Level
HC,1,6,0,Coordinate System                          ,4,       , Vertical CS Axis-height-Orientation-down UoM-ftUS, 5,  Vertical,1
HC,1,6,1,Coordinate System Axis 1                   ,4,     1 ,  1,                Depth, down, D, 5, US survey foot
HC,1,4,0,CRS Number/EPSG Code/Type/Name             ,5,       ,  7,Compound Projected and Vertical,Alaska zone 4 +  NGVD29 Height
HC,1,4,1,Compound Horizontal CRS                    ,5,     1 , NAD27 / Alaska zone 4
HC,1,4,2,Compound Vertical CRS                      ,5,     3 , NGVD29 Height
HC,1,4,0,CRS Number/EPSG Code/Type/Name             ,6,  4269 , 2,geographic 2D,               NAD83
HC,1,4,4,Geodetic Datum                             ,6,  6269 , North American Datum 1983
HC,1,4,5,Prime Meridian                             ,6,  8901 , Greenwich,0,3,degree
HC,1,4,6,Ellipsoid                                  ,6,  7019 , GRS 1980,  6378137,1,metre,298.257222101
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HC,1,6,0,Coordinate System                                ,6,  6422 , Ellipsoidal 2D CS,3, ellipsoidal,2
HC,1,6,1,Coordinate System Axis 1                         ,6,     1 , 106, Geodetic latitude ,north, Lat,3,degree
HC,1,6,1,Coordinate System Axis 2                         ,6,     2 , 107, Geodetic longitude, east,Long,3,degree
HC,1,4,0,CRS Number/EPSG Code/Type/Name                   ,7,5715   ,   5, Vertical,MSL depth
HC,1,4,7,Vertical Datum                                   ,7,5100   , Mean Sea Level
HC,1,6,0,Coordinate System                                ,7,       , Vertical CS Axis-height-Orientation-down UoM-ftUS, 5,  Vertical,1
HC,1,6,1,Coordinate System Axis 1                         ,7,     1 ,  1,                Depth, down, D, 5, US survey foot
HC,1,7,0,Transformation Number/EPSG Code/Name/Source      ,1,  1243 , NAD27 to NAD83 (2),7.9,2011:08:17,EPSG,
HC,1,8,0,Transformation Number/EPSG Code/Name             ,1,  1243 , NAD27 to NAD83 (2),0.5
HC,1,8,1,Source CRS/Target CRS/Version                    ,1,     3 , 4267, NAD27, 6, 4269, NAD83, NGS-Usa AK
HC,1,8,2,Transformation Method                            ,1,  9613 , NADCON,1,2
HC,1,8,3,Latitude difference file                         ,1,  8657 , alaska.las,1
HC,1,8,3,Longitude difference file                        ,1,  8658 , alaska.los,1
HC,1,9,0,Example Coordinate                               ,1,,     2 , 60.65333002,-151.83955293,,1, 169943.7, 2435345.1,,6, 60.65275835, -151.84180802,
HC,2,0,0,Survey Configuration                             ,2,     4 , 13, 5, US Survey Foot
HC,2,1,0,Sercel SN428 Cable-Free Seismic Acquisition System, 1,Acquisition Management,Sercel SN428XL Model 0001,,
HC,2,1,1,Method Of Transfer With Recording System         , 1,20 , Manual Entry                         ,  ,
HC,2,1,1,Polarity                                         , 1, 1 , SEG                                  ,  ,
HC,2,1,1,Sample Interval                                  , 1, 2 , 2                                    , 8,milliseconds
HC,2,1,1,Record Length                                    , 1, 3 , 12                                   , 7,second
HC,2,1,1,Channels Per Record                              , 1, 4 , 1463                                 ,  ,
HC,2,1,1,Tape Type                                        , 1, 5 , Hard Disk                            ,  ,
HC,2,1,1,Tape Format                                      , 1, 6 , SEG D 8058 32 bit IEEE demultiplexed,  ,
HC,2,1,1,Tape Density                                     , 1, 7 , Hard Disk                            ,  ,
HC,2,1,1,Filter-Alias Hz-dB pnt-slope                     , 1,100, 0.8 Nyquist Minimum Phase            ,  ,
HC,2,1,1,Filter_low Hz-dB pnt-slope                       , 1,14 , Out                                  ,  ,
HC,2,1,1,Time delay FTB-SOD app Y/N                       , 1,17 , 0                                    , 8,milliseconds
HC,2,1,1,Time Delay FTB to SOD Applied to Data Flag       , 1,18 , Not applied                          ,  ,
HC,2,1,1,Multi component recording                        , 1,19 , Z                                    ,  ,
HC,2,1,2,Auxilliary Channel 1 Definition                  , 1, 1 , Confirmation TB                      ,  , ,
HC,2,1,2,Auxilliary Channel 2 Definition                  , 1, 2 , Reference                            ,  , ,
HC,2,1,2,Auxilliary Channel 3 Definition                  , 1, 3 , Analog Uphole                        ,  , ,
HC,2,1,2,Auxilliary Channel 4 Definition                  , 1, 4 ,                                      ,  , ,
HC,2,2,0,Input/Output SM-24 Geophone Element              , 2, G1, Land Geophone    ,SM-24
HC,2,2,1,Polarity                                         , 2, 1  , SEG             ,  ,
HC,2,2,1,Damping Coefficient                              , 2, 2  , 0.67            ,  ,
HC,2,2,1,Natural Frequency                                , 2, 3  , 10              ,10, hertz
HC,2,2,1,Number of Elements in Group                      , 2, 4  , 6               ,  ,
HC,2,2,1,Inline Dimension of Group                        , 2, 5  , 60              , 5,US Survey Foot
HC,2,2,1,Crossline Dimension of Group                     , 2, 6  , 0               , 5,US Survey Foot
HC,2,2,1,Inline Distance Between Elements in the Group    , 2, 7  , 0               , 5,US Survey Foot
HC,2,2,1,Crossline Distance Between Elements in the Group , 2, 8  , 12              , 5,US Survey Foot
HC,2,2,0,Sercel 408ULS Multi_Component Hydrophone/Geophone , 4, R1 , MULTI Component,408ULS
CC,1,0,0,Cable Recording Line 111 (Sercel 408ULS Multi-Component Hydrophone/Geophone)
HC,2,2,1,Polarity                                         , 4, 1  , SEG             ,  ,
HC,2,2,1,Damping Coefficient                              , 4, 2  , 0.67            ,  ,
HC,2,2,1,Natural Frequency                                , 4, 3  , 10              ,10, hertz
HC,2,2,1,Number of Elements in Group                      , 4, 4  , 1               ,  ,
HC,2,2,1,Inline Dimension of Group                        , 4, 5  , 1               , 5,US Survey Foot
HC,2,2,1,Crossline Dimension of Group                     , 4, 6  , 1               , 5,US Survey Foot
HC,2,2,1,Inline Distance Between Elements in the Group    , 4, 7  , 1               , 5,US Survey Foot
HC,2,2,1,Crossline Distance Between Elements in the Group , 4, 8  , 1               , 5,US Survey Foot
HC,2,1,0,Fairfield Z700 Remote Marine Nodal Acq'n System   , 2,Acquisition Management,Fairfield Z700,,
HC,2,1,1,Method Of Transfer With Recording System         , 2,20 , Independent - Recording Cable Free and Communication Free Continuously, ,
HC,2,1,1,Polarity                                         , 2, 1 , SEG                                  ,  ,
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HC,2,1,1,Sample Interval                               , 2, 2 , 2                                   , 8,milliseconds
HC,2,1,1,Record Length                                 , 2, 3 , 12                                  , 5,second
HC,2,1,1,Channels Per Record                           , 2, 4 , 4                                   ,  ,
HC,2,1,1,Tape Type                                     , 2, 5 , 32GB NAND Flash Memory              ,  ,
HC,2,1,1,Tape Format                                   , 2, 6 , SEG D 8058 32 bit IEEE demultiplexed,  ,
HC,2,1,1,Tape Density                                  , 2, 7 , 32GB NAND Flash Memory              ,  ,
HC,2,1,1,Filter-Alias Hz-dB pnt-slope                  , 2,100, 0.8 Nyquist Minimum Phase           ,  ,
HC,2,1,1,Filter_low Hz-dB pnt-slope                    , 2,14 , Out                                 ,  ,
HC,2,1,1,Time Delay FTB to SOD                         , 2,17 , 0                                   , 8,milliseconds
HC,2,1,1,Time Delay FTB to SOD Applied to Data Flag    , 2,18 , Not applied                         ,  ,
HC,2,1,1,Components Recorded (Multi)                   , 2,19 , Z                                   ,  ,
HC,2,1,2,Auxilliary Channel 1 Definition               , 2, 1 , Recorded but not used               ,  ,,
HC,2,1,2,Auxilliary Channel 2 Definition               , 2, 2 , Recorded but not used               ,  ,,
HC,2,1,2,Auxilliary Channel 3 Definition               , 2, 3 , Recorded but not used               ,  ,,
HC,2,1,2,Auxilliary Channel 4 Definition               , 2, 4 , Confirmation TB                     ,  ,,
HC,2,2,0,Geospace Technologies Close Tolerance Geophone    , 3, G4, Land Geophone  ,GS-30CT
HC,2,2,1,Polarity                                      , 3, 1  , SEG           ,  ,
HC,2,2,1,Damping Coefficient                           , 3, 2  , 0.67          ,  ,
HC,2,2,1,Natural Frequency                             , 3, 3  , 10            ,10, hertz
HC,2,2,1,Number of Elements in Group                   , 3, 4  , 1             ,  ,
HC,2,2,1,Inline Dimension of Group                     , 3, 5  , 0             , 5,US Survey Foot
HC,2,2,1,Crossline Dimension of Group                  , 3, 6  , 0             , 5,US Survey Foot
HC,2,2,1,Inline Distance Between Elements in the Group     , 3, 7  , 0             , 5,US Survey Foot
HC,2,2,1,Crossline Distance Between Elements in the Group  , 3, 8  , 0             , 5,US Survey Foot
CC,1,0,0,Fairfield Z-700 Marine Node Line 102
CC,1,0,0,3 Geophones (Oyo-Geospace X-Phone-LT Omniphone)
CC,1,0,0,1 Hydrophone (High Tech HTI-96-MIN - 10hz)
HC,2,2,0,Fairfield Marine Nodal System(3 Geo-/1Hydrophone) , 5, R2 , MULTI Component,Z-700
HC,2,2,1,Polarity                                      , 5, 1  , SEG           ,  ,
HC,2,2,1,Damping Coefficient                           , 5, 2  , 0.67          ,  ,
HC,2,2,1,Natural Frequency                             , 5, 3  , N/A           ,  ,
HC,2,2,1,Number of Elements in Group                   , 5, 4  , 1             ,  ,
HC,2,2,1,Inline Dimension of Group                     , 5, 5  , 1.0           , 5,US Survey Foot
HC,2,2,1,Crossline Dimension of Group                  , 5, 6  , 1.0           , 5,US Survey Foot
HC,2,2,1,Inline Distance Between Elements in the Group     , 5, 7  , 0             , 5,US Survey Foot
HC,2,2,1,Crossline Distance Between Elements in the Group  , 5, 8  , 0             , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx           , 6, E1 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                      , 6, 1  , SEG           ,  ,
HC,2,3,1,Total Charge Size                             , 6, 2  , 1.1           ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                        , 6, 5  , 1             ,  ,
HC,2,3,1,Number of Elements in Pattern                 , 6, 7  , 10            ,  ,
HC,2,3,1,Inline Dimension of Pattern                   , 6, 8  , 40            , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                , 6, 9  , 10            , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   , 6,10  , 10            , 5,US Survey Foot
HC,2,3,1,Crossline Distance Between Elements in the Pattern, 6,11  , 10            , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                            , 6,22  , 8             , 5,US Survey Foot
HC,2,3,1,Length of Charge                              , 6,23  , 1             , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx           , 7, E2 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                      , 7, 1  , SEG           ,  ,
HC,2,3,1,Total Charge Size                             , 7, 2  , 4.4           ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                        , 7, 5  , 1             ,  ,
HC,2,3,1,Number of Elements in Pattern                 , 7, 7  , 1             ,  ,
HC,2,3,1,Inline Dimension of Pattern                   , 7, 8  , 0             , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                , 7, 9  , 0             , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   , 7,10  , 0             , 5,US Survey Foot
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HC,2,3,1,Crossline Distance Between Elements in the Pattern, 7,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                                , 7,22  , 25             , 5,US Survey Foot
HC,2,3,1,Length of Charge                                  , 7,23  , 2              , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx               , 8, E3 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                          , 8, 1  , SEG            ,  ,
HC,2,3,1,Total Charge Size                                 , 8, 2  , 4.4            ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                            , 8, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                     , 8, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of Pattern                       , 8, 8  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                    , 8, 9  , 0              , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   , 8,10  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Distance Between Elements in the Pattern, 8,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                                , 8,22  , 35             , 5,US Survey Foot
HC,2,3,1,Length of Charge                                  , 8,23  , 2              , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx               , 9, E4 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                          , 9, 1  , SEG            ,  ,
HC,2,3,1,Total Charge Size                                 , 9, 2  , 8.8            ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                            , 9, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                     , 9, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of Pattern                       , 9, 8  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                    , 9, 9  , 0              , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   , 9,10  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Distance Between Elements in the Pattern, 9,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                                , 9,22  , 35             , 5,US Survey Foot
HC,2,3,1,Length of Charge                                  , 9,23  , 4              , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx               ,10, E5 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                          ,10, 1  , SEG            ,  ,
HC,2,3,1,Total Charge Size                                 ,10, 2  , 8.8            ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                            ,10, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                     ,10, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of Pattern                       ,10, 8  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                    ,10, 9  , 0              , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,10,10  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Distance Between Elements in the Pattern,10,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                                ,10,22  , 45             , 5,US Survey Foot
HC,2,3,1,Length of Charge                                  ,10,23  , 4              , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx               ,11, E6 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                          ,11, 1  , SEG            ,  ,
HC,2,3,1,Total Charge Size                                 ,11, 2  , 8.8            ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                            ,11, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                     ,11, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of Pattern                       ,11, 8  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                    ,11, 9  , 0              , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,11,10  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Distance Between Elements in the Pattern,11,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                                ,11,22  , 100            , 5,US Survey Foot
HC,2,3,1,Length of Charge                                  ,11,23  , 4              , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx               ,12, E7 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                          ,12, 1  , SEG            ,  ,
HC,2,3,1,Total Charge Size                                 ,12, 2  , 4.4            ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                            ,12, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                     ,12, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of Pattern                       ,12, 8  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                    ,12, 9  , 0              , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,12,10  , 0              , 5,US Survey Foot
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HC,2,3,1,Crossline Distance Between Elements in the Pattern,12,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                               ,12,22  , 25             , 5,US Survey Foot
HC,2,3,1,Length of Charge                                 ,12,23  , 25             , 5,US Survey Foot
HC,2,3,0,Orica Seismic Explosive Range - Osx              ,13, E8 , 7, Explosive   ,Osx 8 Z,,,,,,,,,
HC,2,3,1,Polarity                                         ,13, 1  , SEG            ,  ,
HC,2,3,1,Total Charge Size                                ,13, 2  , 8.8            ,21,pounds mass
HC,2,3,1,Vertical Fold of Stack                           ,13, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                    ,13, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of Pattern                      ,13, 8  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Dimension of Pattern                   ,13, 9  , 0              , 5,US Survey Foot
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,13,10  , 0              , 5,US Survey Foot
HC,2,3,1,Crossline Distance Between Elements in the Pattern,13,11  , 0              , 5,US Survey Foot
HC,2,3,1,Nominal Shot Depth                               ,13,22  , 35             , 5,US Survey Foot
HC,2,3,1,Length of Charge                                 ,13,23  , 4              , 5,US Survey Foot
HC,2,3,0,Input/Output Air Gun  (Array 301)                ,14,A1,4, Air Gun,Sleeve Gun Model II,,,,,,,,,
HC,2,3,1,Polarity                                         ,14, 1  , SEG            ,  ,
HC,2,3,1,Air Volume                                       ,14, 4  , 2400           ,15,cubic inch
HC,2,3,1,Vertical Fold of Stack                           ,14, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                    ,14, 7  , 16             ,  ,
HC,2,3,1,Inline Dimension of the Pattern                  ,14, 8  , 4.5            ,1 ,metre
HC,2,3,1,Crossline Dimension of the Pattern               ,14, 9  , 0              ,1 ,metre
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,14, 7  , 0              ,1 ,metre
HC,2,3,1,Crossline Distance Between Elements in the Pattern,14, 8  , 0              ,1 ,metre
HC,2,3,1,Nominal Air Pressure                             ,14,29  , 2000           ,19,pounds/square inch
HC,2,3,1,Number of Sub Arrays                             ,14,30  , 2              ,  ,
HC,2,3,1,Nominal Towing Depth                             ,14,31  , 3.0            , 1 ,metre
HC,2,3,0,Input/Output Air Gun (Array 302)                 ,15,A2,4, Air Gun,Sleeve Gun Model II,,,,,,,,,
HC,2,3,1,Polarity                                         ,15, 1  , SEG            ,  ,
HC,2,3,1,Air Volume                                       ,15, 4  , 1200           ,15,cubic inch
HC,2,3,1,Vertical Fold of Stack                           ,15, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                    ,15, 7  , 8              ,  ,
HC,2,3,1,Inline Dimension of the Pattern                  ,15, 8  , 0              ,1 ,metre
HC,2,3,1,Crossline Dimension of the Pattern               ,15, 9  , 0              ,1 ,metre
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,15, 7  , 0              ,1 ,metre
HC,2,3,1,Crossline Distance Between Elements in the Pattern,15, 8  , 0              ,1 ,metre
HC,2,3,1,Nominal Air Pressure                             ,15,29  , 2000           ,19,pounds/square inch
HC,2,3,1,Number of Sub Arrays                             ,15,30  , 1              ,  ,
HC,2,3,1,Nominal Towing Depth                             ,15,31  , 3.0            ,  5,US Survey Foot
HC,2,3,0,Input/Output Air Gun (Array 303)                 ,16,A3,4, Air Gun,Sleeve Gun Model II,,,,,,,,,
HC,2,3,1,Polarity                                         ,16, 1  , SEG            ,  ,
HC,2,3,1,Air Volume                                       ,16, 4  , 1760           ,15,cubic inch
HC,2,3,1,Vertical Fold of Stack                           ,16, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                    ,16, 7  , 16             ,  ,
HC,2,3,1,Inline Dimension of the Pattern                  ,16, 8  , 4.5            ,1 ,metre
HC,2,3,1,Crossline Dimension of the Pattern               ,16, 9  , 0.0            ,1 ,metre
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,16, 7  , 0              ,1 ,metre
HC,2,3,1,Crossline Distance Between Elements in the Pattern,16, 8  , 0              ,1 ,metre
HC,2,3,1,Nominal Air Pressure                             ,16,29  , 2000           ,19,pounds/square inch
HC,2,3,1,Number of Sub Arrays                             ,16,30  , 2              ,  ,
HC,2,3,1,Nominal Towing Depth                             ,16,31  , 3.0            , 1,metre
HC,2,3,0,Input/Output Air Gun (Array 304)                 ,17,A4,4, Air Gun,Sleeve Gun Model II,,,,,,,,,
HC,2,3,1,Polarity                                         ,17, 1  , SEG            ,  ,
HC,2,3,1,Air Volume                                       ,17, 4  , 880            ,15,cubic inch
HC,2,3,1,Vertical Fold of Stack                           ,17, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                    ,17, 7  , 8              ,  ,
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HC,2,3,1,Inline Dimension of the Pattern                   ,17, 8  , 0.0            ,1 ,metre
HC,2,3,1,Crossline Dimension of the Pattern                ,17, 9  , 0.0            ,1 ,metre
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,17, 7  , 0              ,1 ,metre
HC,2,3,1,Crossline Distance Between Elements in the Pattern,17, 8  , 0              ,1 ,metre
HC,2,3,1,Nominal Air Pressure                              ,17,29  , 2000           ,19,pounds/square inch
HC,2,3,1,Number of Sub Arrays                              ,17,30  , 1              ,  ,
HC,2,3,1,Nominal Towing Depth                              ,17,31  , 3.0            , 1,metre
HC,2,3,0,Input/Output Air Gun (Array 304)                  ,18,A6,4, Air Gun,Sleeve Gun Model II,,,,,,,,,
HC,2,3,1,Polarity                                          ,18, 1  , SEG            ,  ,
HC,2,3,1,Air Volume                                        ,18, 4  , 10             ,15,cubic inch
HC,2,3,1,Vertical Fold of Stack                            ,18, 5  , 1              ,  ,
HC,2,3,1,Number of Elements in Pattern                     ,18, 7  , 1              ,  ,
HC,2,3,1,Inline Dimension of the Pattern                   ,18, 8  , 0.0            ,1 ,metre
HC,2,3,1,Crossline Dimension of the Pattern                ,18, 9  , 0.0            ,1 ,metre
HC,2,3,1,Inline Distance Between Elements in the Pattern   ,18, 7  , 0              ,1 ,metre
HC,2,3,1,Crossline Distance Between Elements in the Pattern,18, 8  , 0              ,1 ,metre
HC,2,3,1,Nominal Air Pressure                              ,18,29  , 2000           ,19,pounds/square inch
HC,2,3,1,Number of Sub Arrays                              ,18,30  , 1              ,  ,
HC,2,3,1,Nominal Towing Depth                              ,18,31  , 2.0            , 1,metre
CC,1,0,0, Source of coordinates (1st Layout - Index 1)
CC,1,0,0, Land Shots                              Extreme Surveys Postplot
CC,1,0,0, Marine Shots                            Ensoco Postplot
CC,1,0,0, Land Nodes Line 102 Sta 1001-1613       Extreme Surveys Postplot
CC,1,0,0, Marine Nodes Line 102 Sta 1615-1977     Ensoco Postplot
CC,1,0,0, Land Receivers Line 111 Sta 1001-1629   Extreme Surveys Postplot
CC,1,0,0, Marine Receivers Line 111 Sta 1631-1717 Extreme Surveys Postplot
CC,1,0,0, Marine Receivers Line 111 Sta 1719-1975 NCS Drop Locations
CC,1,0,0, Source of coordinates (2nd Layout - Index 2)
CC,1,0,0, Land Shots                              Extreme Surveys Postplot
CC,1,0,0, Marine Shots                            Ensoco Postplot
CC,1,0,0, Land Nodes Line 102 Sta 1001-1613       Extreme Surveys Postplot
CC,1,0,0, Marine Nodes Line 102 Sta 1615-1977     Ensoco Postplot
CC,1,0,0, Land Receivers Line 111 Sta 1001-1629   Extreme Surveys Postplot
CC,1,0,0, Marine Receivers Line 111 Sta 1631-1659 Extreme Surveys Postplot
CC,1,0,0, Marine Receivers Line 111 Sta 1661-1913 Ensoco Postplot
CC,1,0,0,
CC,1,0,0, NOTE TO PROCESSORS
CC,1,0,0, An extra FDU was mistakenly inserted between receivers 111-1703 and 111-1705 for FFID 0001-0727.
CC,1,0,0, This FDU has been edited out of the Relational file.
CC,1,0,0, Note the 2 channel gap between these 2 stations.
CC,1,0,0,
CC,1,0,0, The extra FDU between receivers 111-1703 and 111-1705 was disabled for FFID 0728-0764.
CC,1,0,0, The marine portion of receiver line 111 (111-1631 and higher) was relaid between FFID 0765-0769.
CC,1,0,0, The initial receiver layout is index 1.
CC,1,0,0, After the cable relay the receiver index is 2. For simplicity the land receiver
CC,1,0,0, positions have been repeated with receiver index 2 even though their position did not move.
CC,1,0,0,
CC,1,0,0, Marine Point depth column -   Source = height of water above the energy source at the time of the shot
CC,1,0,0, Marine Water depth column - Source = height of water surface above seafloor at the time of the shot
CC,1,0,0,                             Receiver = height of water surface above seafloor at the time of the receiver lay.
CC,1,0,0, Nikisi  Alaska
H1,0,0,0, File Contents Description                        ,Post-Processed Land and Marine Data Converted from several SPS v1.0 files,
H1,0,1,0,Processing Details                                ,Converted from SPS V1.0 files
CC,1,0,0,   H1 1 0 0 for Land Explosive Data with uphole time and charge depth below topographic surface
H1,1,0,0,Position Record Type Definition                   ,1,5,2,6,1,1,2, 6;;Uphole Time;8, 9;;Charge Depth;5
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H1,1,0,1,Position Record Quality Definition                ,1,0,No Quality Data Recorded,,,0
CC,1,0,0,    H1 1 0 0 for Marine Air Gun Data with water depth and source (point) depth at time of recording
H1,1,0,0,Position Record Type Definition                   ,2,1,2,6,1,1,2, 1;4;Water Depth;5,  3;4;Point Depth;5
H1,1,0,1,Position Record Quality Definition                ,2,0,No Quality Data Recorded,,,0
CC,1,0,0,    H1 2 0 0 for Land Receiver Positions
H1,2,0,0,Receiver Record Type Definition                   ,3,1,5,2,6,,1,1,0,
H1,2,0,1,Receiver Record Quality Definition                ,3,0,No Quality Data Recorded,,,0,
CC,1,0,0,    H1 2 0 0 for Marine Receiver Positions with water depth and tidal elevation at time of recording
H1,2,0,0,Receiver Record Type Definition                   ,4,1,1,2,6,1,1,1,2,  1;4;Water Depth;5,  2;4&7;Vertical Datum Difference;5
H1,2,0,1,Receiver Record Quality Definition                ,4,0,No Quality Data Recorded,,,0,
H1,3,0,0,Relation Record Definition                        ,0,
CC,1,0,0,   Beginning of Land Shots
S1,0, 104,,1136,,1,2011:077:14:13:52.0, 7,E2,1,,146155.2,2497892.5,  25.1,60.82245248,-151.98256747,,60.82188715,-151.98481506,,,,,,38;25
S1,0, 106,,1136,,1,2011:077:14:19:14.0, 9,E4,1,,146183.3,2497903.5,  25.3,60.82248488,-151.98241200,,60.82191955,-151.98465960,,,,,,51;35
S1,0, 104,,1320,,1,2011:077:15:24:01.0, 7,E2,1,,151581.4,2483715.8,  24.0,60.78413711,-151.94982673,,60.78357089,-151.95208024,,,,,,13;25
S1,0, 107,,1331,,1,2011:077:15:34:11.0,10,E5,1,,151947.4,2482884.0,  23.2,60.78189261,-151.94764185,,60.78132633,-151.94989570,,,,,,18;45
S1,0, 109,,1331,,1,2011:084:15:25:30.0,12,E7,1,,151975.5,2482894.9,  23.2,60.78192469,-151.94748652,,60.78135842,-151.94974038,,,,,,19;25
S1,0, 110,,1331,,1,2011:084:15:29:48.0,13,E8,1,,151989.8,2482900.3,  23.2,60.78194061,-151.94740745,,60.78137434,-151.94966131,,,,,,19;35
S1,0, 109,,1336,,1,2011:084:15:38:14.0,12,E7,1,,152123.2,2482509.4,  23.5,60.78088268,-151.94659663,,60.78031637,-151.94885064,,,,,,32;25
S1,0, 110,,1336,,1,2011:084:15:42:28.0,13,E8,1,,152137.3,2482515.0,  23.2,60.78089913,-151.94651871,,60.78033283,-151.94877273,,,,,,36;35
S1,0, 109,,1340,,1,2011:084:15:48:56.0,12,E7,1,,152241.3,2482201.7,  23.2,60.78005097,-151.94588521,,60.77948464,-151.94813935,,,,,,29;25
S1,0, 110,,1340,,1,2011:084:15:51:35.0,13,E8,1,,152254.8,2482206.8,  23.2,60.78006601,-151.94581057,,60.77949968,-151.94806471,,,,,,30;32
S1,0, 109,,1653,,1,2011:084:15:54:22.0,12,E7,1,,161478.0,2458073.9,  12.3,60.71481957,-151.89034961,,60.71425100,-151.89260838,,,,,, 8;25
S1,0, 109,,1357,,1,2011:084:16:01:20.0,12,E7,1,,152742.6,2480891.8,  23.1,60.77651017,-151.94286523,,60.77594374,-151.94511991,,,,,,28;25
S1,0, 109,,1648,,1,2011:084:16:03:07.0,12,E7,1,,161323.6,2458470.0,  13.3,60.71589044,-151.89127491,,60.71532191,-151.89353368,,,,,, 8;25
S1,0, 110,,1357,,1,2011:084:16:03:53.0,13,E8,1,,152756.7,2480897.1,  22.9,60.77652580,-151.94278728,,60.77595937,-151.94504195,,,,,,28;35
S1,0, 110,,1648,,1,2011:084:16:07:04.0,13,E8,1,,161337.7,2458475.6,  13.3,60.71590686,-151.89119712,,60.71533834,-151.89345590,,,,,, 5;25
S1,0, 109,,1360,,1,2011:084:16:09:51.0,12,E7,1,,152831.5,2480660.2,  23.2,60.77588414,-151.94232986,,60.77531770,-151.94458463,,,,,,23;25
S1,0, 110,,1360,,1,2011:084:16:12:19.0,13,E8,1,,152845.2,2480665.8,  23.0,60.77590056,-151.94225419,,60.77533412,-151.94450896,,,,,,26;35
S1,0, 109,,1368,,1,2011:084:16:22:54.0,12,E7,1,,153066.8,2480044.2,  23.6,60.77421896,-151.94091244,,60.77365246,-151.94316746,,,,,,21;25
S1,0, 110,,1368,,1,2011:084:16:25:26.0,13,E8,1,,153081.1,2480049.5,  23.4,60.77423461,-151.94083337,,60.77366811,-151.94308839,,,,,,19;35
S1,0, 108,,1368,,1,2011:084:16:28:06.0,11,E6,1,,153052.6,2480038.5,  23.5,60.77420223,-151.94099089,,60.77363573,-151.94324590,,,,,,24;40
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CC,1,0,0,   Beginning of Marine Shots
S1,0, 101,,1785,,1,2011:085:09:09:54.0,18,A6,2,,165018.5,2447784.0,,60.68696154,-151.86895732,,60.68639171,-151.87121514,,,,,,51;7
S1,0, 101,,1784,,1,2011:085:09:10:08.0,18,A6,2,,164987.3,2447860.2,,60.68716747,-151.86914337,,60.68659764,-151.87140121,,,,,,51;7
S1,0, 101,,1783,,1,2011:085:09:10:21.0,18,A6,2,,164964.5,2447938.6,,60.68738006,-151.86928294,,60.68681024,-151.87154079,,,,,,51;7
S1,0, 101,,1782,,1,2011:085:09:10:34.0,18,A6,2,,164947.9,2448020.5,,60.68760270,-151.86938850,,60.68703290,-151.87164636,,,,,,52;7
S1,0, 101,,1781,,1,2011:085:09:10:47.0,18,A6,2,,164937.4,2448104.4,,60.68783129,-151.86946036,,60.68726150,-151.87171824,,,,,,52;7
S1,0, 101,,1780,,1,2011:085:09:11:00.0,18,A6,2,,164927.0,2448188.0,,60.68805907,-151.86953162,,60.68748929,-151.87178951,,,,,,52;7
S1,0, 101,,1779,,1,2011:085:09:11:13.0,18,A6,2,,164913.8,2448272.8,,60.68828990,-151.86961868,,60.68772014,-151.87187658,,,,,,52;7
S1,0, 101,,1778,,1,2011:085:09:11:26.0,18,A6,2,,164895.7,2448354.4,,60.68851161,-151.86973256,,60.68794186,-151.87199048,,,,,,54;7
S1,0, 101,,1777,,1,2011:085:09:11:40.0,18,A6,2,,164872.0,2448432.6,,60.68872359,-151.86987712,,60.68815384,-151.87213506,,,,,,56;7
S1,0, 101,,1776,,1,2011:085:09:11:54.0,18,A6,2,,164840.2,2448509.2,,60.68893056,-151.87006661,,60.68836082,-151.87232456,,,,,,59;7
S1,0, 101,,1775,,1,2011:085:09:12:08.0,18,A6,2,,164806.9,2448585.4,,60.68913631,-151.87026439,,60.68856659,-151.87252236,,,,,,60;7
S1,0, 101,,1774,,1,2011:085:09:12:22.0,18,A6,2,,164774.5,2448660.9,,60.68934023,-151.87045705,,60.68877052,-151.87271504,,,,,,61;7
S1,0, 101,,1773,,1,2011:085:09:12:36.0,18,A6,2,,164744.7,2448737.7,,60.68954790,-151.87063541,,60.68897820,-151.87289342,,,,,,61;7
S1,0, 101,,1772,,1,2011:085:09:12:50.0,18,A6,2,,164715.5,2448815.0,,60.68975698,-151.87081052,,60.68918730,-151.87306854,,,,,,60;7
S1,0, 101,,1771,,1,2011:085:09:13:04.0,18,A6,2,,164684.5,2448891.8,,60.68996456,-151.87099558,,60.68939488,-151.87325362,,,,,,57;7
S1,0, 101,,1770,,1,2011:085:09:13:18.0,18,A6,2,,164652.6,2448968.4,,60.69017152,-151.87118563,,60.68960185,-151.87344370,,,,,,55;7
S1,0, 101,,1769,,1,2011:085:09:13:33.0,18,A6,2,,164621.7,2449044.7,,60.69037774,-151.87137006,,60.68980808,-151.87362814,,,,,,52;7
S1,0, 101,,1768,,1,2011:085:09:13:47.0,18,A6,2,,164592.4,2449122.0,,60.69058681,-151.87154573,,60.69001717,-151.87380383,,,,,,50;7
S1,0, 101,,1767,,1,2011:085:09:14:00.0,18,A6,2,,164567.1,2449200.3,,60.69079893,-151.87169926,,60.69022930,-151.87395738,,,,,,46;7
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S1,0, 101,,1766,,1,2011:085:09:14:13.0,18,A6,2,,164546.7,2449280.3,,60.69101608,-151.87182573,,60.69044646,-151.87408386,,,,,,41;7
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.
CC,1,0,0,   Beginning of Land Receiver Data (no times)
R1,0, 111,,1001,,1,                     , 2,G1,3,1,142195.5,2508346.4,707.6,60.85070423,-152.00652816,,60.85013920,-152.00877110,,,,,,
R1,0, 111,,1003,,1,                     , 2,G1,3,1,142253.5,2508192.2,690.2,60.85028750,-152.00617670,,60.84972247,-152.00841972,,,,,,
R1,0, 111,,1005,,1,                     , 2,G1,3,1,142312.5,2508038.7,682.2,60.84987277,-152.00581977,,60.84930774,-152.00806286,,,,,,
R1,0, 111,,1007,,1,                     , 2,G1,3,1,142371.6,2507883.7,662.1,60.84945394,-152.00546202,,60.84888892,-152.00770520,,,,,,
R1,0, 111,,1009,,1,                     , 2,G1,3,1,142430.9,2507729.9,650.4,60.84903841,-152.00510338,,60.84847340,-152.00734663,,,,,,
R1,0, 111,,1011,,1,                     , 2,G1,3,1,142489.4,2507576.1,638.0,60.84862282,-152.00474922,,60.84805780,-152.00699255,,,,,,
R1,0, 111,,1013,,1,                     , 2,G1,3,1,142548.6,2507421.5,613.4,60.84820509,-152.00439102,,60.84764008,-152.00663442,,,,,,
R1,0, 111,,1015,,1,                     , 2,G1,3,1,142607.8,2507267.7,605.7,60.84778955,-152.00403296,,60.84722454,-152.00627644,,,,,,
R1,0, 111,,1017,,1,                     , 2,G1,3,1,142667.3,2507113.3,587.5,60.84737240,-152.00367313,,60.84680739,-152.00591668,,,,,,
R1,0, 111,,1019,,1,                     , 2,G1,3,1,142725.5,2506959.8,579.6,60.84695759,-152.00332074,,60.84639258,-152.00556437,,,,,,
R1,0, 111,,1021,,1,                     , 2,G1,3,1,142784.7,2506805.8,575.4,60.84654150,-152.00296268,,60.84597650,-152.00520639,,,,,,
R1,0, 111,,1023,,1,                     , 2,G1,3,1,142843.0,2506651.2,574.4,60.84612370,-152.00260956,,60.84555869,-152.00485335,,,,,,
R1,0, 111,,1025,,1,                     , 2,G1,3,1,142902.6,2506497.5,571.8,60.84570846,-152.00224933,,60.84514346,-152.00449319,,,,,,
R1,0, 111,,1027,,1,                     , 2,G1,3,1,142961.6,2506342.9,556.2,60.84529071,-152.00189231,,60.84472571,-152.00413624,,,,,,
R1,0, 111,,1029,,1,                     , 2,G1,3,1,143020.4,2506188.8,549.3,60.84487431,-152.00153651,,60.84430931,-152.00378052,,,,,,
R1,0, 111,,1031,,1,                     , 2,G1,3,1,143078.9,2506035.5,538.7,60.84446007,-152.00118253,,60.84389507,-152.00342662,,,,,,
R1,0, 111,,1033,,1,                     , 2,G1,3,1,143138.7,2505880.2,526.6,60.84404047,-152.00082094,,60.84347547,-152.00306510,,,,,,
R1,0, 111,,1035,,1,                     , 2,G1,3,1,143197.3,2505726.8,521.6,60.84362596,-152.00046640,,60.84306097,-152.00271064,,,,,,
R1,0, 111,,1037,,1,                     , 2,G1,3,1,143256.2,2505572.2,515.2,60.84320820,-152.00010999,,60.84264321,-152.00235430,,,,,,
R1,0, 111,,1039,,1,                     , 2,G1,3,1,143315.4,2505418.8,508.3,60.84279374,-151.99975212,,60.84222875,-152.00199650,,,,,,
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CC,1,0,0,   Beginning of Marine Receiver Data
R1,0, 111,,1719,,1,2011:084:10:55:20.0, 4,R1,4,1,163434.5,2453047.7,,60.70123028,-151.87862880,,60.70066116,-151.88088741,,,,,,19.0;-13.3
R1,0, 111,,1721,,1,2011:084:10:54:34.0, 4,R1,4,1,163502.4,2452899.8,,60.70083119,-151.87822644,,60.70026205,-151.88048505,,,,,,23.0;-16.9
R1,0, 111,,1723,,1,2011:084:10:53:55.0, 4,R1,4,1,163560.2,2452745.5,,60.70041382,-151.87787941,,60.69984466,-151.88013802,,,,,,26.0;-20.2
R1,0, 111,,1725,,1,2011:084:10:53:10.0, 4,R1,4,1,163615.8,2452589.3,,60.69999108,-151.87754436,,60.69942190,-151.87980296,,,,,,29.0;-23.2
R1,0, 111,,1727,,1,2011:084:10:52:26.0, 4,R1,4,1,163681.1,2452438.5,,60.69958386,-151.87715608,,60.69901466,-151.87941467,,,,,,31.0;-25.4
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R1,0, 111,,1741,,1,2011:084:10:44:26.0, 4,R1,4,1,164098.7,2451360.9,,60.69667004,-151.87465515,,60.69610072,-151.87691366,,,,,,35.8;-29.6
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R1,0, 111,,1745,,1,2011:084:10:42:45.0, 4,R1,4,1,164215.8,2451052.6,,60.69583621,-151.87395297,,60.69526684,-151.87621140,,,,,,32.7;-27.1
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R1,0, 111,,1749,,1,2011:084:10:40:59.0, 4,R1,4,1,164330.4,2450743.3,,60.69499944,-151.87326461,,60.69443003,-151.87552297,,,,,,34.7;-28.5
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X1,0,1,  18,1,109,1331,1,392,617,2,111,1705,1929,1,
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X1,0,1,  22,1,109,1340,1,392,617,2,111,1705,1929,1,
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Appendix F: Client/End-User Checklist

The checklist below is provided to enable an end-user to define specific requirements of the P1/11 and P2/11 files. It is a pointer to the sections of the formats where the format writer may need to request content guidance or advice around optional items.

COMMON HEADER:

Section	Reference	Item	Details
Common Header	HC,0,1,0	Project Name	
Common Header	HC,0,2,0	Survey Location	
Common Header	HC,1,2,0	Time Reference (UTC/GPS, etc)	
Common Header	HC,1,3,0	CRS1 Code (EPSG if available) CRS1 Name (used for data)	
Common Header	HC,1,3,0	CRS2 Code (EPSG if available) CRS2 Name (used for data)	
Common Header	HC,1,3,0	CRS3 Code (EPSG if available) CRS3 Name (used for data)	Hub or Reference CRS eg WGS 84
Common Header	HC,1,4,2	Vertical CRS Code Vertical CRS Name	(If a compound CRS is selected)
Common Header	HC,1,7,0	Transformation 1 Code (EPSG) Transformation 1 Name	
Common Header	HC,1,7,0	Transformation 2 Code (EPSG) Transformation 2 Name	
Common Header	HC,1,7,0	Transformation 3 Code (EPSG) Transformation 3 Name	
Common Header	HC,2,1,1	Production System Attributes	
Common Header	HC,2,2,1	Receiver attributes	
Common Header	HC,2,3,0	Objects to be positioned	
Common Header	HC,2,3,1	Object attributes	
Common Header	CC,x,x,x	Entire project related comments	
Common Header	Description Fields	Padding of records for readability, text left/ right justified	

P1/11-specific Header (H1) and P1 Data Records:

Section	Reference	Item	Details
P1 Header	H1,0,2,0	File Attribute Values	
P1 Header	H1,1,0,0	P1/S1 Position Record Extension Fields (including Vertical CRS References)	
P1 Header	H1,1,0,1 H1,2,0,1	Additional Quality Measures	
P1 Header	H1,3,0,0	Relation Record Requirements	
P1 Header	H1,4,0,0	Preplot Requirements	
P1 Header	H1,5,0,0	Survey Perimeters	
P1 Header	CC,x,x,x	P1 Header related Comments	
P1 Data	P1/S1/R1	CRS1 Coordinate Resolution	
P1 Data	P1/S1/R1	CRS2 Coordinate Resolution	
P1 Data	P1/S1/R1	CRS3 Coordinate Resolution	
P1 Data	CC,x,x,x	Data Related Comments	

P2/11-specific Header (H2) and P2 Data Records:

P2 Header	H2,0,0,0 H2,0,0,1	Acquisition Line Prefix/Details
P2 Header	CC,2,0,0	Line Related Comments
P2 Header	H2,0,3,0 H2,0,3,1 H2,0,3,2	Magnetic Variation Information
P2 Header	H2,0,4,1	Speed of Sound Record Extension Fields
P2 Header	H2,0,5,0 H2,0,5,1 H2,0,5,2	Tidal Information
P2 Header	H2,5,4,0	Observation Definition Record Extension Fields
P2 Header	H2,5,5,0	Position Observation Record Extension Fields
P2 Header	H2,6,5,0 H2,6,6,1	GNSS Raw Data Recording Definition
P2 Data	CC,x,x,x	Event Related Comments

Bibliography

1) P1/90 Post Plot Data Exchange Format: OGP: http://info.ogp.org.uk/geomatics/Exchange/P1.pdf

2) P2/94 Raw Marine Positioning Data Exchange Format: OGP: http://info.ogp.org.uk/geomatics/Exchange/P2.pdf

3) Guidance Note 7: EPSG Geodetic Parameter Dataset: http://info.ogp.org.uk/geomatics/guides/index.html

4) Guidance Note for Geodetic and Cartographic Applications (Precision and Presentation): APSG: http://www.apsg.info/resources/Documents/APSG_Software_Guidelines.pdf

5) Iliffe, J. and Lott, R. – Datums and Map Projections: for Remote Sensing, GIS and Surveying, Second Edition 2008 – ISBN 978-1-4200-7041-5 (USA only), ISBN 978-1-904445-47-0 (World except USA).

6) ISO Standards: http://www.iso.org

Glossary of Terms

The following terms and acronyms are used throughout this publication and are defined here for clarity.

The use of italics in the definition column refers to another term in the Glossary.

Additional text providing clarification of the definition or an example are shown in smaller font.

The source of the definition is indicated in italics and square brackets where relevant and when the source is used several times. The following sources are used:

[GIGS]:	Definition as applied to the term in the OGP GIGS documentation (OGP Report #430).
[ISO/TC211]:	Definition from ISO/TC211 website or the 'ISO/TC211 Multi-Lingual glossary of terms': http://www.isotc211.org/TC211_Multi-Lingual_Glossary-2010-06-06_Published.xls
[NGA]:	Definition from National Geospatial Intelligence Agency. See www1.nga.mil
[OGP]:	Definition from the International Association of Oil and Gas Producers

term	definition
accuracy	*[ISO/TC211]*: closeness of agreement between a test result and the accepted reference value.
affine operation	*[GIGS]*: coordinate operation on plane coordinates involving an origin shift and separate rotations and/or scale/unit changes affecting the two axes. Note: This type of operation is often called an affine transformation, but it may exist either as a coordinate conversion or as a coordinate transformation. In the first case the operation parameters have defined values, such as with a seismic bin grid; in the second case these values are empirically determined from survey data, such as for an engineering plant grid.
ASCII	American Standard Code for Information Interchange. Note: See www.ascii.cl
audit trail	*[GIGS]*: the facility provided by a software package to permit independent review and verification of the integrity of its datasets, by tracking and logging each of the operations performed on the dataset.
auxiliary metadata	*[GIGS]*: data captured to support the Audit Trail; in particular, data about all *coordinate operations* (*conversions* & *map projections*, *coordinate transformations*) and *CRS* applied to the geoscience dataset over time, from its original *CRS* through to the final *CRS* used in each module.
azimuth	*[GIGS]*: angle between the north reference and the direction from a point to another point, clockwise positive. Note: The north reference may be *grid north*, *true north*, *magnetic north* or *local north*: .
base geographic CRS	*[GIGS]*: *geographic CRS* from which a *projected CRS* is defined by applying a map projection to the associated geographical coordinates.
Cartesian coordinate system	*[ISO/TC211]*: *coordinate system* that gives the position of points relative to n mutually perpendicular axes.
compliance	*[GIGS]*: agreement to a norm, either precisely or within an acceptable tolerance. Note: Compliance may refer to terminology as e.g. specified in ISO 19111 or the *EPSG Dataset*, in which case agreement needs to be precise or it may refer to numerical equivalence to tests specified in the GIGS Test Dataset

term	definition
compound CRS	*[ISO/TC211]*: Coordinate Reference System using at least two independent Coordinate Reference Systems Note: In the context of GIGS a *compound CRS* is always union of a geographic 2D CRS or a *projected CRS*, or a horizontal *engineering CRS* with a *vertical CRS*. A 2D horizontal engineering CRS, combined with a 1D vertical engineering CRS is not a compound CRS, but an *engineering 3D CRS*.
concatenated coordinate operation	*[ISO/TC211]*: coordinate operation consisting of sequential application of multiple coordinate operations. Note: Usually a concatenated coordinate operation consists of a sequence of *coordinate transformations*, i.e. no *coordinate conversions* in included in that sequence. For that reason is has become customary to speak of a *concatenated coordinate transformation*.
concatenated coordinate transformation	*[GIGS]*: concatenated coordinate operation consisting of sequential application of multiple *coordinate transformations*.
conversion	see *coordinate conversion*.
coordinate	*[ISO/TC211]*: one of a sequence of n scalar numbers designating the position of a point in n-dimensional space
coordinate conversion	*[ISO/TC211]*: *coordinate operation* in which the two *coordinate reference systems* are based on the same *datum*. Example: A *map projection*. Note: Coordinate conversions either have no parameters or have defined (i.e. precise) parameter values.
coordinate dataset	see *coordinate set*.
coordinate operation	*[ISO/TC211]*: change of coordinates, based on a one-to-one relationship, from one *CRS* to another. Note: See also coordinate transformation and coordinate conversion
coordinate reference system	*[ISO/TC211]*: *coordinate system* that is related to an object by a *datum*. Note 1: For *geodetic datum* and *vertical datum*, the object will be the Earth. Note 2: *Coordinate reference system* is normally abbreviated to *CRS*. Note 3: Types of *CRS* distinguished in *ISO 19111* are: *geodetic CRS*, *projected CRS*, *vertical CRS* and *engineering CRS*. In the *EPSG Dataset geodetic CRS* is sub-divided into *geocentric CRS*, *geographic 3D CRS* and *geographic 2D CRS*).
coordinate set	*[ISO/TC211]*: collection of coordinate tuples related to the same *coordinate reference system*. Note: Identical to *coordinate dataset*.
coordinate system	*[ISO/TC211]*: set of mathematical rules for specifying how coordinates are to be assigned to points. Note: The coordinate system defines what type of quantities the coordinates are and provides an implied reference to the manner in which geometrical quantities such as angles and distances are derived from coordinate values. The coordinate system does this by describing the coordinate axes and their relationships. This is expressed in the type of coordinate system (ellipsoidal 2D & 3D, Cartesian 2D & 3D, vertical). Coordinate system also requires specification of the axes names, their orientation and unit of measure and their order. Coordinates in a *coordinate tuple* must be provided in the same order as the axes, as specified in the associated coordinate system.
coordinate transformation	*[ISO/TC211]*: *coordinate operation* in which the two *coordinate reference systems* are based on different *datums*. Note 1: A change of coordinates, referenced to one *CRS*, to become referenced to another *CRS*, and comprising a different *datum*. Note 2: Coordinate transformations are known under a variety of alternative names in the E&P industry, e.g. datum transformation, datum shift, datum conversion, geo-transform, etc.
coordinate tuple	*[ISO/TC211]*: *tuple* composed of a sequence of coordinates
CRS	see *coordinate reference system*.

term	definition
CSV	A comma-separated values or character-separated values (CSV) file is a simple text format for a database table. Each record in the table is one line of the text file. Each field value of a record is separated from the next by a character (typically a comma but some European countries use a semi-colon as a value separator instead of a comma). Implementations of CSV can often handle field values with embedded line breaks or separator characters by using quotation marks or escape sequences. Note: Definition from http://en.wikipedia.org/wiki/Comma-separated_values
data exchange format	defined format for the exchange of digital data. Note: See *OGP, SEG, UKOOA*
data operation	*[GIGS]*: any action performed on spatial data. Note: This may refer to data import, data export, data transfers within the software or between software packages or any other data manipulation, including specifically *coordinate operations.*
dataset	*[ISO/TC211]*: identifiable collection of data. Note: In GIGS a dataset is interpreted as a collection of data produced by a software package; it may be used for output, export or as input to another part of the same software.
datum	*[ISO/TC211]*: parameter or set of parameters that define the position of the origin, the scale, and the orientation of a *coordinate system.* Note: See also *geodetic datum*, *vertical datum* and *engineering datum.*
deprecation	*[GIGS]*: process of rendering a data item invalid or obsolete by removing or flagging the item. In the *EPSG Dataset* deprecation is achieved by setting a flag associated with the data item.
depth	see *gravity-related height (or depth)*
early binding	*[GIGS]*: a priori association of a *coordinate transformation* with a *geodetic CRS.* Note: The association is usually made at start-up of the session or project, as that is defined in the software, but always before any data is associated with the *CRS*. In general the *coordinate transformation* specified uses the *CRS* of the data as the source CRS and WGS 84 as the target CRS.
easting	*[ISO/TC211]*: distance in a *coordinate system*, eastwards (positive) or westwards (negative) from a north-south reference line. Note: Easting may be designated e.g. by E, x or y; this is defined in the coordinate system in use with the specific *CRS.*
ellipsoid	*[ISO/TC211]*: surface formed by the rotation of an ellipse about a main axis. Note: In ISO 19111 and the *EPSG Dataset* ellipsoids are always oblate, meaning that the axis of rotation is always the minor axis.
ellipsoidal coordinate system	*[ISO/TC211]*: *coordinate system* in which position is specified by *geodetic latitude*, *geodetic longitude* and (in the three-dimensional 3D case) *ellipsoidal height.*
ellipsoidal height	*[ISO/TC211]*: distance of a point from the *ellipsoid* measured along the perpendicular from the *ellipsoid* to this point, positive if upwards or outside of the *ellipsoid.* Note 1: Only used as part of a three-dimensional ellipsoidal *coordinate system* and never on its own. Note 2: Ellipsoidal height is commonly designated by h. Note 3: See also *gravity-related height.*
engineering CRS	*[ISO/TC211]*: *coordinate reference system* based on an *engineering datum.* Example: engineering plant grids, well location plats, 3D seismic bin grids, well tracks.

term	definition
engineering datum	*[ISO/TC211]*: *datum* describing the relationship of a *coordinate system* to a local reference. Example: Reference points of engineering plant grids, well tracks, etc.
EPSG	*[OGP]*: acronym of the European Petroleum Survey Group, formerly a forum of chief surveyors and geodetic experts from European-based E&P operators. This forum has been absorbed into the International Oil and Gas Producers Association as the OGP Surveying & Positioning Committee. The acronym EPSG remains associated as a brand name with the *EPSG Geodetic Parameter Dataset*, a product of the original EPSG.
EPSG code	*[OGP]*: numeric code allocated to geodetic data objects in the *EPSG Dataset*. Note: Also see *EPSG geodetic Parameter Dataset*.
EPSG data model	*[OGP]*: the data model that underlies the EPSG Geodetic Parameter Dataset. Note: the EPSG data model is a profile, i.e. a consistent sub-model, of *ISO 19111*.
EPSG Dataset	see EPSG Geodetic Parameter Dataset.
EPSG Geodetic Parameter Dataset	*[OGP]*: dataset of *geodetic data objects* with worldwide coverage, published by *OGP*. Note 1: Also known as *EPSG Dataset*. Note 2: The dataset is distributed through a web-based delivery platform [see EPSG Registry], or in a MS Access relational database and SQL script files. See http://info.ogp.org.uk/geodesy/
EPSG Registry	*[OGP]*: the *EPSG* Geodetic Parameter Registry, a web-based delivery platform for the *EPSG Geodetic Parameter Dataset*. Note: The EPSG Registry can be accessed in any web browser, using URL www.epsg-registry.org
ESRI geodatabase feature classes	ESRI Personal Geodatabase Feature Classes and ESRI File Geodatabase Feature Classes are both recommended, imported/exported to and from *ESRI* applications. Note: See www.esri.com
E&P	Exploration & Production (of oil and natural gas)
geodetic data object	*[GIGS]*: a components part of the geodetic data model implemented in the software or the *EPSG data model*. Example: Geodetic data objects may be *CRS*, coordinate transformation, datum, ellipsoid, map projection, coordinate system, etc. Note 1: The term 'EPSG geodetic data object' in this documentation refers to geodetic data objects defined in the *EPSG Dataset*. Note 2: See also *geodetic parameter* and *parameter value*.
geodetic parameter	*[GIGS]*: component part of a *geodetic data object*, not itself a geodetic data object. Note 1: This may be a parameter belonging to a *coordinate conversion* or *coordinate transformation*, one of the defining parameters of an *ellipsoid*, etc., but it also refers to the attributes of a *geodetic data object*, such as its name and the *EPSG code* of the object. Note 2: Where the term 'EPSG geodetic parameter' is used in this documentation, geodetic parameters as defined in the *EPSG Dataset* are meant.
geocentric CRS	*[OGP]*: a *geodetic CRS* using an earth-centred Cartesian 3D *coordinate system*; the origin of a geocentric CRS is at the centre of mass of the Earth Note 1: Also known as ECEF (Earth-Centred, Earth-Fixed) Note 2: Associated *coordinate tuples* consists of X, Y and Z coordinates Note 3: Definition from 'OGP Guidance Note 7, Part 1: Using the EPSG Geodetic Parameter Dataset', with URL: http://www.epsg.org/guides/docs/G7-1.pdf
geodetic CRS	*[ISO/TC211]*: *coordinate reference system* based on a *geodetic datum*. Note: See *geocentric CRS*, *geographic 2D CRS*, *geographic 3D CRS*.

term	definition
geodetic datum	*[ISO/TC211]*: *datum* describing the relationship of a two- or three-dimensional coordinate system to the Earth.
geodetic latitude	*[ISO/TC211]*: angle from the equatorial plane to the perpendicular to the *ellipsoid* through a given point, northwards treated as positive. Note: Usually just referred to as *latitude*, geodetic latitude is normally designated by φ.
geodetic longitude	*[ISO/TC211]*: angle from the *prime meridian* plane to the meridian plane of a given point, eastward treated as positive. Note: Usually just referred to as *longitude*, geodetic longitude is normally designated by λ
geographic 2D CRS	*[OGP]*: a *geodetic CRS* using a 2D *ellipsoidal coordinate system*, where ellipsoidal height is undefined. Note 1: Used when positions of features are described on the surface of the *ellipsoid* through *latitude* and *longitude* coordinates. Note 2: Definition from 'OGP Guidance Note 7, Part 1: Using the EPSG Geodetic Parameter Dataset', with URL: http://www.epsg.org/guides/docs/G7-1.pdf
geographic 3D CRS	*[OGP]*: a geodetic CRS using a 3D ellipsoidal 3D coordinate system, where ellipsoidal height is defined. Note 1: Used when positions of features are described on, above or below the surface of the *ellipsoid* through latitude and longitude coordinates, and *ellipsoidal height* Note 2: Definition from 'OGP Guidance Note 7, Part 1: Using the EPSG Geodetic Parameter Dataset', with URL: http://www.epsg.org/guides/docs/G7-1.pdf
geographic CRS	*[OGP]*: collective term for any *geodetic CRS* using an ellipsoidal model of the Earth. See *geographic 2D CRS* and *geographic 3D CRS*
geographic north	*[GIGS]*: direction from a given location pointing towards the Geographic North Pole. Note: See also *True North*
geoid	*[ISO/TC211]*: equipotential surface of the Earth's gravity field which is everywhere perpendicular to the direction of gravity and which best fits mean sea level either locally or globally
geomatics	Geomatics Engineering is an emerging information technology in the 21st Century. Geomatics deals with the acquisition, modelling, analysis and management of spatial data and includes exciting applications such as positioning by satellites, remote sensing, land surveying, and geospatial information management. Note 1: It includes all forms of land & hydrographic surveying, positioning, mapping, & boundary determination, and is based on the scientific framework of geodesy, applying modern technologies such as GIS, photogrammetry, terrain modelling and cartography. Note 2: Definition by University of Calgary, Department of Geomatics Engineering. See www.geomatics.ucalgary.ca/about
Geomatics Committee	*[OGP]*: OGP Geomatics Committee. One of ten standing committees of the *OGP*, comprised of leading specialists in the areas of surveying, geodesy, cartography and spatial data management. Note: The OGP Geomatics Committee aims to help members by: • Developing and disseminating best practice through Guidelines of relevance in the fields of geodesy, surveying and positioning • Providing a forum for exchanging experiences and knowledge • Influencing regulators and standards organisations • Maintaining international positioning exchange formats and a geodetic parameter database (known as EPSG Geodetic Parameter Dataset) • Liaising with industry associations Note: See http://info.ogp.org.uk/geodesy/
geoscience	*[GIGS]*: all scientific disciplines relating to studies of the subsurface, including Geology, Geophysics, Geodesy, Geomatics, Geotechnical studies and others.

term	definition
geoscience software	*[GIGS]*: any computer package used in *geoscience* activities, including applications, along with their user interfaces, processing packages, and underlying databases; also included as applications are geodetic data engines, extensions and middleware.
geospatial data	*[NGA]*: data concerning the Earth and the manmade features on the earth that can be shown on maps, navigation charts, and images; Note: Geospatial data includes a *coordinate dataset* and its *geospatial metadata.*
geospatial integrity	*[GIGS]*: the extent to which *geospatial data* are complete, correct, consistent and verifiable. Note: Geospatial integrity applies to the software functions that address data import, creation, merging, processing, *coordinate operations* & *map projections*, visualisation, and export. It is therefore more than a static property of geospatial data.
geospatial metadata	*[GIGS]*: the CRS to which the *coordinate dataset* is referenced, extended by the definition of any *coordinate operations* when relevant. Note: *Coordinate operation* information is relevant when the geospatial data was originally collected in a different *CRS*. It is not relevant when the *geospatial data* is not (going to be) merged with geospatial data that is referenced to another *CRS*.
GeoTIFF	Data exchange format for georeferenced raster imagery. Current version *v1.0*. Note: See http://trac.osgeo.org/geotiff/
GIGS	*[OGP]*: a Joint Industry Project, under the auspices of *OGP* (*JIP* 24), created to produce industry guidelines for the evaluation of the capabilities of geoscience software regarding *geospatial integrity*.
GIGS Guidelines	*[OGP]*: public-release products from the GIGS Joint Industry Project, published as OGP Publications 430-1, 430-2 and 430-3. Note: See www.ogp.org.uk
GIGS JIP	See *GIGS* and *JIP*.
GIGS Test Dataset	*[OGP]*: a dataset created to enable tests of *coordinate operations*; based on use of the *EPSG Dataset*, and using methods and formulae outlined in 'OGP Guidance Note 7, Part 1:'Coordinate Conversions and Transformations including Formulas'. Note: http://www.epsg.org/guides/docs/G7-2.pdf
gravity-related height (or depth)	*[ISO/TC211]*: *height* (or *depth*) dependent on the earth's gravity field Note 1: See also *ellipsoidal height.* Note 2: Gravity-related height is normally designated by H, and depth by D.
grid north	*[OGP]*: the direction from a given location pointing along a line of equal easting (or westing) in a projected CRS. Note: Also known as *map north.*
height	See *gravity-related height* and *ellipsoidal height.*
International Standard	Standard published by the International Organization for Standardization. Note: International Organization for Standardization is commonly abbreviated as ISO
ISO 19111	International Standard describing a data model for geospatial metada. Note 1: Its full title is: 'Geographic information – Spatial referencing by coordinates'. See www.isotc211.org Note 2: See *EPSG Data Model.*

term	definition
ISO/TC211	ISO Technical Committee 211. Its scope is defined as: "standardisation in the field of digital geographic information. This work aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth." Note: See www.isotc211.org
JIP	*[OGP]*: Joint Industry Project, a commonly used term to describe a project which is jointly funded by a number of companies, who share a specific technical problem, and wish to propose industry-wide solutions for the betterment of all parties.
latitude	See *geodetic latitude*
late binding	*[GIGS]*: Association at run time of a *coordinate transformation* with a *CRS*. Note: Late binding allows the user to select the appropriate transformation upon import of *geospatial data* or merge of two geospatial datasets. This means that, in cases where there are multiple existing transformations, the user can choose the appropriate one, possibly aided by additional information.
local north	*[OGP]*: Arbitrarily chosen reference direction for azimuths for local usage. Note: Use of local north is not always associated with an *Engineering CRS*. Example: The angle between 'rig north' may be defined along the axis of a rig regardless of its relationship to earth orientation.
longitude	See *geodetic longitude*
magnetic north	*[OGP]*: direction of the projection of magnetic field lines to the horizontal plane, pointing approximately towards the earth's magnetic north pole.
map grid	*[OGP]*: the realisation of a *projected CRS*.
map projection	*[ISO/TC211]*: *coordinate conversion* from an ellipsoidal *coordinate system* to a plane. Note: Also see *coordinate conversion*
MD	Measured Depth, in well log data.
metadata	*[ISO/TC211]*: data about data. Example: *CRS* metadata gives all the parameters that are necessary to interpret the meaning of coordinate data, and correlate them with other *coordinate datasets*.
nomenclature	*[GIGS]*: names, definitions and terminology applied to given class of data. Used particularly with reference to *geodetic data objects* and their associated *geodetic parameters* in the *EPSG Dataset*.
northing	*[ISO/TC211]*: distance in a *coordinate system*, northwards (positive) or southwards (negative) from an east-west reference line. Note: Northing may be designated by e.g. N, y or x depending upon the *coordinate system* in use with the relevant *CRS*.
OGC	the Open Geospatial Consortium, Inc.® – a non-profit, international, voluntary consensus standards organisation that is leading the development of standards for geospatial and location based services. Note: See www.opengeospatial.org/
OGP	*[OGP]*: the International Association of Oil & Gas Producers – encompasses most of the world's leading publicly-traded, private and state-owned oil & gas companies, oil & gas associations and major upstream service companies. Note: See www.ogp.org.uk.

term	definition
P1/84	*[OGP]*: Industry standard seismic post plot positioning data exchange format previously established by *UKOOA* and currently maintained by OGP. Note: Current version is *P1/11* but the *P1/84* version is still important with legacy data. See www.epsg.org/p-formats.html
P1/90	*[OGP]*: Industry standard seismic post plot positioning data exchange format previously established by *UKOOA* and currently maintained by OGP. Note 1: Current version is *P1/11* but *P1/90* version is still important with legacy data. See www.EPSG.org/p-formats.html Note 2: Q records are utilised for bin-centre input data in 3D seismic surveys, even though such records do not represent the final navigation bin-centre locations.
P1/11	*[OGP]*: Industry standard geophysical positioning data exchange format scheduled for release by OGP Geomatics Committee Q4 2011. Note: See www.EPSG.org/p-formats.html
P2/94	*[OGP]*: Industry standard seismic raw positioning data exchange format previously established by *UKOOA* and currently maintained by *OGP*. Note: Current version is *P2/11* but *P2/94* version is still important with legacy data. See www.EPSG.org/p-formats.html
P2/11	*[OGP]*: Industry standard geophysical raw positioning data exchange format scheduled for release by OGP Geomatics Committee Q4 2011. Note: See www.EPSG.org/p-formats.html
P5/94	*[OGP]*: Industry standard pipeline position data exchange format previously established by *UKOOA* for use on the UKCS and currently maintained by *OGP*. Note 1: Current version is P5/94. See www.EPSG.org/p-formats.html Note 2: Pipeline data is only considered here as an input for mapping purposes.
P6/98	*[OGP]*: Industry standard format for the definition of 3D Seismic Binning Grids and the associated data exchange, previously established by *UKOOA* and currently maintained by *OGP*. Current version is *P6/98*, revised in 2000 and currently under review (see Note 2 below). Note 1: See www.EPSG.org/p-formats.html Note 2: An OGP Task Force is currently undertaking a review of P6 with a new version expected to be published Q4 2011 or Q1 2012
P7/2000	*[OGP]*: Industry standard well deviation data exchange format previously established by *UKOOA* and currently maintained by *OGP*. Note 1: Current version is Rev 5, /2000. See www.EPSG.org/p-formats.html Note 2: Contains description of well curve data, through wellbore survey measurement data (measured depth, inclination and azimuth) or calculated positions.:
P-EPSG	*[OGP]*: 'EPSG Coordinate Reference System Description in UKOOA P-Formats', maintained by OGP. Note 1: See www.EPSG.org/p-formats.html Note 2: Contains detailed information on compiling *CRS* information in the other P-Formats.
parameter value	*[OGP]*: value allocated to one specific instance of *geodetic parameter*. Example: A parameter value of 6,378,137 is allocated to the geodetic parameter with the name 'semi-major axis' of a geodetic data object with the name 'ellipsoid'. The same object has the parameter value 'WGS 84' for its 'name' attribute. Note: Where the term 'EPSG parameter value' is used in this documentation, parameter values as recorded in the *EPSG Dataset* are meant.
polar coordinate system	*[ISO/TC211]*: two-dimensional coordinate system in which position is specified by distance and direction from the origin.

term	definition
precision	*[ISO/TC211]*: measure of the repeatability of a set of measurements.
prime meridian	*[ISO/TC211]*: meridian from which the longitudes of other meridians are quantified. Note: This is usually the Greenwich prime meridian, but usage of other prime meridians, Ferro, Bogota, Paris, Jakarta etc
projected CRS	*[ISO/TC211]*: CRS derived from a two-dimensional *geodetic CRS* by applying a *map projection*. Note: a projected CRS is sometimes referred to as a *map grid*; *coordinates* in a projected CRS are sometimes referred to as grid coordinates.
quality	*[ISO/TC211]*: totality of characteristics of a product that bear on its ability to satisfy stated and implied needs Note: Quality is often expressed as 'fitness for purpose'.
SEG	Society of Exploration Geophysicists. A not-for-profit organisation that promotes the science of applied geophysics and the education of geophysicists. Note: See www.seg.org link to Technical Standards
SEG-P1	Postplot location data exchange format 1983. Note: The SEG-P1 format generally superseded by OGP *P1/90* but is still important with legacy data. See www.seg.org link to Technical Standards
SEG-Y	Seismic data recording format, including position data. Note: current version is Rev 1 2002. Earlier versions may be important with legacy data. See www.seg.org link to Technical Standards.
shape files	.shp format and associated files used for spatial data, to store non-topological geometry and attribute information for the spatial features in a data set. The geometry for a feature is stored as a shape comprising a set of vector coordinates. Used in conjunction with other essential files for data exchange. Developed and regulated by *ESRI*. Note: current version July 1998. See http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf
southing	*[OGP]*: distance in a coordinate system, southwards (positive) or northwards (negative) from an east-west reference line. Note 1: Southing is rarely encountered and is applicable only to south orientated coordinate systems and may be designated by e.g. S, y or x. Note 2: Definition from 'OGP Guidance Note 7, Part 1: Using the EPSG Geodetic Parameter Dataset', with URL: http://www.epsg.org/guides/docs/G7-1.pdf
SPS	SPS format–SEG Technical Standards Committee on Ancillary Data Formats, Shell Processing Support Format for Land 3-D Surveys, 2006. Note: Current version is SPS rev 2.1. See www.seg.org link to Technical Standards
transformation	See *coordinate transformation*.
true north	See *geographic north*.
tuple	*[ISO/TC211]*: ordered list of values Note: See also *coordinate tuple*.
TVD	True Vertical Depth: the vertical distance from a point in the well (usually the current or final depth) to a point at the surface, usually the elevation of the rotary kelly bushing (RKB). Note 1: See www.glossary.oilfield.slb.com Note2: The vertical CRS of a TVD value is a 1D *engineering CRS* of which the (positive) axis points down, its direction coinciding everywhere with the vector of gravity.
TVDBML	*TVD* below Mud Line – for well data

term	definition
TVDSS	*TVD* sub-sea (below sea level) – for well data
UKOOA	United Kingdom Offshore Oil and Gas Industry Association, trading as Oil & Gas UK, was originally known as The UK Offshore Operators' Association. It is the leading representative body for the UK offshore oil and gas industry. Note 1: Several of the data exchange formats referenced in this document were originally published by UKOOA. Responsibility for the maintenance of these formats passed to OGP in 2006. Note 2: See www.oilandgasuk.co.uk
unit	*[ISO/TC211]*: defined quantity in which dimensioned parameters are expressed. Note: Also referred to as 'unit of measure'. In the *EPSG Dataset* three types of unit are distinguished: linear, angular and scale.
vertical coordinate system	*[ISO/TC211]*: one-dimensional coordinate system used for gravity-related height or depth measurements.
vertical CRS	*[ISO/TC211]*: one-dimensional CRS based on a vertical datum.
vertical datum	*[ISO/TC211]*: *datum* describing the relation of *gravity-related heights* or *depths* to the Earth.
vertical transformation	*[GIGS]*: coordinate transformation applied to heights or depths. Note: This may apply to gravity-related heights or depths and to 1D engineering CRSs with a vertical coordinate axis.
wellbore survey data	*[GIGS]*: the set of Measured Depth (MD), azimuth and inclination tuples observed in points along a wellbore in a wellbore survey.
well track	*[GIGS]*: the set of coordinates of identified points along the wellbore, calculated from wellbore survey data for that wellbore.
westing	*[OGP]*: distance in a *coordinate system*, westwards (positive) or eastwards (negative) from a north-south reference line. Note: westing is rarely encountered and is only applicable to *coordinate systems* that are positive westward and may be designated by e.g. W, x or y depending upon the *coordinate system* in use with a specific *CRS*.

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