WITSML stimJob Object Usage Guide

VERSION 1.0

Standards Document Title	**stimJob Object Implementation Guide** Guide for managing the data contained in a fracturing treatment post-job summary report.
Version:	**Version 1.0**
Abstract	This document is a guide to the implementation of the WITSML stimJob Data Standard
Prepared by:	Performance Enhancement Sub-Team
Date published:	April 10, 2010
Document type:	Usage Guide
Keywords:	Standards, Fracturing, data, information, process, stimulation

energistics™
The Energy Standards Resource Centre

Document Information	
DOCUMENT VERSION:	1.0
DATE:	10 April 2010
Technical	
Language	US English

This document was produced by
Energistics and the WITSML SIG
Performance Enhancement Sub-Team.

Amendment History			
Version	**Date**	**Comment**	**By**
0.1	18 January 2010	Internal release candidate.	Performance Enhancement Sub-Team
0.2	1 March 2010	Finalize document for SIG review	Jana Schey
1.0	10 April 2010	Finalize document	Gary Masters

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1. Executive Summary

Fracturing services are performed on wells for the primary purpose of enhancing oil and gas production from a well. Fracturing treatments are a very complex process and result in the generation of large volumes of data. This data is very valuable in determining the efficiency and optimization of oil and gas production from a well, therefore, it is essential that all data generated is properly recorded so it can be provided to the operator of the well.

The Fracturing Object contains treatment data which is a post-job, summary view of what was pumped, how it was pumped, observations made during the job, and summary interpretations of observed data. The summary report content is already well standardized across fracturing service providers with only slight differences in format and content. Historically, this data has been provided to the well operator as a paper report. The creation and adoption of the Fracturing Object enables fracturing service companies to create and transmit an electronic version of this data to the operator in a consistent manner.

The Fracturing Treatment Object and this implementation guide were created by the Performance Enhancement Sub-Team Special Interest Group (SIG).

2. Introduction

The Performance Enhancement Sub-Team was organized for the initial purpose of creating a stimulation job data standard in order to enable efficiencies in the management of fracturing treatment post-job summary report data. Enabling the exchange of digital data between the fracturing service companies and the well operators replaces the exchange of a paper report and creates many time and labor efficiencies and helps to facilitate business intelligence efforts.

This document is a guideline for implementation of this data standard by fracturing service companies and well operators.

3. Scope

The scope of this document is to provide a good understanding of the business application of this WITSML Object and enable an efficient implementation for the relevant companies.

4. Objectives

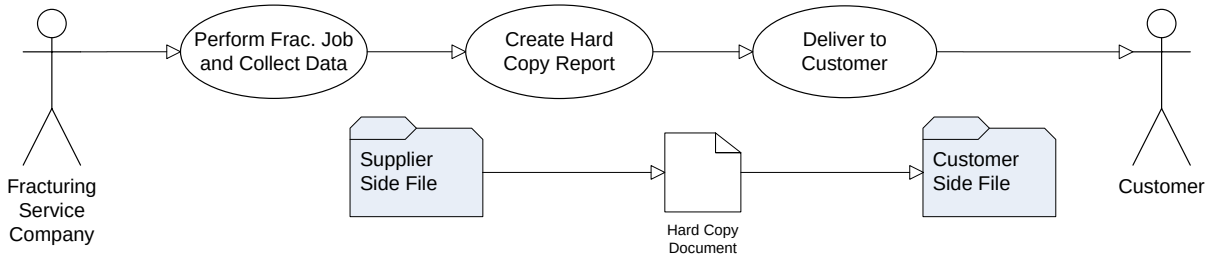
4.1 Discussion

Historically there has not been a standardized, post-job fracturing treatment report that is produced by the fracturing service companies for the well operator. The reports being produced are similar but not identical. Variations in data content, format, and terminology causes frustration and inefficiencies for well operators. This has caused operator companies to request unique reports from each service company which comply with their own company's data format and terminology that may reside in their internal databases. The result for the fracturing service companies is increased time and cost producing customer-specific reports.

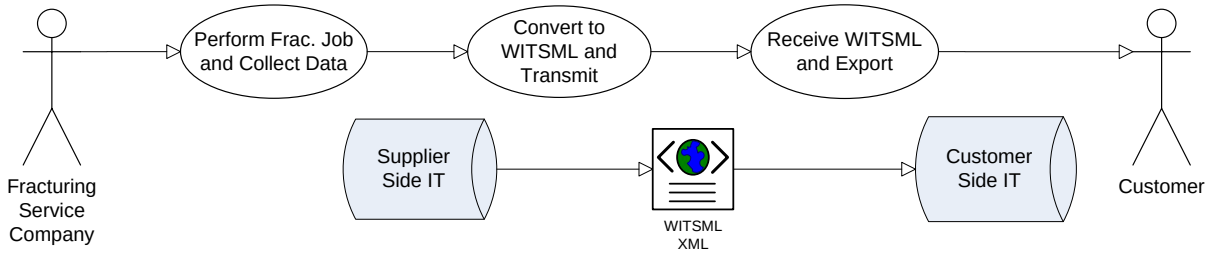
The stimJob Object was developed to standardize the service company output thus ensuring that customers not only know what to expect but can also specify what they are expecting with respect to the completeness of the object. This also allows a service company to quickly produce a post-job report data file for a customer without having to explain the terminology and having to produce different output files for different customers.

4.2 Business Processes

Old Process - Transfer of data via a paper report.



New Process – Transfer of data electronically.



Delivery Options

- Email Attachment
- Hand Delivered
- FTP
- HTTP
- Etc.

4.3 Key Business Objectives:

- Standardized post job reporting for fracturing operations regardless of the service provider
- Consistent data terminology to eliminate confusion in the interpretation of the data
- Consistent data formats to simplify transformation of the data into the well operator's data systems
- Reduce the service company's cost of preparing and delivering data to the well operator
- Minimize future service company's cost increases in the preparation and delivery of data to the well operator
- Reduce the well operator's cost of managing fracturing treatment data
- Minimize future well operator's cost increases for the management of fracturing treatment data

5. Intended Audiences

This section defines the types of people who are primary and secondary intended readers and users of this document and other related documents.

USE KEY A= PRIMARY DOCUMENT Key document to read B=SECONDARY DOCUMENT Good material to review C= LESS USEFUL Review as needed **DOCUMENTATION**	**ROLE** Business Analysts	Standards Users	Software Developers	IT Managers	Business Managers	Standards Developers	Left Blank
Fracturing Treatment Object Implementation Guide	A	A	A	A	A	A	
Well Object Data Schema	B	A	A	B	C	A	
Wellbore Object Data Schema	B	A	A	B	C	A	
Fracturing Object Data Schema	B	A	A	B	C	A	

6. stimJob Object

6.1 Design Concepts

This object was designed to include all data that is typically included in a post-job treatment report for all types of fracturing services as well as single well, multi-treatment scenarios.

Two pre-existing WITSML data standards are used to create a complete set of the data elements needed to define a fracturing job. Within the context of the stimJob Object, these pre-existing objects can be viewed as parent objects of the stimJob Object. These objects are the well and wellbore WITSML objects as defined in the following attachments.

The object has been designed so that every level has a summary of the data values of the levels below it. There are 2 reasons for this:

1. For simple jobs there may not be a need to go into great detail for all the levels and hence you do not have to populate as much information.

2. For more complicated jobs where there is a one to many relationship such as many flow paths for a given treatment interval, you will want to have a summary of the total proppant at a high level table. This gives an improved efficiency by not having to search through sub-hierarchal tables to find the values and then add them up.

We also wanted to ensure that the object was scalable at the stage level of a fracturing job. This meant that we did not want to limit the content by designing the elements with today's technology in mind. We wanted to ensure the object was scalable and hence would embrace changes in technology without a schema change. We hopefully achieved this by separating the fluids from the stage and also allowing more than one to be present. This should get around the differentiating technologies of any particular service company. The same concept applies to the proppant and all other additives. All of these data elements are optional allowing the population of the stage object to be as much or as little as needed.

The treatment interval is a key concept in the design. All diagnostic tests hierarchically roll up to the sub-object cs_stimJobInterval. The diagnostic tests are performed on an interval level so it makes sense for them to be here. Perforations are treated similarly. A perforation will only apply to a single treatment interval. Since you can have many perforations, they are a separate sub-object from the treatment area. Although this does seem to conflict with the object design, by doing this we can make the object more data efficient and also capture the different information associated with a perforation.

One thing to note is that the number of required fields in this object is very low. The reason for this is that every fracturing operation is unique so not all the fields are appropriate. Also the object is designed to cover many different types of operations such as acid, simple fracturing, foam, mutli-stage, and multi flow path. Therefore the number of elements in each table may seem large but it is unlikely that all the elements would be used in a single fracturing job.

6.2 Data Types

The stimJob object consists of several data types. Each type consists of a unique set of data elements that when combined, make up the entire Fracturing Object. The sub-objects are:

- obj_stimJob
- grp_stimJob
- cs_stimAdditive
- cs_stimEvent
- cs_stimFetTest
- cs_stimFlowPath
- cs_stimFluid
- cs_stimJobInterval
- cs_stimJobStage
- cs_stimPdatSession
- cs_stimPerforationSet
- cs_stimPressureFlowRate
- cs_stimProppant
- cs_stimProppantUsage
- cs_stimPumpFlowBackTest
- cs_stimReservoirInterval
- cs_stimShutInPressure
- cs_stimStepDownTest
- cs_stimStepTest
- cs_stimTestStep
- cs_stimTubular

6.3 Object Hierarchy

The schema of the object follows the generic flow path of a fracturing operation. The parent well object contains fracturing treatment report header information such as the well's API#, well name, customer name, etc. The parent wellbore object is basic information about the wellbore. The top of the stimJob object holds information that relates to the complete fracturing operation and represents summary data values that are commonly used for high level queries of fracturing job data. Having the data represented here will hopefully allow for more efficient data searching.

From the stimJob element we then move down to the treatment interval (of type cs_stimJobInterval). Every fracturing job has one or more treatment intervals. Every treatment interval will have its own unique treatment entry point as defined by perforations. The perforation sets potentially have a many to one relationship to the treatment interval.

Each interval can have one or many flow paths. The flow path structure summarizes all the treatment stages that can exist below it. It also has the tubular description associated to it. This represents the exact tubular section that is associated with that treatment in that flow path. The event structure is also associated at the flow path level. The reason for this is that operations will occur on a flow path. Having them at the stage level is too low level. The whole idea of the events at this level is to have high level events captured such as start job, start stage 1, pumps on etc. It is not intended to be very detailed

although it has the capability to be made so. It is also not intended to be mandatory as it is anticipated many service companies will not use the events object.

From the flow path you can have one (very rare) but more likely many stages. These stages represent what exactly happened in a set of stages. A stage is defined by the fluid properties and when a fluid changes then a new stage will be created. Fluid changes would be a differing concentration, the addition of proppant, change in concentration of a proppant, etc.

The fluid is held as a separate structure from the stages. This allows multiple fluids to be added to a stage and from there have additives and a proppant described. The proppant is a child of the fluid as a proppant is always added to the fluid. Please note the amount of additives you enter is up to the user. These are not mandatory and there is no expectation on the amount of detail you enter for the proppant, additive or fluid. This is entirely up to the data provider.

Note we have included enumerated values for concepts such as proppant type, stage type etc. The intention of this is to ensure that reporting can be consistent. The purpose of the stimJob object is to ensure uniformity in data description and hence allow common reports for consumers of the data. By using the enumerated types we can achieve this and also stay away from proprietary names.

Figure#1 illustrates the data type usage hierarchy.

```
obj_stimJob
      grp_stimJob
           cs_stimJobInterval
                cs_stimProppantUsage
                cs_stimShutInPressure
                cs_stimFlowPath
                     cs_stimTubular
                     cs_stimJobStage
                          cs_stimFluid
                               cs_stimAdditive
                               cs_stimProppant
                     cs_stimEvent
                cs_stimPdatSession
                     cs_stimStepTest
                          cs_stimPressureFlowRate
                     cs_stimFetTest
                     cs_stimPumpFlowBackTest
                     cs_stimStepDownTest
                          cs_stimTestStep
                     cs_extensionNameValue
                cs_stimReservoirInterval
                cs_stimPerforationSet
```

6.4 Data Elements

The stimJob object data elements are documented in the normative XSD schema files which are summarized in file ancillary/WITSML_v141_content.xls. In the content spreadsheet, the data elements are organized by component schema name (i.e., by cs_xxxx or obj_xxxx). The name, definition, and other pertinent information are provided for each of the data elements.

7. Terminology and Definitions

Certain fracturing related terms are used in different ways by different companies and therefore have different meanings. The non-standard use of these terms can create confusion and misunderstanding for

the parties involved. The following are a few key terms that are defined based on their use and context within the Fracturing Object standard.

Table 1: Terms

Term	Definition
Job	A job is a complete fracturing treatment. One job could potentially contain every data element defined in this standard. A job will contain one or more treatments
Stage	A stage is a sub-set of a job. Examples of stages are Pad stage, 1ppg proppant stage, Flush stage, etc.
Treatment	A treatment is an operation that will be performed on a flow path with a set of perforations. This treatment will most likely include more than one stage
Flow Path	This is the path that the fluid will take during a treatment

8. Data Transmission Protocol

A standardized data transmission protocol has not been defined for the stimJob Object. The method of transmission is to be determined by the service company and the well operator as it is directly dependent on the capabilities of the individual companies. Some of the transmission options are FTP, HTTP, email attachment, delivery on digital media, WITSML client/server, or other.

The fracturing object is a post-job report and does not require real-time connectivity during the actual treatment which allows for different options. Each of the fracturing services companies have developed and implemented their own transmission protocols for real-time transmission of detailed treatment data which is out of scope for this standard.

9. Usage, Intellectual Property Rights, and Copyright