J. Marine. Sci. Appl. (2009) 8: 228-232
DOI: 10.1007/s11804-009-8104-2

Applying the vantage PDMS to jack-up drilling ships

YIN Peng*, CHEN Yuan-ming, CUI Tong-kai, WANG Zi-shen, GONG Li-jiang and YU Xiang-fen

Offshore Oil Engineering Co. Ltd, Tianjin 300451, China

Abstract: The plant design management system (PDMS) is an integrated application which includes a database and is useful when designing complex 3-D industrial projects. It could be used to simplify the most difficult part of a subsea oil extraction project—detailed pipeline design. It could also be used to integrate the design of equipment, structures, HVAC, E-ways as well as the detailed designs of other specialists. This article mainly examines the applicability of the Vantage PDMS database to pipeline projects involving jack-up drilling ships. It discusses the catalogue (CATA) of the pipeline, the spec-world (SPWL) of the pipeline, the bolt tables (BLTA) and so on. This article explains the main methods for CATA construction as well as problem in the process of construction. In this article, the authors point out matters needing attention when using the Vantage PDMS database in the design process and discuss partial solutions to these questions.

Keywords: Vantage PDMS; component database; rate database; bolt; jack-up drilling ships
CLC number: TP319 **Document code:** A **Article ID:** 1671-9433(2009)03-0228-05

1 Introduction

Vantage PDMS is a 3-D design software developed by the company of AVEVA. It has formidable construction capability of the 3-D model and the charting function, and it can find the question immediately during the design. So we can also use it to roam and simulate the construction progress. By using it we could raise the rated capacity, reduce the design cycle, and would also upgrade the design to a higher level.

The database of PDMS is very simple and logical. It's based on strict level and dendritic structure. The establishment of the CATA of the pipeline is the foundation of the 3-D design. These data's integrality, veracity would influence the establishment of the 3-D model and extract each kind of blueprint, materials list. Therefore reasonably planning the database and accurately establishing it would be especially important. The Offshore Oil Engineering Co. Ltd. is a first company to use the 3-D design software of Vantage PDMS which has been applied in China off-shore oil domain since 2004. And then we've used it in the projects of XJ23-1, HZ25-3/1, and so on, and the effect is very well. But this software was firstly applied in the jack-up drilling ship project, which is different from the former project because the standard of low pound level which the owner requested must accord with the national code (GB). And the materials PE, 30CrMo and so on used in this project are also different from the former platform project.

This drilling-ship is used in offshore oil's mining, prospecting for LNG and so on. It is suited to drill the well between 10 meters and 69.96 meters water depths, mainly in the area of BOHAI and other similar marine areas. This paper demonstrated some main performance of the drilling ship. In this project the pipeline and fittings of high pressure are based on the standards of ANSI, API; meanwhile the pipeline and fittings of low pressure are based on the standards of CCS, ABS and so on. For this is the first jack-up drilling ship constructed in China, the original component database cannot meet the project's requirement any more. So we have to redesign the database, in order to accomplish all the pipe designing work and put special parts of the national standard materials into the primary component database and so on. The foundation of all the work is the PDMS's powerful component database.

2 The catalogue (CATA) of pipeline of PDMS

2.1 The standard for the database

This project uses the standards of ANSI and API for the pipeline and fittings of high pound level and uses the standards of CCS, ABS, GB8163, GB/T10752, GB/T2506 and so on for the pipeline and fittings of low pound level. The CATA of VANTAGE PDMS adopts the standard of ANSI, but if we want to meet the request of the jack-up-drilling-ship database, we must first consummate the original database and then based on the

Received date: 2009-02-27.
***Corresponding author Email:** yinpeng@mail.cooec.com.cn

former database, add the special part made of the materials which satisfy the GB code.

The jack-up-drilling-ship project's database was established by the CATA, including former database and the other database requested by this project. The constructed database by ourselves includes the GB code, special CATA, and so on.

2.2 Parts naming

Each element in the jack-up-drilling-ship database would have only one name, and VANTAGE PDMS has provided a set of coding systems for implementing the standard.

2.3 The method for increasing parts

The methods for increasing parts are classified into two kinds: one is to use the method of "the copy–revision". We can refer to some similar or close part, use "Tools/Copy Category" to copy CATA to the jack-up-drilling-ship's CATA database, and then rename them, carry on with the revision parameters. For example, in Fig.1's TEE which is accordant with the GB code, we could make over the TEE according to the same caliber and the same type of connection TEE which is accordant with the ANSI code.

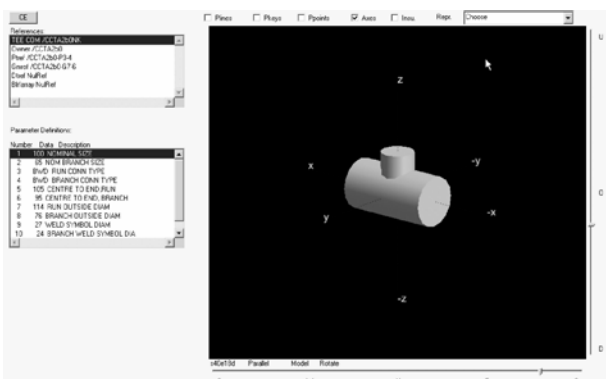

Fig.1 TEE accordant with the GB code

Another one is that we could anew establish the part. Now we take a 90° bend according to the GB code as an example, see Fig.2.

Firstly, we establish the management.

Secondly, we fix on the parameters: first we determine the bend's five parameters: 1) NOMINAL SIZE, 2) CENTRE TO FACE, 3) CONN TYPE, 4) OUTSIDE DIAM, and 5) WELD SYMBOL DIAM. Then we set up the parameters. We must pay attention that the first parameter must be the NOMINAL SIZE for entrance, and then we go on with the points and the graphics.

Thirdly, create part: first we use "Create>Component" to create the bend, and then separately input the bend's five parameters[1]. We must pay attention to that the part which has been created must be put under the PTSE.

Fourthly, create the points: the set of points is to set the junction points of the part and the reference points. We use "Point Set>Primitives>Axial *P*-point (PTAX)" to separately create the bend's points of P_1 and P_2.

Fifthly, create the graphics: at last we need to create the parts' graphics, namely, to set the basic figures. The process of creating the graphics is similar to creating the equipment, that is, we use the basic figures to create the part's externality. So we first must confirm the graphics, and then create the bend's figure by using the points of P_1 and P_2. Finally we create the centre line and the welding points.

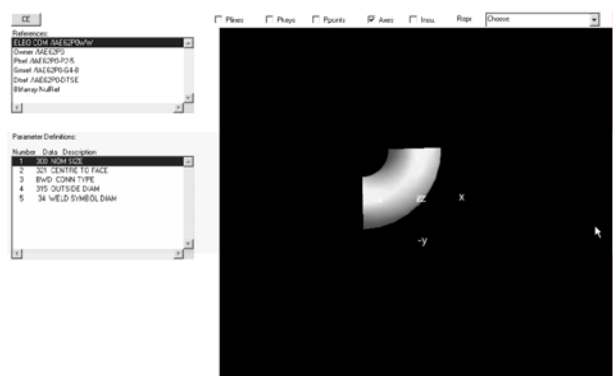

Fig.2 Creating a 90° bend

2.4 The part description

The part description is mainly to describe part's geometrical shape and characteristics.

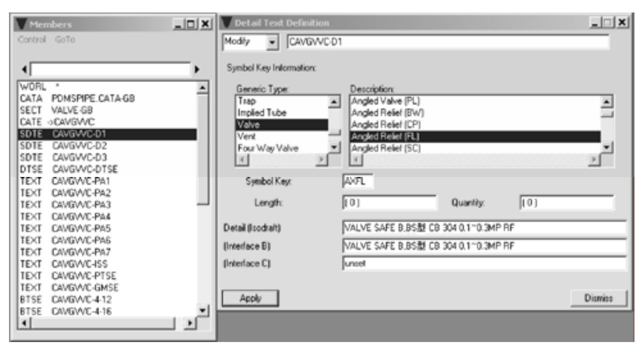

Fig.3 Creating the SDTE

When creating the rank and the materials report, the materials list for Isodraft will be used, and it comes down to the charts expression whether they are correct and up to snuff. Vantage PDMS retains 3 attributes-RTXT, STEXT and TTEX in the part describing, respectively, but that could not surpass 120 characters. Detail corresponds to RTEXT, Interface B corresponds to STEXT, and Interface *C* corresponds to TTEX. These three attributes' usage is completely the same. They are mainly used as outputs by different languages or different forms. Sometimes when a part needs multi-SDTE (description), it may use CATVIEW to search these SDTE elements directly. For example, when some safety valves which are in identical size have 3 kinds of pressure ratings, we need to create 3 SDTEs under the part of safety valve, see Fig.3.

3 Bolt table

The bolt table is a part of the pipeline database. The contents of this part are easy to be neglected because only in the end when we compile the bill of materials, extraction ISO for pipeline can we find the error message in the bolt table. So it is listed separately here. Below are some points for attention in the process of creating the tables[2].

3.1 Construction of data in the bolt tables

The bolt tables are composed of the standard measure of bolt length table, the affixation measure of bolt length table, the bolt rank table, the bolt diameter comparison table, and so on. (The purpose for setting up the bolt diameter comparison table is mainly to compare with the British system diameter of bolt.)

3.2 The quotation relation of bolt in modeling

In the modeling, each pipeline rank would quote the bolt rank. We know that the application of bolt depends on the diameter and length of the bolt, so the affixation measure of length table and the standard measure of length table to influence the length of the bolt. But the diameter of bolt depends on the attribute of bolt diameter in the affixation measure of length table.

3.3 The construction of bolt table

The bolt table is different from the part table which has the interface of graphic establishment, it completely consists of the data of digitized contact surface. Some contents need people operate it outside the software, and add the attributes which must have. So the people who constructed the database understand the bolt table's construction of data and the quotation relations.

·Establishing the standard measure of length table for the bolt.

·Establishing the affixation measure of length table for the bolt.

·Establishing the description tables for the bolt materials.

·Establishing the material tables for the bolt.

·Establishing the bolt rank table.

·The pipeline rank quoting the bolt rank.

What we should pay attention to is that we must give the diameter unit of the affixation measure of length table for the bolt, otherwise when we get the Isodraft, the bolt will not show the materials.

4 The rank table of pipeline

The function of the rank table is to reduce the choice scope for the fittings. The relations of the PDMS's rank table and part table are that each rank of fitting points to only one part in the part table. This kind of relation ensures that the same fitting is identical in each rank, so that the artificially caused mistake that the same fitting has different rank description using the former 3-D software would not happen.

The 3-D design software Vantage PDMS is based on the part table and taking the database drive the software of graphical. The graphic interface is pointed by the rank table not by the component table directly, see Fig.4.

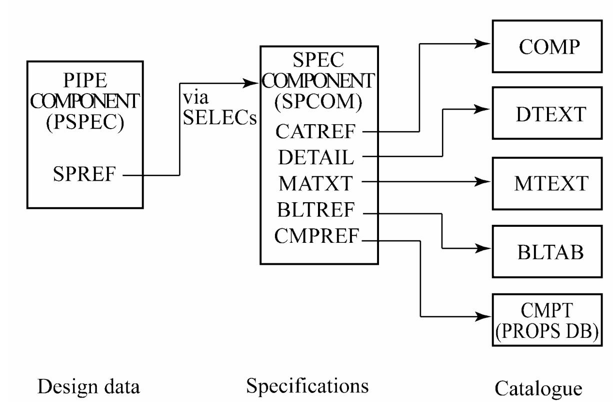

Fig.4 The rank table pointing to the part table

We use the CATVIEW-the maintenance tool under the module of PARAGON to add the parts to the part list of the rank table of pipeline.

Using the "CATVIEW/BROWSE", we could see the rank part list in the part database. First we could use the software of "CATVIEW" to select the part (CATA) which we need from the part database, and then choose the size of the part and the type of the material, and finally add the part into the rank which we need. We could find the new adding part in the part rank list.

Nine ranks of the pipeline in this project have been established based on the owner's requests and the materials' criteria document, e.g. the high-pressured well cementation is API 10 000 psi, and so on; the material aspect increased the material of 30CrMo, PE and so on.

5 Suggestions

VANTAGE PDMS is a 3-D design software based on the database. But the 3-D modeling, the correct and reliable final product and the rated capacity enhancement are based on the part database and the rank database are completely foundation. Build the general part database and the rank database, so that it can be used in all projects. Along with the 3-D design's accumulation and the part database, the rank database unceasing consummation, the rated capacity will have enormous enhancement.

Combining the practice in the drilling ship project, the following suggestions on PDMS database are proposed:

For establishing the part table of pipeline fast and accurately, we could use the number of database which is provided by AVEVA fully. The concrete procedure is that we refer to some similar or close part, use Tools/Copy Category to copy CATE to the corresponding part database, rename them, and finally revise the parameters.

When establishing the set of points, we should pay attention to the following points[3]:
1) The three-way valve's hand wheel way point must be bigger than P_3, and diameter is unset.

2) The four-way valve must establish the points symmetry, P_1 corresponds to P_2, P_3 corresponds to P_4, the hand wheel way-point must be bigger than P_4, and diameter must be unset.

3) The pan of the Eccentric Reducer without the point for connection must be pointed to P_3 for rotating along axial direction in the design, and P_3 does not have established diameter and connection form.

4) The point for connection of the Eccentric Reducer with the point to be connected must be P_3, and the pan must be at the point of P, and P_9 does not have established diameter and connection form.

Regarding some non-standard valve and fittings, they need to be designed specially in the actual project according to the project situation. We will add a similar part to the part table in the earlier period and describe it, and when the factory provides this kind of part's attribute we will make the revision to the part database. In this way we can guarantee that there will not be gap of the parts, besides, the data of parts will be accurate during the design.

The atmospheric pressure pipeline is usually composed of the slope tube. When the level and slope tubes are connected with the vertical tube, the section of straight pipe cannot be connected automatically because of the special angle. We need to use zero length BEND to connect them. Therefore, we must increase this zero length BEND in the part database.

When establishing tubing database, we also need to pay attention to the versatility, making it suit not only to this project but also to the later project, namely all projects use the same part database. This is the direction what we will work toward.

6 Conclusions

We substitute the component database for primitive method, and standardize the database, so that the work in later period becomes simple and convenient. Thus we'll greatly reduce the design cycle and the mistakes which would appear in the design. This will be beneficial to future design of project, making the design even more stylized and reducing the time for middle communication link.

References

[1] ZHANG Zhifeng. Application of PDMS software in high-pressure polyethylene plant[J]. Chemical Engineering Design Communications, 2007, 33(1): 43-45.

[2] YANG Lina, LI Weitian. PDMS running model and applying research[J]. Coal Mine Machinery, 2007, 28(1): 80-82.

[3] YAN Yingming. Application of PDMS in chemical engineering project management[J]. Chinese Hi-tech Enterprise, 2009, 8: 20-21.

YIN Peng was born in 1986. He is working at the COOEC. His current research is Vantage PDMS software database.

CHEN Yuan-ming was born in 1984. He is working at the COOEC. His current research interests include the redevelopment for INTOOLS' database and the pipeline hoisting mechanics analysis and simulation.

PDMS 元件库在自升式钻井船项目的应用

殷 鹏，陈渊明，崔同凯，王子申，巩立江，于香芬

（海洋石油工程股份有限公司设计公司，天津 300451）

摘　要：Vantage PDMS 为一体化多专业集成布置设计数据库平台, 可以进行工程设计最难点——管道详细设计，并可以进行设备、结构、暖通、电缆桥架、支吊架各专业详细设计，同时可以实现各专业间充分关联联动．该文主要研究 Vantage PDMS 软件数据库在自升式钻进船项目配管方面的应用，其中主要包括管道元件库、管道等级库、螺栓库等方面的内容. 文章对建库的主要方法进行阐述，对建库过程出现的问题进行研究，总结出 Vantage PDMS 软件数据库在工程设计中的注意事项，并探讨了部分问题的解决方法.

关键词：Vantage PDMS；元件库；等级库；螺栓；自升式钻井船