Oxygen Compatibility Assessment Database Web Application

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Materials in human space systems are assessed for fire hazards as required by two NASA standards: NASA-STD-(I)-6001, *Flammability, Off Gassing, and Compatibility Requirements and Test Procedures*, and NASA-STD-6016, *Standard Materials and Processes Requirements for Spacecraft*. These standards reference a method for performing an oxygen compatibility assessment (NASA TM-2007-213740, *Guide for Oxygen Compatibility Assessments on Oxygen Components and Systems*). Hazards associated with the system and its components are identified and documented. Information needed to perform a compatibility assessment includes details on system components, configurations, and operating conditions. Material flammability, ignitability, and potential damage data are also used when assessing fire hazards. Currently, the Oxygen Compatibility Assessment Group at NASA White Sands Test Facility (WSTF) uses a database application to catalog and retrieve the wide variety of numerical data, explanatory text, pictures, and graphics that make up a properly documented assessment report.

Engineers at WSTF perform an increased number of oxygen compatibility assessments in conjunction with other NASA facilities. This collaboration reveals the need for engineers working at different NASA sites to have common access to the same compatibility information and assessment data. However, with the existing tools, only WSTF engineers can access report data for the assessment reports. To address this problem, WSTF developed the Oxygen Compatibility Assessment Database Web Application, a relational electronic database for performing oxygen compatibility assessments.

To make the WSTF Oxygen Compatibility Assessment Database Web Application a useful tool for engineers, one main requirement must be met: the report data for an assessment must be accessible by people at different locations. To solve this problem, we applied a two-layered, backend/frontend architecture (figure 1). Microsoft SQL Server® acts as the database management system to the backend of the application; it is responsible for storing the data and handling the different types of data requests. WSTF chose Microsoft SQL Server® because of its wide acceptance, availability, and robustness as a reputable and scalable database platform. The frontend of the application

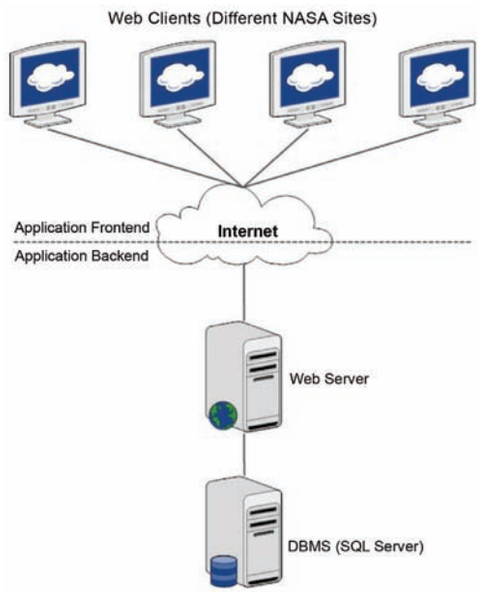

Fig. 1. *Backend/frontend architecture.*

is the user interface, where the user interacts with the data. In keeping with the goal of having an application accessible and usable by different engineers in different locations, the technology for the user interface should be readily and commonly available. The one piece of technology that meets these goals is a Web browser (client). A Web browser, regardless of operating system or computer manufacturer, is common to all computer platforms (figure 2). All clients (e.g., Internet Explorer, Firefox, etc.) use common "languages" to display and render information and data to the user. Any updates, bug fixes, or modifications to the application can be made without impact to the user – an advantage this model has over a stand-alone application. So a user would not be bothered with a request for updates or be concerned with backend compatibility issues. This is not the case if a stand-alone application model were used.

The backend uses a relational database with tables as the basis for modeling "real-world" data. In common database terminology, the columns and rows represent fields and records. Each table, or relation, represents a particular object or event (e.g., a compatibility assessment). However, any compatibility assessment is made up of many different parts, with some parts being related.

Having all of the information for many assessments in one table would make the database large and cumbersome, especially as the assessment database grows over time. Therefore, to model real-world data, a database must contain many different relations. By using relational database principals, a compatibility assessment is relatively easy to model and allows data to be queried and generated in various ways. The database provides a repository of all information used in hazards analyses, including drawings, materials data, and environmental information that can be used for future assessments. When performing a current compatibility assessment, users can quickly access all data and past assessments as a reference.

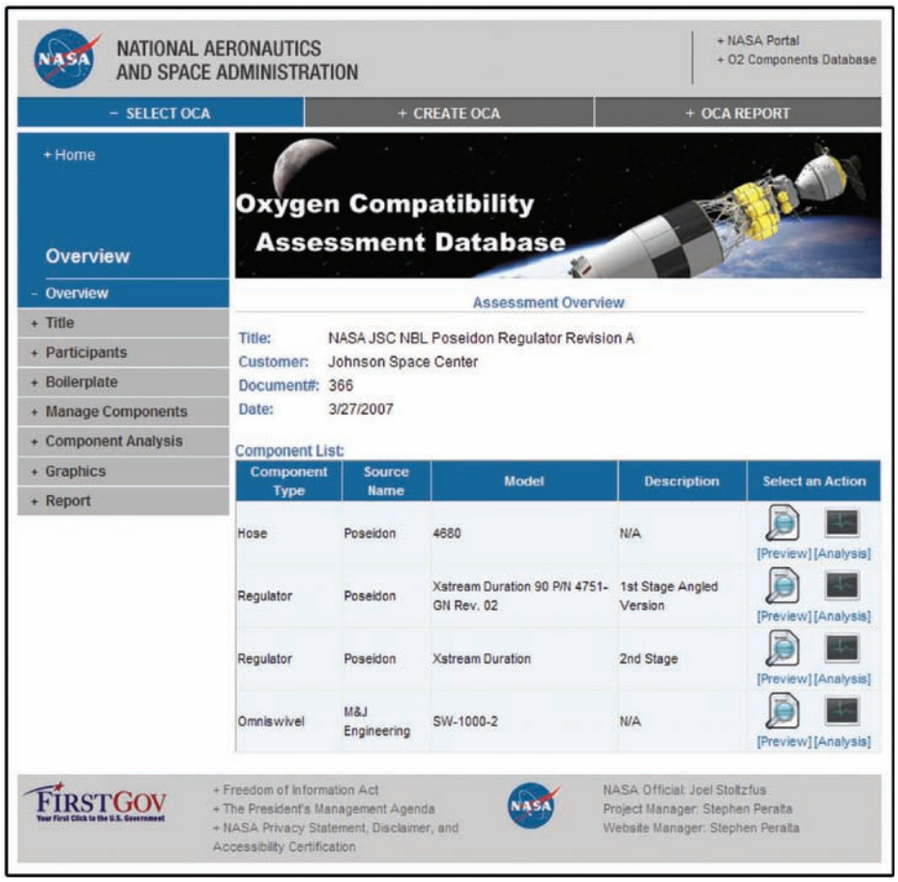

Fig. 2. *Oxygen Compatibility Assessment Database Website.*

The development and use of the relational Oxygen Compatibility Assessment Application makes performing oxygen compatibility assessments a very efficient process. Engineers executing analyses need only input the assessment data and information into the database, and the application provides a repository of information. The data-relational structure makes it easy to find answers to questions about the data by constructing and executing a simple query. New user interfaces can easily be constructed to handle greater amounts of data from a more complicated query, or to manipulate the data in other useful ways. Engineers can now quickly reference all data from past assessments as they meet requirements to develop new, accurately documented Oxygen Compatibility Assessments.

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