

European Space Agency: Web Services and Data Integration for Collaborative Design

Daysha
Consulting

Daysha Consultants have extensive experience in R&D, Innovation, and Software Engineering. Combined with our strong project management skills, Daysha were chosen to join a consortium of European companies to build the next generation Collaborate Design System for ESA.

Situation

Summary

In the 50+ years since the first unmanned space flight, the challenge to space agencies and aerospace designers has grown more and more complex. Concurrent Engineering and Concurrent Design is one such process which can help aerospace engineers and related specialists tackle these complexities quickly and efficiently.

The European Space Research and Technology Centre (ESTEC) has built the Concurrent Design Facility (CDF). This is a state-of-the-art facility equipped with a network of computers, multimedia devices and software tools that enable engineers and specialist to collaborate, concurrently in real-time to study and design future space missions.

To achieve this, the specialists engaged in these studies need to be able to share data – usually the results of their calculations of specific mission parameter values. The software system to support this sharing and exchange has been built over the past five years and utilizes Microsoft Excel heavily.

The objective of this project is to build a replacement software system which can streamline the data exchange process, reducing the possibility for errors, and enabling the exchange of information with external agencies.

Customer Profile

The European Space Agency (ESA) along with its 17 Member States work together to pursue a wide range of ambitious and exciting goals. Together, they create fascinating projects that would not be possible for the Member States to develop individually.

Solution Overview

Customer Profile

- Name: European Space Agency
- Location: Noordwijk, Netherlands
- Sectors: Aerospace

Objectives

To provide design a web services infrastructure to enable the collaboration and sharing of spacecraft parameters during mission design and preparation phase, and to provide the client applications to be used by mission specialists.

Daysha Services Used

- Project Management
- Software Engineering
- QA

Benefits

- Central warehouse of mission study data.
- Data sharing and exchange facilitated by the implementation of web services.
- All software delivered based on open source best practices
- Generalized approach to integration of third-party tools.
- Improved system reliability and security.

Problem

Context

ESA uses the Concurrent Design Facility at ESTEC conduct studies and concurrent design sessions, in which the various disciplines work together in a concurrent and collaborative manner to define the main design parameters of the systems required to realise a proposed mission.

The CDF Integrated Design Model (CDF IDM) is the information system used for concurrent design. It consists of the tools used by each of the disciplines, a central database, "data exchange/data parking" used to exchange data between disciplines as well as other tools and databases.

The current CDF IDM is implemented primarily as a collection of Microsoft Excel workbooks. There are workbooks per domain, as well as workbooks that are used to handle the sharing and exchange of data.

There are obvious limitations to this type of systems architecture, not least the fact that it is difficult to manage the data, govern the flow of data, correct errors, and also change the study process. In addition, ESA have received requests from various national space agencies, the space industry and academia, to share their CDF technologies, tools and experiences. But in its current form it cannot effectively be distributed to and used by new user organizations.

So ESA initiated a project to provide a solution that will replace the current CDF-IDM with an industrial strength alternative.

Objectives

The solution is being built by a consortium of several European partners and is known as the Open Concurrent Design Server (OCDS). It aims to

1. Deliver an industry standards based information model which will govern all terms and parameters used to represent and exchange data between
2. Replace the current Excel based Data Exchange/Data Parking component by a full featured multi-user database server which acts as a central repository for all study related data
3. Deliver a generalized framework or architecture, based on Web Services, for the integration of Domain Specific tools and external databases as well as sharing and updating of data in the central repository
4. Provide a software engineering approach to both designing domain models and operating studies. Excel is still envisaged as an ongoing element of this solution but Domain Engineers will be encouraged to adopt common approaches and methodologies in carrying out their work. Processes, procedures, and a tool will be provided to support these common work practices.

Solution

Daysha have been a key member of this consortium since the projects inception. Daysha personnel are primarily responsible for the design and implementation of (3) - the Web Services infrastructure and supporting client applications.

Module	Description
Web Services Infrastructure	The primary purpose of the web services infrastructure is to allow clients on different platforms and at different locations communicate with the OCDS using a common data format and a common understanding of the operational semantics. All client applications communicate with the central repository through web service operations. These operations allow clients access and update study specific data, perform administrative tasks, and download files and templates, amongst other things.
Study Management Console	The Study Management Console is .NET application which uses the web services infrastructure to manage users, study templates and meta data, initiate new studies, and perform general administrative tasks.
Excel Workbook Add-In	Microsoft Excel is a very important tool for ESTEC and still has a large part to play in the work done at ESTEC. In order to integrate Excel into the new OCDS solution, Daysha developed a .NET add-in for Excel using Microsoft Visual Studio Tools for Office. This add-in supports data exchange between domain engineers and allows domain engineers to view and manipulate the Study Architecture from their domain workbook.
DST Integration Framework	Domain Specific Tools are specialized applications used by domains e.g. CAD and Simulation tool. The DST Integration framework provides the tools and techniques to allow these tools to integrate with the OCDS and exchange data using web services.

Evaluation

Results and Benefits

Upon completion of the project, ESA will be able to access to a central repository through web services. This will greatly increase flexibility by providing a means to share data with external systems and organizations.

The implementation of a common data format through web services will eliminate the internal data management problems by providing a consistent mechanism for accessing and updating data.

Because of the implementation of an Excel Add-in using Microsoft .NET, users are able to continue using Microsoft Excel as their primary interface to study data.

These solutions provide a generalized approach to integrating domain specific tools and external data sources. The solutions have a huge impact on the usability of the system for many domains because data from these tools can be made directly available to other domains for integration into their study elements and calculations.

For More Information

For more information about Daysha Consulting services, contact us through info@dayshaconsulting.com.

To access information using the World Wide Web, go to: <http://www.dayshaconsulting.com>

