

# Arup

Developing world-leading buildings and sports facilities with Dassault Systèmes and Microsoft technology



## Overview

### ■ Challenge

*To efficiently create innovative, aesthetically and technically advanced iconic sports stadiums and buildings delivered on time and on budget.*

### ■ Solution

*Combining CATIA, Digital Project, and Microsoft® Office 2007 software, ArupSport satisfies the diverse needs of all stakeholders.*

### ■ Benefits

*Arup accelerates design-to-build time, retains creative intent to completion, and uses fewer resources to produce the world's most celebrated buildings, structures, and sports facilities.*

### Delivering the world's most impressive buildings

Arup is a global firm of designers, engineers, planners and business consultants producing outstanding solutions in the architecture, engineering, and construction (AEC) industry characterized by innovation and value. With 10,500 employees and 90 offices in more than 35 countries, Arup has a vast pool of technical expertise across the world enabling it to achieve the best possible results for clients.

Arup exerts a significant influence on the AEC sector and is the creative force behind many of the world's most innovative and sustainable buildings. At any one time, it has over 10,000 projects running concurrently.

This impact is best exemplified at ArupSport which is at the leading edge of worldwide sports venue design. The company continues to deliver award-winning spaces for the world's top sporting events including

the 2008 Olympic Games in Beijing, the Asian and Commonwealth games, the FIFA World Cup as well as developing the colour-changing Allianz Arena in Munich with Herzog & de Meuron, and stadiums in Valencia, Manchester, Qatar, the Ukraine and beyond.

### Flexible, creative, powerful methodology

Arup uses Dassault Systèmes CATIA and Gehry Technologies Digital Project (DP) solutions. It couples CATIA and DP with Microsoft® Office 2007. Using the Beijing Bird's Nest Stadium as an example, Martin Simpson, Associate Director of Arup and lead structural engineer at ArupSport, explained how his company uses the power of technology from Dassault Systèmes and Microsoft, "We defined the geometry of the stadium and its roof using CATIA. The distinctive 1.2 metre twisted box sections were developed using CATIA in conjunction with Microsoft Excel® 2007, which is used to input critical dimensions and rotational

"The Beijing National Stadium showed the role engineers can play in defining what is possible in architecture."

Michael Kwok, Project Director  
Arup



**Microsoft®**



“Dassault Systèmes CATIA, Gehry Technologies Digital Project, and Microsoft® Office 2007 form the technical backbone of our ability to produce buildings that would otherwise prove impossible to deliver.”

Martin Simpson  
Associate Director (Arup)  
Lead Structural Engineer (ArupSport)

symmetry for the geometry of the twists and curves.”

“CATIA 3D models can be driven using data contained within Microsoft Excel® 2007 and vice versa. This allows designers to very quickly modify designs based on numerous inputs from structural and other consultants whose calculations need to be considered and incorporated. Because the design iterates so frequently this technique of updating the 3D model means that we can incorporate multiple modifications and progress the project rapidly with all relevant information available.”

### Time savings and better outcomes

Kate McDougall, senior structural engineer, ArupSport added, “The capability of CATIA and Gehry Technologies Digital Project to operate parametrically means that changes to the design can quickly be implemented and the models adjusted accordingly. Scripts that define the rules by which the models are linked are written in Microsoft Visual Basic® programming language. The ease with which these scripts are written, coupled with their power to take hours out of the modelling process, is a real bonus.”

The consortium members involved with the Bird’s Nest Stadium include architects Herzog & de Meuron and China’s Architectural Design Group. Each deploys CATIA and Digital Project enabling direct model communication throughout. Thousands of components were modelled and iterated using Dassault Systèmes, Gehry Technologies and Microsoft technology. The software allows ArupSport to create families of similar parts which are precisely positioned within the digital 3D model. This produces great time-savings and a fuller overall impression at the design stage, and better accuracy of component manufacture, fabrication and final construction through the provision of realistic imagery and all related data.

### Better decisions made faster

“Each of our projects is unique so statistical comparison on efficiencies using this technology are not available,” said Simpson. “However, this advanced working methodology is very much quicker than any other technique and allows us to make better decisions because we have all the information to hand available from the 3D model. Design intent is maintained throughout the development process



because a single data source is used. Sub-contractors who do not have the same software can be provided with production data in the format that best suits their needs, for example, the steelwork for the Bird's Nest was issued to the ship builders using point coordinate data who fabricated the complex twisted components."

**Greater efficiency using fewer resources for better results**

Arup is able to better advance its work using CATIA, DP, and Microsoft® Office 2007 software while deploying people more efficiently for an improved outcome at lower cost. Very complex analysis that can affect the design is easy to integrate.

"We are pushing stadium design to the limit with these software tools and finding it quicker and easier with better end results," he continued. "Each project that we undertake presents very different challenges and is always an improvement on the last. Using this software in combination we can achieve better performance in our own business, for our clients, for the spectators and for the sportspeople who they come to see."



**Focus on Gehry Technologies**

Gehry Technologies provides building information modeling technologies and services for construction project planning, analysis, control, and evolution. The company has provided digitally guided construction practices to a broad spectrum of professional organizations and project typologies, from commercial and institutional building projects to large scale infrastructure works.

Gehry Technologies develops Digital Project™, a suite of integration, modeling and analysis applications. The company offers Digital Project training and consulting services, and provide comprehensive, cross platform project strategies implementing a range of building information modeling (BIM) software products and custom solutions.

Digital Project uses CATIA as a core engine. The entire suite of Digital Project products includes two base products, Viewer and Designer, and several add-on products: Primavera Integration, MEP/Systems Routing, Imagine & Shape, Knowledgware, Specialized Translators and Photo Studio. Base products Designer and Viewer may be used as stand-alone products; Viewer or Designer is required for all add-on products.



## Lean manufacturing and lean construction

“We are able to bring new ideas into play based on our experience and the capabilities of using software as we do. While Beijing is the largest stadium that we have undertaken, the challenges offered by other projects are equally significant. Reuse of stadiums after major events and sustainability are key needs which we meet using Dassault Systèmes, Gehry Technologies and Microsoft methodology. Lean manufacturing is enhanced with this technology and building techniques that reduce waste, producing lean construction, are now possible.”

In addition to CATIA and DP, Arup is now considering Dassault Systèmes ENOVIA SmarTeam technology to enhance the data management aspects of its work.

“Arup with ArupSport is at the forefront of design, development and delivery of AEC projects,” concludes Simpson.

“Dassault Systèmes CATIA, Gehry Technologies Digital Project with Microsoft® Office 2007 and Visual Basic® form the technical backbone of our ability

to produce buildings that would otherwise prove impossible to deliver. This software has enabled us to produce ever more complex and iconic structures that are completed on time, on budget with greater efficiency using fewer resources for better sustainability.”

Arup’s benefits from using Dassault Systèmes and Microsoft technology:

- Accelerated development times
- Automatic design updates
- Route-to-manufacture defined at design stage
- Better design productivity using fewer resources
- Multiple rapid iterations possible
- Design integrity maintained through to construction
- Sustainability improved
- Waste reduced
- 3D communications with supply chain
- Improvements increased with every project.

“The stadiums and facilities that ArupSport are working on benefit from combining Dassault Systèmes’ 3D modeling with Microsoft® Office 2007 and Visual Basic technology through the powerful functionality and flexibility that this methodology provides.”

Kate McDougall, Senior Structural Engineer  
ArupSport



Dassault Systèmes  
10, rue Marcel Dassault  
78140 Vélizy Villacoublay – France  
+33 (0)1 61 62 61 62

Microsoft Corporation  
One Microsoft Way  
Redmond, WA 98052-7329, USA  
Tel: (425) 882-8080



SolidWorks®, CATIA®, DELMIA®, ENOVIA®, SIMULIA® and 3D VIA® are registered trademarks of Dassault Systèmes or its subsidiaries in the US and/or other countries.

Images courtesy of Arup

© Copyright Dassault Systèmes 2008  
All Rights Reserved

RF\_F\_O4G39\_EN\_200901

Microsoft Corporation.  
All rights reserved. This case study is for informational purposes only. MICROSOFT MAKES NO WARRANTIES, EXPRESS OR IMPLIED, IN THIS SUMMARY. Microsoft, Visual Studio, Windows, the Windows logo, Windows Server, and Windows Server System are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. All other trademarks are properties of their respective owners.

The Dassault Systèmes home page can be found at [www.3ds.com](http://www.3ds.com)

The Microsoft home page can be found at [www.microsoft.com](http://www.microsoft.com)