

Aerospace and defense

BAE Systems Global Combat Systems

Accelerating vital enhancements and urgent modifications to British Army's field units

Products

Teamcenter, NX

Business challenges

Reduce risk of errors at prototype stage
Avoid cost and time overruns
Eliminate ambiguity

Keys to success

Fast loading of model and data
Use of ISO-standard JT lightweight data

Results

Improved decision making
Conflicts identified and resolved earlier
Many more concepts and variations assessed in a fraction of the time, compared to previous process
Measurably reduced cost and time savings
Further strengthened reputation for meeting urgent operational requirements

Teamcenter drives 3D VR dome, enabling engineers and field vehicle crews to display life-size models; virtual collaboration results in greater innovation, faster validation and reduced costs

Comprehensive land systems

One of the biggest challenges for companies dedicated to supporting today's demanding armed forces is to deliver military capability on time and on budget. That's because modern-day land systems are more complex than ever before and must be capable of doing the job in the most demanding of situations. It is essential that the combination of vehicle, powertrain, systems and armaments work the first time, every time.

BAE Systems is a proven expert in this field

BAE Systems Global Combat Systems (GCS) provides land forces with platforms, systems and through-life capability management. In the United Kingdom (UK), GCS delivers enhanced military capability, urgent operational requirements and upgrade programs. The company



manufactures, develops, markets and maintains smart weapon systems within the fields of intelligent ammunition, artillery systems, combat vehicle turrets, naval gun and air defense gun systems, as well as ammunition for small arms, mortars, tanks, and land and naval artillery. Global Combat Systems also designs, manufactures, integrates and supports combat vehicles. Its primary products include main battle tanks, infantry fighting vehicles, armored engineer vehicles, armored all-terrain vehicles, military bridging and logistical support.



Driving out risk

The Systems Integration Facility comprises a number of laboratories: the Combat Systems Integration Laboratory (CSIL), the VR dome itself, two Electronic Systems Integration Labs (ESILs) and the Vehicle Systems Integration Laboratory (VSIL). The purpose of the facility is to drive risk out of the company's systems engineering processes. To avoid cost and time overruns, it is vital that errors are detected before the prototype stage, so that there are few, if any, issues during prototyping. The GCS Systems Engineering Management Plan provides the basis for this. David Vallis, manager of the GCS Land Systems Integration Facility, explains, "The plan dictates that we take the user requirement from the Ministry of Defence and analyze it to produce the requirements specifications. Then we produce the subsystems requirements specifications and architecture design. Once procured or manufactured, the subsystems are integrated, tested and installed in the vehicle. Finally, we run tests to demonstrate to the customer that our vehicle meets their requirements."

Vallis adds, "Although there are stage checkpoints, the whole process is highly dynamic. There are frequent changes, upgrades and so on, and it may be quite late in the long process before everything is fixed. This is where the VR dome comes into its own."

Applying advanced technologies

The Systems Integration Facility at GCS helps engineers and vehicle crews work together to develop enhanced capabilities and urgent modifications for the British Army's in-service fleet of main battle tanks, infantry fighting vehicles and armored personnel carriers. In addition, the facility is used to design and demonstrate vehicle concepts and systems integration capabilities for future requirements. At the heart of the facility, the 3D visualization laboratory (VR dome) is used to display three-dimensional, life-size, fully textured, virtual stereoscopic models using Vega Prime™ visualization software from Presagis and Teamcenter® software from Siemens PLM Software.

“This is a flagship facility within the company and with customers, and it has strengthened our already excellent reputation for meeting urgent operational requirements.”

David Vallis
Manager, Land Systems Integration Facility
BAE Systems Global Combat Systems

Seamless, 360-degree panoramic view

GCS operates several VR domes. Similar in configuration, each VR dome consists of a 360-degree, octagonal arrangement. Each wall has two projectors that are offset to create a stereo image when viewed through passive polarizing spectacles. The projected images are blended across all eight walls, delivering a seamless, 360-degree panoramic view from the center-view position. A cluster of eight workstations is used to drive all eight walls. Each workstation has two outputs, which carry the eye-separation images (one for each eye to create the 3D stereoscopic effect) to the projectors. An additional workstation synchronizes the output-view perspective relative to the other workstations.

Visual comparisons of concepts and layouts

"Very early on in the process we can make visual comparisons of concepts and layouts in the dome," says Vallis. "It's an iterative process that loops back within each stage of the system engineering 'V' diagram. We bring the customer in to carry out an assessment as early as possible. We load the concept drawings – multiple concepts if applicable – and run them in the dome. Any changes are fed back into the design and the computer-aided design (CAD) file is updated. At the following stage of the 'V' diagram process, we load the design again and re-assess it." He notes, "We can do everything the CAD system does. We can remove layers to see what lies underneath; we can add and remove equipment, personnel, weapons, armor and so on. In addition, we can animate objects, too – doors, turrets, etc."

Life-size, 3D stereoscopic models

"Immediately before cutting metal, we may run a photorealistic, high-fidelity visualization, complete with all services – wiring, piping and so on – for an assessment of maintainability and access, for example," says Vallis. "For major client

presentations and reviews, we use the Vega Prime visualization system with the VR dome to display full, life-size, 3D stereoscopic models of our physical solution. We animate and render the vehicle model surfaces and provide a fully textured background. We get very high-quality results."

Immersive digital mockup for realistic design validation

Normally, the engineers and draftsmen work primarily at their CAD stations. "However, once there are more than two or three people involved, it's difficult to carry out a review around a desktop," says Vallis. "They can't assess things at full size, so it is possible to miss problems. We can load a model in the VR dome in JT format using Teamcenter software in an hour or so, compared to the days it would normally take (though the model surfaces are shaded rather than rendered and the background is omitted). We currently only use three screens, although we could expand to eight."

Vallis says that while they sometimes get CAD drawings where subsystems show clashes in the VR dome, they typically

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aren't identified until later in the process, when cost and time have already been incurred. “In the dome, we tend to find them quite quickly,” he says. “We are looking at the whole model, whereas the draftsman at his desk may just be looking at single items – a chair, a display, a controller or a welded panel on the side of a component or assembly.”

In these situations, Teamcenter is used to manage and drive the required multi-projected images into the VR dome. The Teamcenter concept desktop capability is used to add realism to the CAD model and enables users to leverage their existing International Organization for Standardization (ISO) JT™ data format to add greater realism to their digital mock-ups and surrounding scenes. (The JT file format is an open and widely used technology for 3D visualization, collaboration and data sharing in today's product lifecycle management (PLM) environments. The JT Open program and JT Open toolkit are part of Siemens PLM Software's PLM Components suite of software tools that support innovation and promote interoperability in CAD, CAM, CAE and PLM applications.)

The Teamcenter concept showroom capability enables the virtual product (prepared in Concept Desktop) to be reviewed in

life-size, virtual environments for true 1:1 scale realism. Combined with the dome, this provides an immersive evaluation environment for formal and informal digital design reviews, especially effective with stakeholders who may not relate well to CAD images.

Improved decision making and conflict resolution

One of the main advantages of the VR dome is that it can directly read the industry-standard 3D JT files produced with Teamcenter, part of the overall production management system at GCS. Vallis notes, “All new work here is done in NX, managed by Teamcenter. We keep Pro/Engineer for legacy work and this is also managed by Teamcenter.

“By displaying NX designs in stereoscopic 3D in the VR dome, our engineers are able to eliminate the ambiguity associated with 2D drawings. Using the VR dome for collaborative design reviews allows us to assess many more concepts and variations in a fraction of the time it would take to build prototypes for each variation. We can also assess ergonomic factors such as sight lines, reachability and clearances. Using digital mock-ups in the VR dome helps improve decision making and helps identify and resolve conflicts earlier.”

Solutions/Services

Teamcenter
www.siemens.com/teamcenter

NX
www.siemens.com/nx

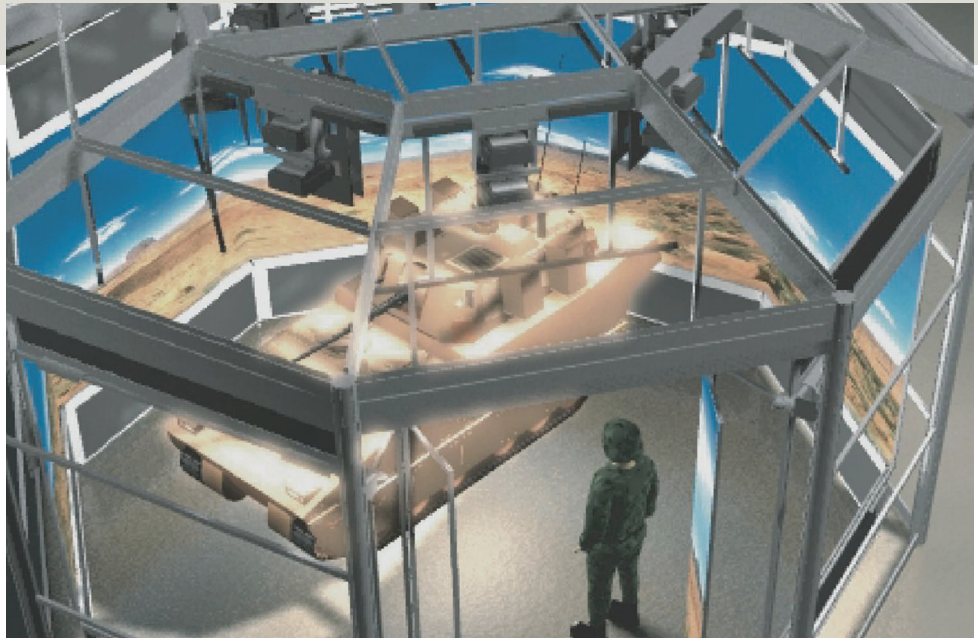
JT
www.siemens.com/plmcomponents

Customer's primary business

BAE Systems Global Combat Systems designs, manufactures and supports land systems: weapons, munitions and vehicles.
www.baesystems.com

Customer location

United Kingdom



A flagship facility, a worthy investment

"This is a big investment but it has been well worth it," says Vallis. "We used it on a number of military platforms and it has been hugely beneficial in identifying problems, integrating subsystems and selecting and agreeing on concepts at the design stage. We used the VR dome for the Terrier vehicle, which is in Teamcenter, and were easily able to transfer the data from

Teamcenter into the 3D dome." He notes, "We have reduced risk down to manageable levels much earlier than had we waited until the prototype stage. This is a flagship facility within the company and with customers, and it has strengthened our already excellent reputation for meeting urgent operational requirements."

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