

**The virtual factory – witness models munitions facility for BAE Systems**

**BAE SYSTEMS**

**BAE Systems plc**

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BAE Systems plc is a British multinational defence, security and aerospace company headquartered in London in the United Kingdom and with operations worldwide. It is among the world's largest defence contractors; it ranked as the second-largest based on applicable 2012 revenues. Its largest operations are in the United Kingdom and United States, where its BAE Systems Inc. subsidiary is one of the six largest suppliers to the US Department of Defense. Other major markets include Australia, India and Saudi Arabia. The company was formed on 30 November 1999 by the £7.7 billion merger of two British companies; Marconi Electronic Systems (MES) – the defence electronics and naval shipbuilding subsidiary of the General Electric Company plc (GEC) – and British Aerospace (BAe) – an aircraft, munitions and naval systems manufacturer.

In this study a simulation software was used at the project's inception in order to determine initial unit costs, the likely effectiveness and form of the processes to be used, the requirements for capacity and customer demand, the possible time pressures and resource limitations and the breadth and volume of materials to be used, and for all points it proved extremely useful in supporting the initial capital investment proposals.

**Simulation and Forecasting Technology role**

Life cycle costs, resource planning, project management

**Sector**

Aerospace and Defence

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**The Virtual Factory – WITNESS Models Munitions Facility for BAE SYSTEMS**

**BAE SYSTEMS**

**APPLICATION:** Facility Design & Operation

**VERTICAL:** Military & Defence

**SECTOR:** Defence - Manufacturing

**BENEFIT:** BAE Systems used WITNESS simulation to determine the costs, time constraints and resources required to gain initial capital investment in project.

**Data Collation**  
Covering 14 square mile, the new site comprises

**Lanner WITNESS simulation software is used to model a new insensitive munitions facility for BAE SYSTEMS.**

**Background**  
A NATO-led initiative to increase weapon safety for armed forces, together with the need to satisfy customer demand, led BAE SYSTEMS Land Systems to design and build a unique new high volume PBX (Polymer Bonded Explosives) manufacturing facility at Glascoed in South Wales. The PBX filled munitions are designed to adhere to the UK MoD's (Land Systems' largest customer) exacting policy for assessment and testing of such munitions and will meet the IM (Insensitive Munition) standards set out in STANAG 4439.

**Project planning**  
Lanner's WITNESS simulation software was used at the project's inception in order to determine initial unit costs, the likely effectiveness and form of the processes to be used, requirements for capacity and customer demand, possible time pressures and resource limitations and the breadth and volume of materials to be used, all of which proved extremely useful in supporting the initial capital investment proposals.

The manufacturing facility is designed around a Land Systems proprietary PBX known as Rowanex 1100, or Rx1100 for short. Rx1100 is a composition based on the use of explosive crystals held in a rubbery matrix, and the manufacturing process therefore requires the addition of catalyst and hardener, plus a cure cycle, to allow the material to harden. Rx1100 will replace the conventional explosives containing TNT, which are generally 'melt cast' directly into the munitions and then allowed to harden by cooling

The cost of the new facility was GBP15 million, comprising GBP5 million on local infrastructure, GBP5 million on support equipment and supporting studies, and GBP5 million on civil works. The new facility has been designed to achieve a high degree of automation via remote facilities and remotely controlled plant and equipment, ensuring an efficient process flow. Overall, this led to resource savings and an anticipated workforce of just 25 skilled employees to resource the entire plant.

**witness**  
BY **LANNER**  
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**"The results yielded by WITNESS provided some surprises in terms of what the operatives were doing whilst processes were underway. We were also surprised to note the effects of buying different plant and equipment: firstly costs rose and then flattened out. Lanner's simulation expertise has enabled us to act upon this and to pinpoint the most efficient manufacturing processes for the HVPBX facility by way of a 'virtual pilot study' which allowed us to model processes in a risk free situation, understand how well they performed and make adjustments accordingly. We therefore minimised risk and waste and avoided the time and expense of implementing real pilots,"** said Phil Djali, Project Leader.

**Modelling within a risk-free environment**  
Taking into account that the likely users of the model may not all have WITNESS expertise, it was constructed with an extremely user friendly excel based front end which enabled non WITNESS experts to efficiently experiment with the model.

Using this data interface Land Systems were able to apply a number of scenarios to the data Lanner had collected:

- The differences in types of shells produced
- The differences in output between a 2 shift and a 3 shift operation
- Depending on the size of order whether to run the facility on a campaign basis or on a low level continuously
- The effect of using different levels of X Ray inspection
- The efficiency of using different numbers of equipment such as drums, pallets and filling headers

**Enabling stakeholder buy-in**  
The result, accessible via a user-friendly front end, showed the assembly of a shell at the new plant from start to finish using 3D virtual reality, the project team for the new facility were able to communicate the proposed new concept to staff and customers. This was done on an on-going basis via Lanner's virtual reality flythrough of the facility.

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