vLOGIX
ENGINEERING OPERATIONAL EXCELLENCE

cogITo SMART
GET IT RIGHT FROM THE START

INTRODUCING vLOGIX SYSTEM DIGITAL TWIN TOOLSET

vLOGIX System Digital Twin business objectives,

- A 'near real-life' modelling capability cheaper and earlier in the project lifecycle
- Achieve design certainty quicker to reduce time and cost earlier in the development lifecycle
- A reduction in testing effort and cost
- A reduction in overall project change, contributing to Net Zero
- Validate change before implementation
- Effective management reporting to influence key decision making for better project outcomes
- A System Digital Twin capability reduces cost of ownership

©vLOGIX,2017

OVERVIEW

The innovations team at vLOGIX have deployed a unique product capable of delivering an end-to-end product lifecycle management capability.

The product allows designers, builders, testers, operators and other stakeholders such as Airlines and Airports to verify and validate that the Baggage Handling System meets their works requirements.

During its lifetime, a baggage system will undergo many changes to cater for demands in capacity, improvements in efficiency and upgrades to realise advances in new technology. Due to its constant evolution driven by business change, many suppliers will contribute to the baggage system design.

The airport is often faced with difficulties when knowledge of the existing system is lost because key employees or suppliers are no longer available. The vLOGIX System Digital Twin capability seeks to codify the design knowledge so that valuable configuration data and information is always retained to allow an airport to evolve in a controlled way even when key resources leave the organisation.

©vLOGIX,2017

The vLOGIX System Digital Twin capability enables baggage handling systems (BHS) owners to deliver a configuration control strategy over their electro-mechanical systems. Changes can be performed to the system in an orderly manner and the impacts of these can be determined long before the system or system changes are actually built.

The CogITo Smart Product Lifecycle Management (PLM) solution is provisioned and deployed in a modular approach, with increasing level of functionality and reporting capability with each module. The five modules are depicted in the following diagram, starting with the base module of a 3D BIM compliant spatial model.

The CogITo PLM platform provides a totally integrated solution to deliver a System Digital Twin capability for an operational baggage environment.

The cloud-based product has a graphic rich interface providing a near real-life interaction experience with the Baggage Handling System. CogITo PLM can be used for any stage of the baggage handling system lifecycle from concept through to client handover and beyond.

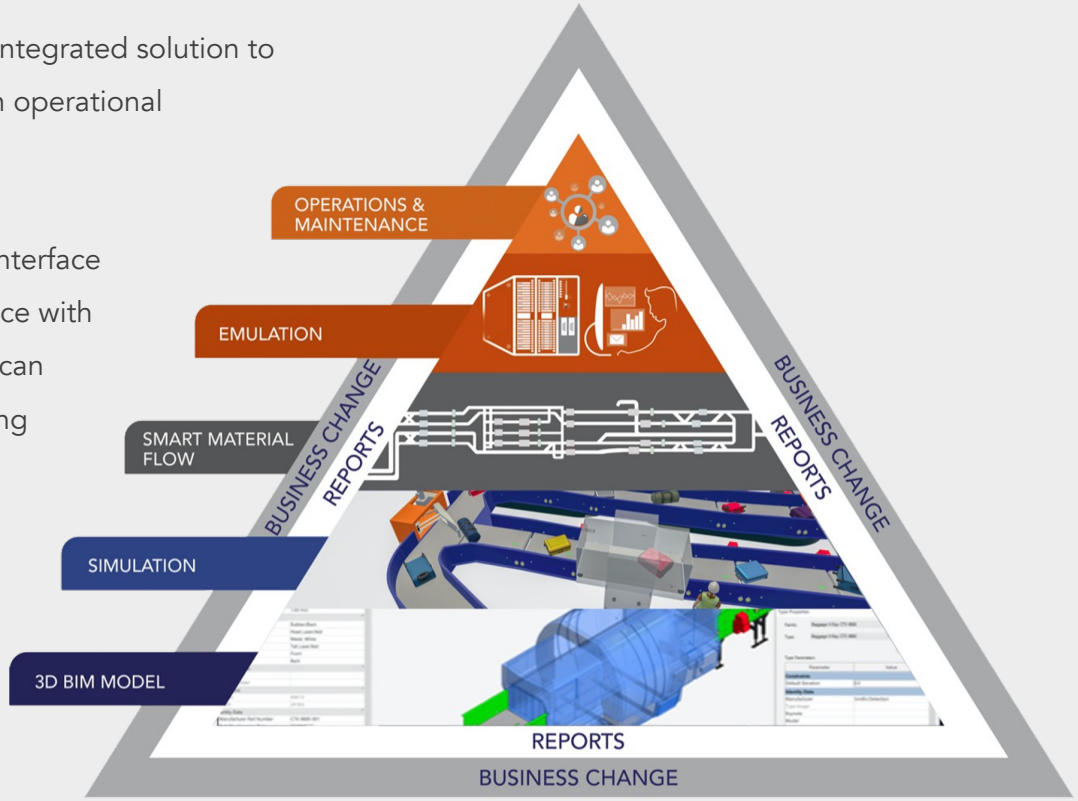


Figure 1: CogITo Smart – Product Lifecycle Management Platform (PLM)

©vLOGIX,2017

3D BIM MODEL – PLM MODULE 1

vLOGIX have created a highly configurable 3D BIM compliant library of components that accurately reflect the spatial and basic operating requirements for the common baggage system functions such as Check-in Desks, collector conveyors, Hold baggage screening, Vertical sortation units, Ploughs, Pushers, Tilt Tray sorters etc. An example BIM component is illustrated in Figure 2 below.

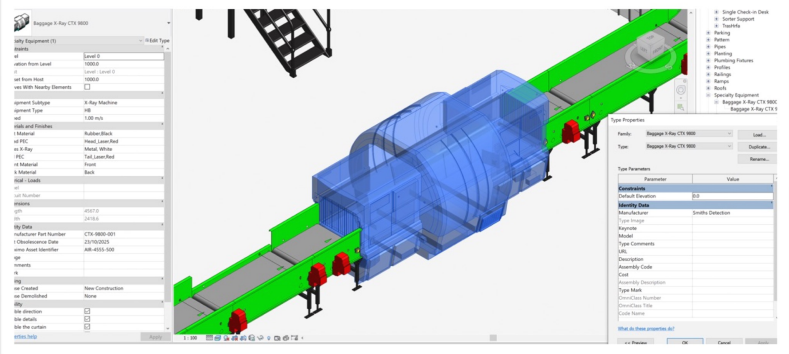


Figure 2: BIM Compliant Components

All the 3D BIM components are developed within Autodesk Revit and align with BIM / LOD 300 / 350 standards for the visualisation and volumetric attributes of the BHS system. The configurable data contained within each of the vLOGIX BIM components is either derived from BHS supplier data sheets and/or from site surveys of existing equipment for the basic operating and configuration parameters such as belt speeds etc. To further enhance the accuracy of the System Digital Twin vLOGIX has developed a library of 3D BIM bag components that represent the baggage product within the Simulation.

©vLOGIX,2017

The versatile nature of these BIM components means that designers can quickly create option layouts of the Baggage Handling System solution for discussion with key stakeholders also enabling the building interfaces and spatial constraints to be confirmed through standard clash detection software packages as required.

Once a layout is selected, CogITo PLM automatically transforms the BIM standard components into a virtual augmented reality workspace and uses the BIM components configuration data to generate a logical data model framework as an input to the Simulator. The platform's logical model has reached a level of maturity to define system functional requirements to inform third party suppliers system software design strategy. An example of a Converted BIM Model illustrated if Figure 3 below.

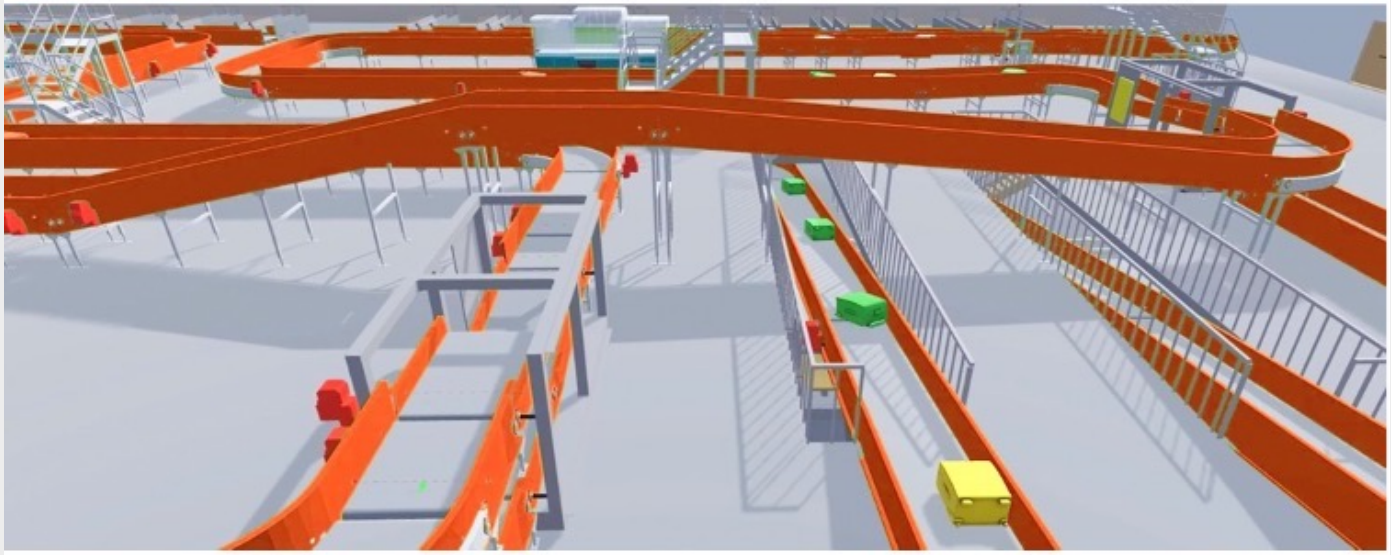


Figure 3: Converted Model with Baggage Product

©vLOGIX,2017

SIMULATION - PLM MODULE 2

The simulation module is the first step in providing the System Digital Twin capability. Encompassing life-like system and baggage movements, the built-in physics engine can replicate both the system mechanical movements and the motion of bags by considering centres of gravity, bag shape and material friction to provide realistic behaviour of the bags in the Baggage Handling System.

Included within the module is a Scenario Manager tool that enables the ability to pre-configure bag or product input to output profiles and equipment status characteristics that mimic real life build plans. Simulation scenarios allow stakeholders to measure system performance and visualise constraints and bottlenecks within the 3D Model in real-time, based on the scenario configuration.

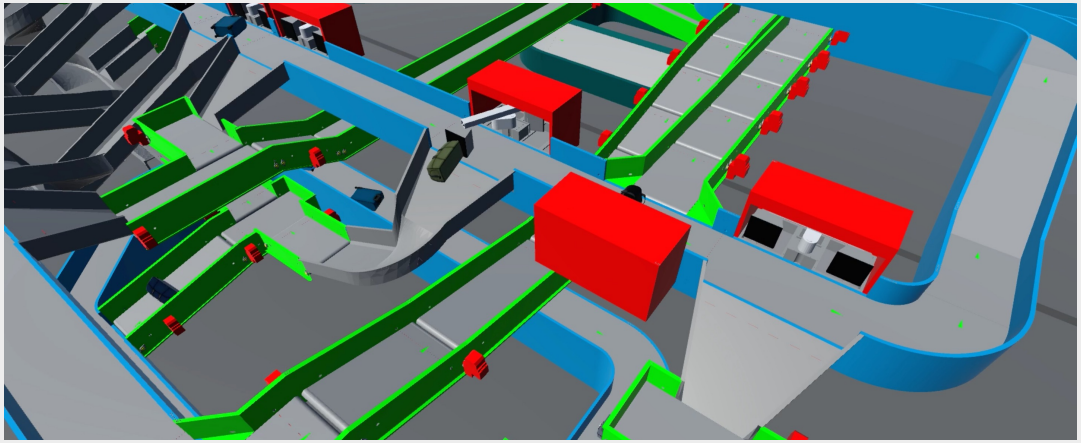
In conjunction with the built-in scenario manager and the platforms logical model that provides generic system behaviour, stakeholders can validate design change or operational procedures against a set of defined test cases to check if a given option can meet its functional and non-functional requirements. For every option the throughput of the system can be tested, potential bottlenecks identified, and resilience proven using failure mode scenario tests.

©vLOGIX,2017

The System Digital Twin capability can be used in conjunction with the scenario manager to provide predictive analytics based on generic system logic to determine system capacity requirements ahead of time. This can be particularly useful during incident management. For example, running the system with fewer HBS Screeners or fewer staff removing bags from Chutes or Makeup Carousels., the impact of reduced staffing levels can be calculated so that the correct resources can be deployed to mitigate any consequential issues.

SMART MATERIAL FLOW - PLM MODULE 3

The Smart Material Flow module adds the dynamic control and accuracy to the Simulation module, by enabling bag decisions to be based on business rules and existing system behaviours (as required). These rules typically comprise of flight schedules, problem bag types and dynamic behaviours used within the system control software.



Complex Bag Routine

©vLOGIX,2017

Smart Material Flow can be configured with typical start of the day parameters including the base flight schedule, default sortation rules and mechanical static routing defaults.

The versatile cloud interface allows operators to change dynamic characteristics and behaviour at the start of or during a test run, such as modify the flight schedule, change sortation rules, start or stop machinery, change the visual appearance of components or highlight identified bag routes to mirror real-life scenarios. Feedback from component functions can be sent to the cloud in near real time and the cloud can respond with control commands to individual components. The platform's logical model has reached a level of maturity to generate the dynamic control rules to Inform Third Part Suppliers system control software functional design.

EMULATION - PLM MODULE 4

The virtual baggage handling system can be connected to real-world Low-level and High-Level control systems such as Programmable Logic Controllers, Logistics and Conformance Controllers for example Sort Allocation Computers. The SCADA solutions can also be integrated to provide visual control and feedback for the Baggage Handling System.

©vLOGIX,2017

The emulator will by-pass the Smart Material Flow module to take control of the Simulation to allow the entire Baggage Handling System to be tested end-to-end to the satisfaction of all stakeholders. Due to the powerful cloud capability, the virtual models can be driven entirely by real-world components so that the low-level and high-level control system can be fully tested and validated from remote locations.

OPERATIONS & MAINTENANCE - PLM MODULE 5

To support the Operations and Maintenance teams, data can be taken from the production environment and integrated into the platform for analysis. Routes with a high level of faults can be identified using a RAG status indicator to produce a heat map, enabling the maintenance team to target the equipment that has the most impact to improve baggage operations.

The system can also perform an “action replay” of a previous incident. This allows stakeholders to carefully analyse the scenario and to put in place and test mitigations to prevent such situations arising in the future.

Master Data including key BHS equipment information such as Manufacturers part number, performance information, maintenance and configuration data are all stored within the BIM model to ensure that the entire BHS can be formally controlled for change and configuration management purposes.

Operations and maintenance teams can optimise system performance and plan predictive maintenance activities by enabling selective visualisation of system and components.

©vLOGIX,2017

The selective visualisation enables the ability to display additional information for each baggage handling system component. The type and nature of this data can be completely controlled via the Cloud's graphical user interface. This additional information could, for example, be a commissioning schedule. If different parties require access to the system, then the visual representation of the schedule could be viewed by all parties to ensure that the work can be successfully planned without conflict.

Through the selective visualisation, the platform facilitates the management of schedule integration to accurately reflect programme stages through to the final build. This capability ensures that stakeholders better understand project changes and can be involved throughout the Baggage handling systems lifecycle to deliver better project outcomes. The impact of phasing critical changes to a live operational system can be visualised and mitigation factors can be more easily identified to reduce the risk to live operations.

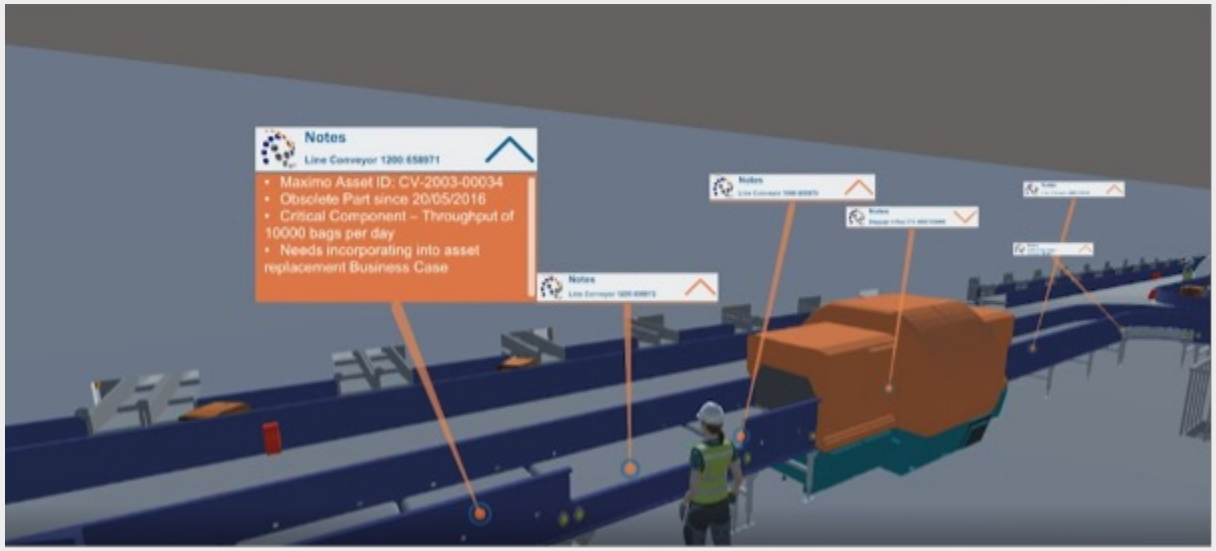


Figure 4: Selective Visualisation Component

©vLOGIX,2017

With this data enriched 3D model, the airport is now able to maintain an accurate Master Data Asset inventory which means that constant surveys do not need to be undertaken for each new project. Obsolescence of key asset items can also be identified in advance so that appropriate mitigations or replacements can be implemented.

PLM REPORTS

The CogITo PLM database design offers real-time configurable reporting based on Power BI enabling informed engineering and management decision making to support better project outcomes. As PLM modules are added to the CogITo platform the database is expanded providing a data rich model of the System. As scenarios are run all product or bag transactions are recorded with the system dynamic control status. Reports can be generated from any stakeholders view and linked together to allow operators to drill down into the details. See examples shown in figures 5 and 6 below.

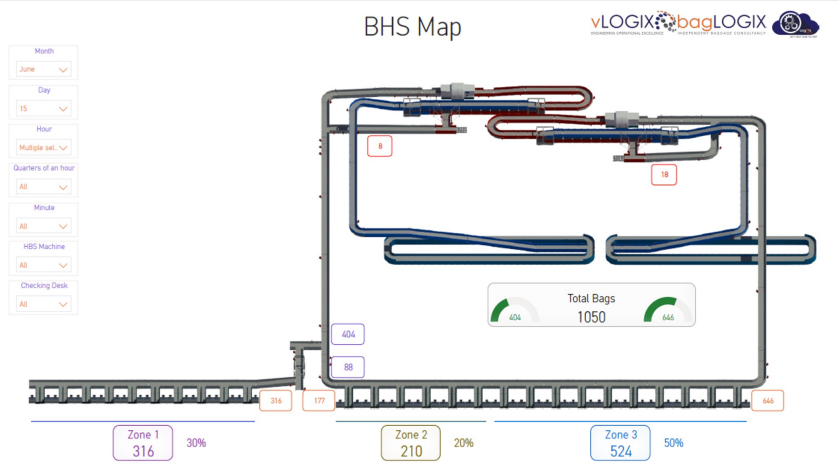


Figure 5: Example Overview Report

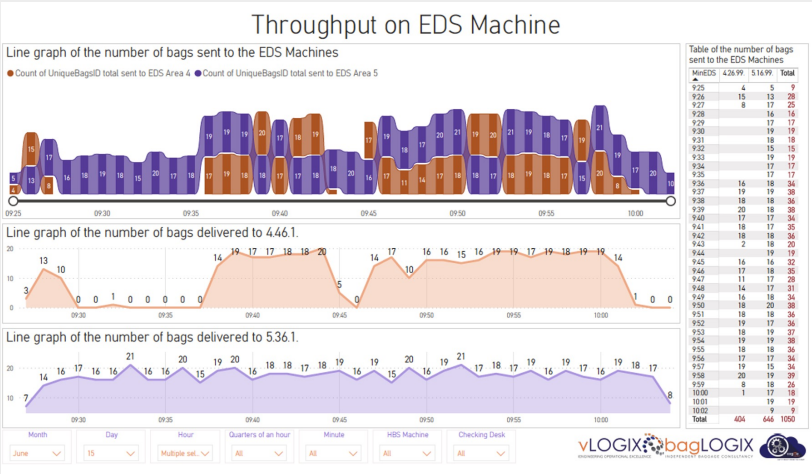


Figure 6: Example Drill Down Detailed Report

©vLOGIX,2017

www.vlogix.co.uk

enquiries@vlogix.co.uk

Follow us on LinkedIn

+44 (0) 800 368 8183

THANK YOU, ANY QUESTIONS?

Contact Mike Croot - Head of Sales

mike.croot@vlogix.co.uk

+44 (0) 7867 430 453

Please visit our website

www.vlogix.co.uk

©vLOGIX,2017