Interoperability for Improved Plant Floor Efficiency and Safety
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1. Executive Summary

Intergraph® and eVision® offer a unique value proposition for operating facilities, combining eVision’s leading operational safety solutions, including Permit to Work, with Intergraph’s renowned solutions for visualization and sustaining a high quality virtual plant asset.

The main benefits of the combined solution include:

a. Increase of plant floor efficiency by providing intuitive access to accurate, trustworthy information and documentation in the context of plant floor work processes such as Permit to Work, Shift Management, and Lock-out/Tag-Out (LOTO)

b. Reduce the time and effort required to draft permits and perform risk assessments and improve their quality

c. Improve the oversight of ongoing work through visualization based on interactive 3D models or photo-realistic laser scans that show active permits and isolations

d. Minimize risk and maximize safety by decreasing errors and incidents from misidentification of incorrect equipment and isolation points. Enhance the quality and understandability of the isolation plans during execution of the isolations aided by 3D and laser scan visualization

e. Reduce cycle times and provide a smooth hand-off of work processes between plant floor workers and supporting organizations such as planning and engineering through interoperability between Control of Work and Asset Life Cycle Information Management systems

f. Ensure compliance through cross-organizational traceability of work with fully auditable solutions

1.1. Challenges

Owner Operators globally face similar challenges. These include:

- How to increase effectiveness of plant floor workers and reduce operational expenditure whilst improving safe working practices
- How to eliminate cross-organizational barriers to collaboration between front-line plant floor workers and “back-office” planners, engineers, and others
- How to replace retiring plant floor workers and their inherent “tribal knowledge” with IT tools that will guide the new generation of tech-savvy plant workers

These challenges mean that “business as usual” is no longer a viable option and that a step change is required in working practices and supporting technologies.

1.2. The Intergraph/eVision Approach

Intergraph and eVision offer a “best of breed” approach providing interoperability between Asset Life Cycle information and associated processes in Intergraph’s SmartPlant® Fusion and eVision’s control of work and LOTO processes in Permit Vision and Shift Vision solutions and interactive P&ID’s.

The joint solution offers access to high quality plant asset information and documentation from Intergraph’s SmartPlant Fusion to support activities such as risk analysis and drafting of isolation plans in eVision’s safety solutions. Improved visualization of work via 3D models and/or photo-realistic TruView
laser scans to show the location of nearby work and specific equipment and isolation points. Planners and maintenance staff can see the physical location of equipment and place isolation points. The solution also provides a clear 3D overview of planned and ongoing work in the control room. In addition, visualization aids correct identification of equipment and isolation points for front line plant floor workers to eliminate inefficiencies in executing work processes and potential incidents and accidents.

The solution ensures that workers are provided with trustworthy information to perform their duties through simple “fit for purpose” purpose applications that are both simple and appealing to use.

The integrated solution ensures that work is effectively and seamlessly handed off between plant-floor workers and planners, engineers, and others, improving efficiency and eliminating delays and errors whilst information is transcribed. The solution also ensures the ‘as is state’ of the site and installations and provide the accurate up-to-date information of the plant.

Intergraph and eVision bring to the market a joint portfolio of solutions focused on improving the efficiency of both “back office” and frontline workers whilst minimizing risks and maximizing safety. High quality asset life cycle information is provided in the context of the work performed and work is handed over smoothly reducing cycle time and unproductive time locating and verifying information.
2. Introduction

Asset life cycle information comprises all the information and documentation that describes the design and configuration of a facility. It can include a wide range of information types including 3D models, laser scans, intelligent schematics information such as P&IDs, engineering databases, 2D CAD drawings, and scanned vendor documentation. Asset Life Cycle Information Management (ALIM) is important because it provides the base information that is used to support plant floor activities such as maintenance, repairs, inspection, and isolation, as well as supporting processes such as Process Safety Management, Asset Integrity Management, design modification, maintenance planning etc. ALIM includes all the processes to capture, verify and sustain asset life-cycle information.

Intergraph offers a set of solutions that manage both data and document centric information in a central repository. This information is then used to support a wide range of preconfigured, intuitive, value added work processes that are tightly integrated with ALIM and can be rapidly adopted to individual customer requirements. For legacy facilities where there is either no or limited structured information Intergraph provides SmartPlant Fusion, a solution to rapidly crawl across a data network to identify extract data from existing documents and databases, to verify and prepare data for use. Intergraph provides work processes where asset life cycle information is used in the context of Owner Operator work processes including: Management of Change, Equipment Inspections, Non-conformity Management, Action and Issue tracking, Query Management, completions, commissioning, immersive 3D training etc. Visualization using 3D models, TruView photo realistic laser scans, and intelligent schematic or hot-spotted drawings provide further support to these processes.

Control of work includes hazard identification and risk assessment, permit to work systems, and the arrangements for the safe isolation and reinstatement of a plant. eVision's approach is to provide simple practical solutions to complex real-world problems, for front-line operations staff including Control of Work comprising processes like Permit To Work, Risk Assessment, LOTO, Shift Management Incident Management, Operational Risk Management, and Management of Change.

Interoperability between Intergraph and eVision offers unique synergistic benefits to visualize work to be done in the field and avoids disconnects across organizational boundaries by providing seamless hand-off between plant-floor work processes such as operator rounds, Permit To Work, LOTO and “back office” processes such as work planning and management of change.
3. Industry Challenges

Owner Operators globally are facing common challenges. They are under pressure to improve efficiency and reduce costs whilst improving safety and meeting increased regulatory authority demands. Legislation and regulation related to Process Safety and Asset Integrity is increasing and the threat of losing license to operate, increased insurance costs, and threat of legal sanction are very real as well as costs related to Lost Time Injury (LTI) and environmental damage.

Owner Operators are diverse organizations with many stakeholders that have specific focused interests and targets; they increasingly recognize the need for cross organizational collaboration to achieve operational efficiency and effectiveness and reach the highest Health, Safety, and Environment (HSE) targets. A prerequisite to achieve this is the elimination of barriers to collaboration between front-line plant floor workers and “back-office” planners, engineers, and others because each have their own “silo” IT systems.

Another challenge Owners face is that due to the high price of replacement capacity they are typically running plants beyond their original design life, leading to uncertainties to how facilities can run reliably and safely.

A high percentage of plant workers are reaching retirement age and there is an urgent need to replace pass their “tribal knowledge” rapidly onto the new generation of tech savvy workers which have grown up
to expect information to be provided to them quickly on-demand, and lack the operational knowledge and experience.

A significant barrier to meeting these challenges is the quality of asset life cycle information. Analysts at ARC\(^1\) have estimated typical Owner Operator lose 1.5 percent of annual revenue due to poor quality asset life cycle information, impacting availability, operating delays, higher CAPEX for modifications and higher maintenance costs. When looking at the Hands on Tool Time (HOTT) inefficiencies Proftion\(^2\) research showed a percentage of Indirect Productive Hours of 42 percent. eVision estimates that at least 50 percent of these Unproductive Hours can be influenced by the use of the right Control of Work software.

### 4. The Intergraph/eVision Approach

Intergraph and eVision offer simple, targeted “fit for purpose” applications to Owner Operators to support work processes that maximize asset integrity, reduce risk and improve safety, worker efficiency and effectiveness. This improves Return on Capital Employed (ROCE) and relations with both the facility workforce, authorities, and the local population as unplanned incidents are reduced. The offering is based on integrating Intergraph’s SmartPlant Fusion managing asset life cycle information and eVision’s control of work and LOTO processes in Permit Vision and Shift Vision solutions. These are both industry leading and well established portfolios of applications in their own right. Intergraph and eVision are now offering interoperability between our solutions that provide additional synergies including:

- Seamless electronic handoff of work processes between plant floor work processes such as operator rounds, equipment isolation, Leak Detection and Repair (LDAR), and other activities to planners, engineers, and other personnel to reduce cycle times, reduce risk, improve safety, and increase effectiveness of both office based and plant floor staff
- 3D Visualization using 3D models and photo-realistic TruView laser scans provide improved visibility of work to improve planning, execution in the field and control of work
- Reduce the time and effort required to draft permits and perform associated risk assessments and improve the quality of these through fast and simple access to high quality, current asset life cycle information
- Provide simple, mobile 2D and 3D visualization apps to plant floor workers that will prevent potential errors and incidents from misidentification of incorrect equipment and isolation points
- Demonstrable compliance through Improved, auditable traceability of work processes

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\(^1\) Asset Information Management (AIM) Part I – The Case for Developing an AIM Strategy, ARC Advisory Group, Sid Snitkin, Bob Mick and Russ Novak (July 2010)

\(^2\) Proftion Tooltime resultaten per janueri 2013, HOTT Workshop 17 January 2013
5. Permit to Work and LOTO with Intergraph/eVision

Permit to Work and Lock-out/Tag-out (LOTO) of equipment are common tasks performed every day on an operating facility. Efficiency in planning and execution of this work in a safe manner is highly dependent on the availability of correct and complete Asset Life Cycle Information.

Figure 2 provides a simplified overview of the process and the interoperability provided between eVision’s Permit Vision and Intergraph’s Smart Plant Fusion. A Permit is initiated in Permit Vision by the selection of a Work Order from a computerized maintenance management system such as SAP by the Permit Requester (refer 1 in figure 2). Details from the Work Order including related tags are transferred automatically to the permit. During the drafting of the permit a preliminary Risk Assessment is executed and the need for an equipment isolation is identified. This will trigger the planning of an isolation and detailed Risk Assessment including identification of hazards. In order to effectively conduct a Job Safety Analysis /Task Risk Assessment and to identify first the relevant Hazards and Controls (like isolations) access is required to plant asset information.

eVision’s Permit Vision can query Intergraph’s Fusion system seamlessly based on the tag numbers related to the Work Permit. The 3D model and/or photo-realistic, TruView laser scan from Fusion can be instantly retrieved and the relevant tag number highlighted. A complete list of documentation can be presented and individual documents such as P&IDs, data sheets, single line diagrams, and loop diagrams can be displayed. Tag metadata such as name, description, and relations to systems, areas, and other items can be reviewed. During the location of isolation points, the physical location of the isolation point or hazards can be identified on the 3D model or TruView laser scan (Figure 3). The Isolation Authority creating the isolation plan can quickly assess whether optimal isolation points have been selected based on ease of access and need for ladders, scaffolding, and other necessary items.

Figure 2 LOTO using Permit Vision and Intergraph Fusion
The isolation is performed in the field (refer figure 2). The execution of the isolation is supported and recorded by the eVision mobile application. The identification of correct isolation points can be further aided by viewing the 3D model/TruView laser scans offline on a portable tablet, avoiding the risk of incorrect identification and potential accidents. The status of isolation points being recorded in the field updating the status in Permit Vision in real time.

The control room (refer figure 2) can review the status of any isolation on a facility and show these graphically on an interactive P&ID or a 3D model/TruView laser scan from Fusion. The status of nearby work can also be shown. This information is used as the basis to make a decision to bring the permit live in Permit Vision.

![Figure 3: TruView Laser Scan integrated with eVision LOTO](image)

![Figure 4: Interactive P&ID showing isolation points in eVision LOTO](image)
6. Immersive 3D Training

When faced with an especially complex or hazardous isolation, Intergraph’s immersive training solution allows field personnel to rehearse the isolation. The use of either 3D models or TruView laser scans gives a realistic, immersive training experience. Avatars can be included, and the users can be required to identify correct Personal Protection Equipment to equip the avatar. Most isolation scenarios can be easily prepared in a few hours, without the use of programming or scripting, using the isolation plan designed in eVision Permit Vision as a basis.

Isolation scenarios can be run in training or test modules to verify if the trainees can identify the right isolation points and perform the isolation actions correctly and safely. Full records of the results of the training tests are recorded for audit purposes.

This can be used for a wide range of training purposes including operator training, simulation of turnaround activities, emergency response, and other activities. The use of laser scans now brings 3D immersive training within the reach of the majority of facilities that do not have an as-built 3D model available.
Figure 6 Immersive training using TruView Lase Scan
7. Managing Observations and Shift Management

Transparent, structured communication is essential for efficient shift handovers and safe operation of any facility. eVision’s Shift Vision is an electronic record for keeping track of what happens during a shift. Shift Vision streamlines the communication process and is ideally suited for shift and crew handovers. It has an inbuilt wizard for creating fast, consistent, and accurate handover documents. This wizard enables workers to setup handover documents within minutes instead of hours.

Logging and investigation of field observations are activities that need to be incorporated as part of the shift log. Intergraph’s Mobile Observation app allows any worker on the plant floor to simply capture details of issues, such as a leaking valve, unusual noise coming from equipment, and tools or materials left on-site etc. on a mobile device. Photos can be taken to illustrate the issue and if using a TruView laser scan, the location can be indicated with pin-point accuracy.

The Shift Supervisor will be notified of incoming Observations with an e-mail alert and evaluate these on a workstation. The Shift Supervisor can quickly attach additional documentation or information and send the Observation electronically to a relevant technician for further investigation. Details from the observation can be entered into the Shift log.

Electronic management of observations eliminates manual recording on forms or cards, eliminates problems in interpreting the written observation, and reduces the lag time between the recording of an issue, a decision being made as to how to address the issue, and dispatch of relevant technician to investigate or resolve the issue.

Figure 7 Managing Observations and link to Shift Vision
8. Summary

Interoperability between eVision’s Permit Vision and Shift Vision solutions and Intergraph’s SmartPlant Fusion provides a collaborative platform to support Operations and Maintenance work processes and leads to operational efficiencies, reduced risk, reduced cycle times, and improved safety.

SmartPlant Fusion provides is a source of trustworthy Asset Life Cycle Information on-demand to support eVision’s operational safety work processes including Permit to Work, Isolation Management, and Shift Management.

3D visualization of plant equipment isolations ensure optimal selection of isolation points whilst designing isolations, and assists location of isolation points in the field avoiding errors and potential incidents and accidents. Access to improved 3D visualization using 3D models and photo-realistic TruView laser scans in the control room provides a unique overview of planned and ongoing work processes to improve decision making and faster emergency response.

Intergraph’s Mobile Observations app provides a simple, fast way for all plant workers on a facility to submit detailed observations of issues. It ensures rapid evaluation and action on these by plant supervisors reducing the risk of downtime and incidents.

End-to-end traceability of processes is captured to support auditable traceability for regulatory authorities.

3D immersive training scenarios based on eVision isolation plans can be used to ensure that plant teams are familiar with work to be undertaken and can be used to assist teams in the field.

All the above leads to improved ROCE, better safety, increased workforce satisfaction, and improved relationships with authorities and the local population as the rate of plant incidents decline.
For more information about eVision, visit www.evision-software.com

eVision Industry Software is an international software development company specialising in operational safety. eVision is based in The Hague, The Netherlands, with regional offices located in the United Kingdom, Middle East, and United States. eVision has a global partner network and clients on five continents. eVision’s flagship product Permit Vision is a complete Single Safe System of Work which integrates permit to work software, risk assessment, isolations management processes, and external work order systems into one user-friendly system.

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