HEXAGON

White Paper

Digitizing Completions to Increase Project Performance and Value

Contents

Introduction

The Case for Commissioning and Completions

The Cost of Neglecting Commissioning

The Data Deficit and Need for Digital Completions

Intergraph Smart® Completions

Case Study

Conclusion

Introduction

It's time to challenge the status quo of poor project performance.

There is no doubt that COVID-19 has had an enormous effect on the world's economy. But as countries start to open up, experts across the globe are hoping for a construction-led recovery.

The World Economic Forum has called on governments to invest in sustainable, technologically advanced and resilient infrastructure projects.

It reports that low- and middle-income countries could see a $4 return for every $1 spent on such civil engineering projects. To realise these returns, the construction industry worldwide needs to reduce its reputation for cost blowouts and overrun schedules.

Especially since, according to IDC,[1] 75% of projects face total schedule and budget overruns. This contributes up to 15.8B in annual losses.

Lack of commissioning and startup methodology, and data standardization contributes to the schedule and budget blowout.

The longer and less confident you are about your handover, the more revenue your client loses as the time to first production drags on. According to Ernst & Young,[2] that's about $15.8 billion in annual losses, meaning between 1% and 2% of total capital facilities industry revenues for every year of a facility's life.

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[1] **Source:** E&Y Spotlight on Oil & Gas Mega Projects
[2] **Source:** Successful Handover of Capital Projects in the Oil and Gas Industry, Ernst & Young

The Case for Commissioning and Completions

What is Commissioning

The primary goal of commissioning is to ensure that success for the project is clearly defined in the Owner's Project Requirements (OPR) and that the building, asset or facility performs as intended to fulfill that mission. In short, commissioning is the testing of the build to a set criterion to prove the build meets the design requirements.

Total Commissioning Activities

Commissioning

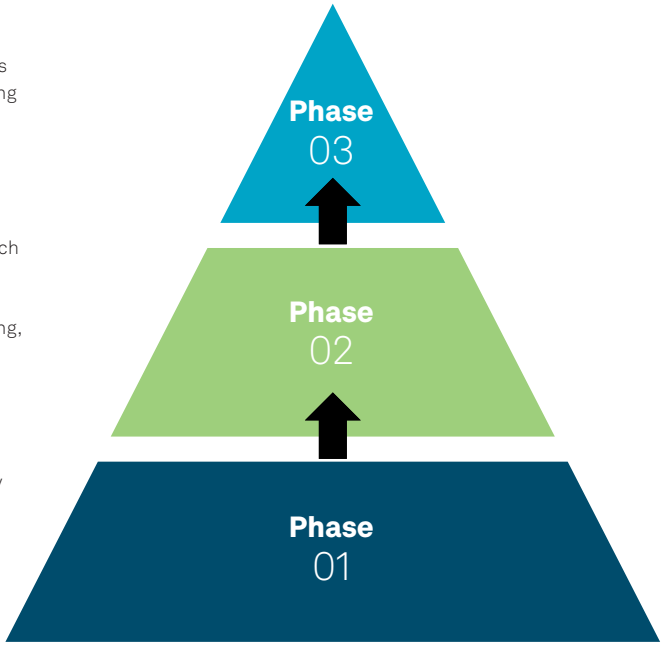
Commissioning is usually the phase in a project when design process fluids are introduced to the systems and sub-systems. Sometimes commissioning means running the systems with a safe fluid only. The next step after commissioning is PSSR (Pre-Start-up Safety Review) followed by start-up.

Pre-Commissioning

An essential mark between the transition, from a discipline-based approach to one that verifies the mechanical completion and the functionality of systems, is to ensure that it is complete and ready for commissioning and start-up. Pre-commissioning activities include: flushing and cleaning, drying, leak testing, running-in of equipment etc. Sometimes pre-commissioning activities are included into mechanical completion.

Mechanical Completion

As the final phase of construction is to verify that a facility is mechanically completed, inspection or an oversight team must ensure that the final construction is in accordance with the project drawings, specifications, industry standards, as well as all regulatory requirements from the authorities having jurisdiction. It involves fabrication, assembly and non-functional testing to confirm the integrity of the construction and installation.



What is Completions

Completions, on the other hand, is the record of the state of "completeness" to a predefined criteria set by clients and projects to meet regulations and standards, for example, construction completions.

Whether run by owners or contractors, the goals and scope must be intended to be a fully verified construction and commissioning which is fully tested and fit to perform the role for which it is intended.

The Cost of Neglecting Commissioning

Time

It is a known fact that most projects encounter delays. But the commissioning phase faces the brunt force of delays cascaded down from the initiation, planning, implementation, monitoring and controlling, and finally commissioning.

Instead, commissioning schedules need to be created early in the project to sync with other teams. If the commissioning schedule is developed later in the project, the sequence of activities during design, procurement, and construction can be completely misaligned.

Several teams are usually spread out in a simple project, and seamless communication is vital in a construction project. Otherwise, the cross-team collaboration required to streamline the flow of paper documentation and data can increase errors.

Other delays that hamper a project during commissioning include:

- Insufficient information to manage assets at custody transfer dates, potentially delaying depreciation of assets
- Delayed asset management setup and loading creates exposure due to the inability to manage high-risk assets
- Early demobilization of the project management team
- Delay in punch list clearance
- Delay in provisional acceptance certificate issuance
- Lack in provisions for feedstock for commissioning and start-up activities

Risk

Based on a study by Martin Helander on the safety challenges in the construction industry,[3] the industry experiences the highest accident rate of all major industries and the annual costs for accidents has been assessed at $12 billion.

Risk is often linked to the safety of those on-site. One thing that is often overlooked but essential is the planning stage – where safety is reviewed before anything even begins.

It is necessary to thoroughly understand the project scope required to plan and develop the schedule for the various systems and equipment needed in commissioning. The schedule can be included as part of the commissioning safety plan, which will address multiple coordination requirements, such as the impact of systems coming online at various points during the commissioning timeline.

During the planning stage, it is also essential to include additional safety equipment that must be used for site-specific conditions. Additional assessments must be conducted regularly to procure and store this safety equipment.

The construction team still plays a significant role in safety during the commissioning phase. One of the highest risks occurs when various construction and commissioning personnel occupy a site while it is still an active construction zone. This can create additional risks due to the various potential hazards.

[3] Martin Helander, Safety challenges in the construction industry, Journal of Occupational Accidents, Volume 2, Issue 4. 1980.

Cost

Inevitably, all these problems lead to one major issue: the increase in the project's cost. Commissioning costs are typically low, yet the cost of delays during commissioning is vast. Therefore, the commissioning phase of your project needs to be planned to a tee.

The delays that stem from lack of communication in teams lead to an idle team that incurs extra expenses due to overhead. In a similar circumstance, the delay in payment of contractors and suppliers after project completion could lead to dispute and delay in signing the completion certificate, which leads to further expenses.

Risks must be mitigated as soon as possible to avoid costly delays during commissioning. If proper safety training and procedure are not conducted, the accidents on-site will eventually lead to delays and incur cost as the problem is being rectified.

Scrutiny is at its peak during the commissioning phase, particularly when the pressure to complete the project is high, equipment testing, and system failures would cost a large sum to re-test if done wrongly and in a rush.

A good commissioning plan can make or break a project's budget and schedule. It can save a company time and money at every stage of a project while preventing safety and operability issues, increasing productivity, lowering downtime, and perhaps most importantly, giving the person charged with starting up the plant, the confidence to get it running.

The Data Deficit and Need for Digital Completions

Engineering data and documentation are essential for on-budget and on-schedule projects. This information is also crucial for the efficient and safe operations of facilities after commissioning.

Lack of accessible, accurate information compromises can impact the successful build and handover of a facility in some of the following ways:

- Preparation and execution of tasks are time and cost-intensive. Delays in locating and verifying data further add to ongoing costs.
- Out-of-date information can result in unexpected and undocumented issues when on-site work is executed, leading to extended downtime, reduced productivity, and increased costs.
- Failure to locate documentation to demonstrate ongoing regulatory compliance may lead to the loss of operating licenses.

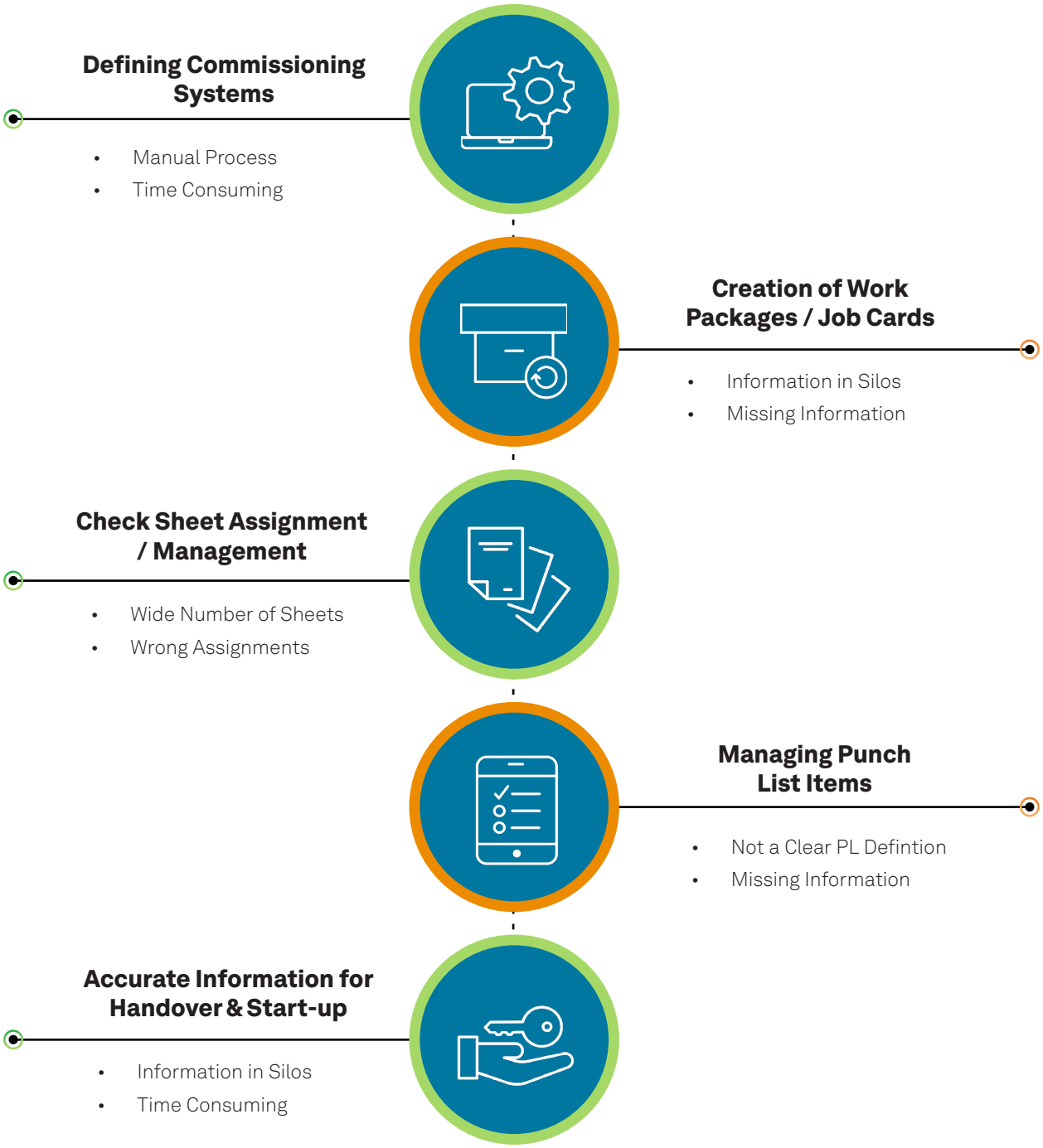
In the event of a severe incident, delayed responses can impact your reputation and share price, and in worst-case scenarios, lack of access to critical information could result in casualties.

Accessible, structured information is well-organized in form and format and per your company's data governance policy.

As such, you can continuously use and reuse that information knowing that it is controlled, managed, and reliable. However, in many companies, most project information is still unstructured or inaccessible, resulting in significant challenges to find the data needed to support critical day-to-day decisions.

The figure on the next page details the issues that project teams can face due to a lack of standardized and timely information.

The Impact of Poor & Unstructured Data



Intergraph Smart® Completions

To stay ahead of the game, CCMS - Commissioning Completions Management System should be implemented. An example of a CCMS tool is our very own Intergraph Smart® Completions (ISC). It creates a foundation of information with traceability and accountability for custody, control and work processes providing seamless transitions to operations and maintenance.

It also allows you to manage all projects, large or small, by enabling your organization to plan, prepare and execute a project effectively. Used on some of the largest mega-projects throughout the world with exceptional performance and results, it has proven to be a reliable and predictable system designed to achieve project goals.

Smart Completions is designed to consolidate asset information and verify installation, testing and performance of all equipment, instruments, piping and Control System Input Output (I/O) points.

The flexible foundation provides projects with the tools needed to track all facets to ensure system integrity and deliver an end product that meets ISO specifications or higher standards. Smart Completions, the “plant and project lifecycle” application suite, includes:

- Completions & Commissioning Management System
- Safety & Risk Management System
- Turnaround Management System

Key Benefits of Smart Completions

- More sophisticated approach to project portfolios (standardization)
- Quick to deploy
- Fully Scalable
- Transparent and consistent reporting across vendors
- Simplify reuse of best practices on new projects
- Single Repository of data
- Demonstrate Technical Integrity across all phases of the project
- Paperless mobile execution with real-time reporting for inspections, punch items and turnover
- Automatic work package/job car compilation
- Automatic turnover package compilation and submission to operator
- Equipment history for warranty and maintenance
- Integration with other products – Hexagon solutions like Smart P&ID and HxGN SDx® and third-party solutions

Instances and Projects

Smart Completions allows System Administrators to create multiple instances within a site and multiple projects within an Instance depending on the project needs. There is no limitation to the number of instances and projects you can create. Some configurations and data are shared within projects that are not shared between Instances, and each customer’s specific circumstances will determine the logic employed.

Systemization and Location Structure

he Smart Completions database is an advanced database with more than 1,000 tables and tens of thousands of fields. Assigning tags to systemization provides the end-user with a simple method to find a tag, or collection of tags without actually knowing what tag they are looking for. Process Breakdown Structure (PBS), also known as systemization and Location Breakdown Structure (LBS), is designed to allocate tags, work, certification, and handover, which is key to reviewing the overlap between Construction and commissioning turnover processes.

It also provides the basis for the “Completions Skyline” designed to provide all relevant information to meet turnover requirements.

Task Models

Task Models create any task for an asset, loop, pack, system/subsystem, or certificate. Task Models are used to build digital checksheets (Smart Forms) or to attach a mail merge word document from the Forms Library (Paper-Based solution). It is the template of the form that will be taken into the field and the rules that will govern the tasks. They house both the form and the underlying scope for the tasks that will be created from them.

Task models are a great tool to create and apply best practices that can also provide early estimating in required labor, equipment and materials. As soon as an initial equipment/tag list is loaded, the task models can be assigned to provide you detailed labor requirements for any phase/stage, system/subsystem, with the required labor types, work-hours. This is a great feature to review the Level 4 resource and MH estimates typically defined in the master schedule.

Import Project Control Tasks (PCTs)

Project Control Tasks (PCTs) align the CCMS with the master schedule for a project that is generated from either a Primavera P6 or Microsoft Project schedule. The CCMS can link CCMS planned tasks to any P6 activity so that when the CCMS planned tasks are completed, it will automatically update the percent complete of the activity. This enables projects to configure an export that generates itself weekly with updated completions percentage for any P6 activity linked to completions tasks.

Smart Completions Mobile Application Overview

The Smart Completions Mobile Application is designed to simplify daily tasks and planning for field personnel. When used in conjunction with our CCMS, the Smart Completions Mobile Application can be used to simplify punch listing, collection of equipment information, and execution of paperless tasks from the field - with or without Wi-Fi connections readily available all from your mobile device. The mobile application provides field personnel; access to content located in a database located on your company intranet or through a Hosted internet solution.

The mobile application can be used to:

- Retrieve and Edit (e.g., Primary & OEM Data) detailed equipment (asset) information
- Retrieve detailed document information and view the document itself (e.g., P&IDs, Datasheets)
- View and Execute tasks (e.g., Field Installation Checks) electronically
- Enter and complete Punchlist items in the field (with as-found & as-left images)
- View and Execute Preservation tasks electronically
- Enter and complete Non-Compliance items in the field (with as-found / as-left images)
- View and Execute Routine Inspection tasks electronically

Handover and Turnover Packages

The Handover/Turnover Package is the culmination of the project. It identifies what documents are to be handed from Construction to Commissioning and Commissioning to Operations. The “Systemization” breakdown must be approved by the client first, as all HOPs/TOPs will be handed over at the System level and Mechanical Completion Packages at the Subsystem level. All tests and related documentation, by law, must be handed over to the client upon satisfactory completion. It is essential that all documents are legible and included.

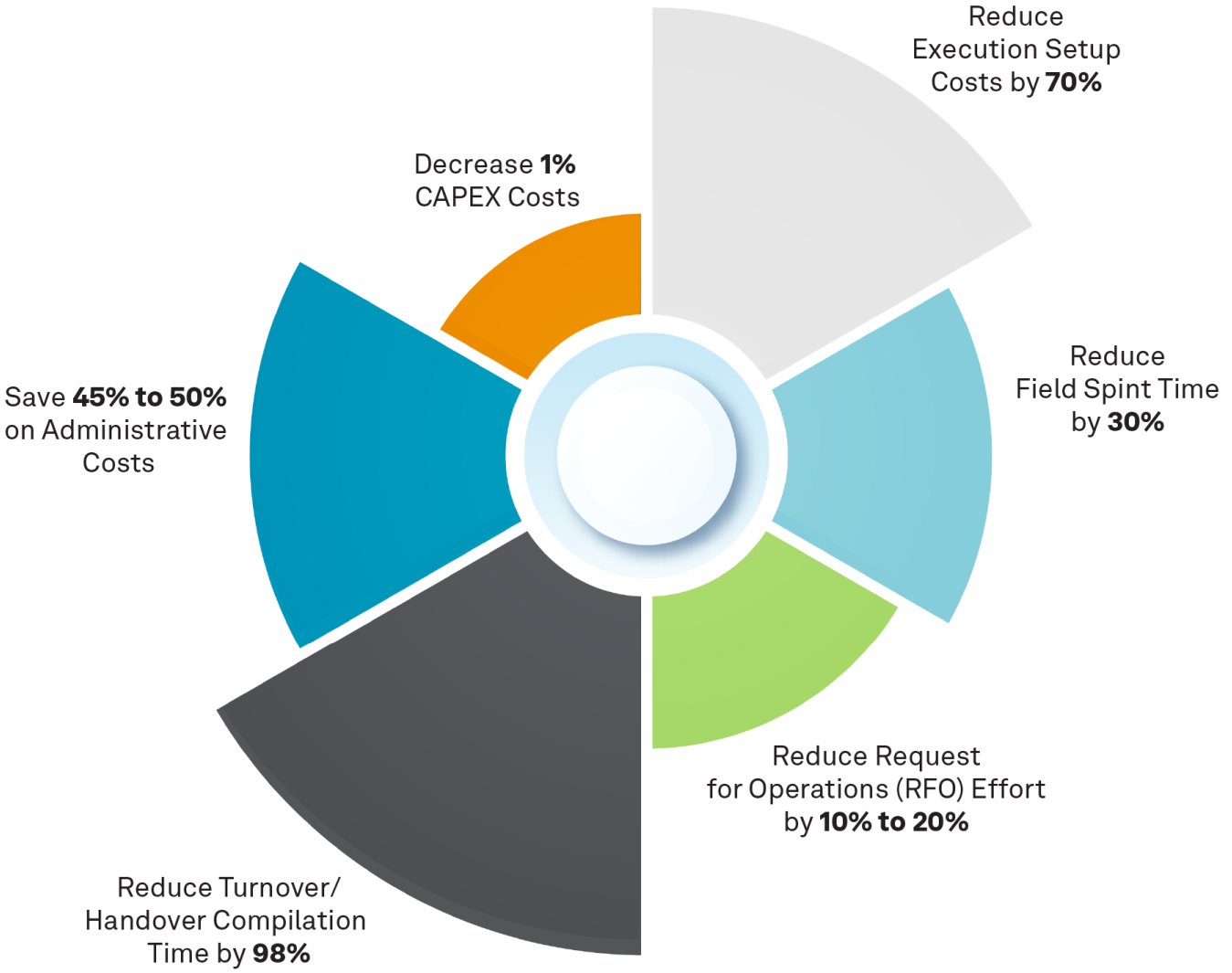
Reporting and Data Exchange ISC Reporting

Template Reports included in Intergraph Smart Completions (ISC) will cover all critical and supplemental reporting requirements. Each module within ISC contain several template reports, whereby each report can display and report on the information filtered in any one module. Accessed via the primary switchboard, the “Saved Report” function allows appointed users to create specific reports for specific content and either keep these reports private or publish them to others. With the combination of advanced filtering, and selection of detail to be included in the saved report, end users can provide detailed index (list) reports, or summary reports that roll up all status information at a single level of the project (e.g., only report at system level, not at subsystem level). All reports can also be exported into raw data format, using Microsoft Excel formats.

- Report Packages is a powerful feature that can combine several individual reports, using similar filtering criteria, into a single PDF file. It stops management from having to open several individual reports. It’s very useful for reviewing a contactor scope.
- Power BI dashboard is available for those clients that want enhanced graphical reporting. ISC comes with a PBI Template (PBIX) that can be used OOB and will enable users to analyze critical completions and commissioning information.

Data Exchange

- The DE module is designed for the system administrators to automate data importing or exporting using Application Programming Interface (APIs) or through traditional Microsoft Excel formats. It provides a single location to configure “data connectors” to other Hexagon products, client In-house and third-party solutions.



Reliable, proven and tested
More than 14,000 Licenses used by EPCs and Owner Operators.
Single Source of Truth.

Industries Span and applicability
Oil and Gas, utilities, Renewables, Mining, Petrochemicals, offshore, Industrial 4.0, Cloud base and Intrinsic Lean End-to-End Solution.

Real-Time Smarter Decision
Advanced Reporting, Power BI interface.
Collaborative environment for all stakeholders.

Proven and Tangible Outcome Results
CAPEX and OPEX impact that matter.
Enablement to execute business strategy.

Smart API Integration
Unlocking communication barriers with Digital Twin and SPID live integration.
Seamless reliable and validated data flow.

Innovation and Ingenuity
R&D and Enhancement.
Smart and actionable Feedback capturing for continuous improvements.

Relevance
Modern and intuitive UI experience.
Developed by hands-on field experts to meet site commissioning challenges (e.g., advanced “wizards” to automate task assignments, saved searches/ reports, etc.).

Case Study

How an Australian energy company simplified well handover with Intergraph Smart Completions

The field delivery and well commissioning and stabilization (WCS) team sought an improved well handover and completion process for a liquified natural gas (LNG) company on an upstream project. The team was challenged to combine innovation and collaboration to develop a best practice approach to simplify their current process.

The team knew that they needed to implement a new methodology of creating handover packages married with the latest in completions software technology.

Working with the field delivery document control and the completions and commissioning management system (CCMS) teams, the WCS team created an automated system to compile a more streamlined version of commissioning dossiers using Intergraph Smart Completions CCMS. As part of the process, the WCS team now compiles a dossier containing a suite of documents of all the relevant inspection test records, installation checklists, completions certificates and procedures used throughout the commissioning process. An average well site commissioning dossier may contain more than 180 pages and take up to 5 hours to put together.

The result was a more simplified set of processes that included:

1. Delivering a consistent suite of documentation for well delivery.
2. Implementing electronic documentation that allows users to complete an activity and automatically upload documentation.
3. Developing “Real Time” monitoring processes that provide a more accurate picture of Mechanical Completion.

The new process will be used to compile and deliver all 977 well-commissioning dossiers for the Australian LNG upstream phase 1 project in less than 2 percent of the time it was taking to generate the dossiers manually. Both the field delivery and WCS teams will continue to work together to expand this process further to all vendor documentation and eventually create a ‘one source’ document reference point for the operations teams.

Conclusion

Commissioning helps cut costs, reduce risk ensure projects stay on schedule. While digital completions is instrumental in assuring that the right data and information is available to all who need it, whenever they need it.

It’s clear that in a world where average or above-average won’t cut it anymore, the benefits of commissioning and completions will be the difference in helping both Asset Owners & Contractors stay ahead of the competition.

Get in touch with us for more information.

Hexagon is a global leader in digital reality solutions, combining sensor, software and autonomous technologies. We are putting data to work to boost efficiency, productivity, quality and safety across industrial, manufacturing, infrastructure, public sector, and mobility applications.

Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build, and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 21,000 employees in 50 countries and net sales of approximately 3.8bn EUR. Learn more at hexagon.com and follow us @HexagonAB.