



References List  
2008 - 2023

**inprocess** 

## Inprocess References List: 2008-2023

### Document Control

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| <b>Document Title</b>     | Inprocess References List 2008 - 2023 |
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| Project Type                   | Customer  | Project Title  | Process Simulator | Year | Country | Company Type             | Industry         | Short Description   |
|--------------------------------|---|--|-------------------|------|---------|--------------------------|------------------|---|
| Online Application             | Spanish branch of a multinational petrochemical company | Inferential to estimate the propane content at the bottom of a De-propanizer column  | Aspen HYSYS       | 2023 | Spain   | Operator                 | Petrochem        | The project successfully replaced the empirical formula used for inferring C3 at the bottom of the depropanizer column with a precise process simulation-based method, employing Aspen HYSYS. By incorporating new plant instrumentation and refining the inferential equation, the accuracy of C3 estimations, especially under challenging conditions, significantly improved. The resulting rigorous models achieved the project's objectives, leading to the successful update of the Digital Twin previously provided by Inprocess.  |
| Operator Training System (OTS) | American Oil Major for its Nigerian subsidiary          | Operator Training System for a Gas to Liquids facility in Nigeria                    | Aspen HYSYS       | 2023 | Nigeria | Operator                 | Refining         | Inprocess has successfully delivered four Operator Training Simulators (OTS) to the customer, accompanied by a series of courses. These OTS systems include a comprehensive representation of associated controllers (DCS), interactive Operator Interface, and an Instructor Station, specifically designed for conducting training sessions. The primary goal of the OTS was to provide operational staff, including control room operators, operating supervisors, and process engineers, with practical experience in operating facilities under various scenarios. This encompasses control of process systems during normal operation, preparation of process systems for normal shutdown, startup procedures following a trip or shutdown, and the ability to effectively manage emergencies and abnormal situations |
| Operator Training System (OTS) | Norwegian Subsidiary of a main automation contractor    | Direct-Connect OTS for a FPSO located in an oil & gas field in the north of Scotland | Aspen HYSYS       | 2023 | Norway  | Instrumentation Provider | Oil & Gas (FPSO) | The delivered Operator Training Simulators (OTSS) aim to train operational staff on both process and control systems, reduce the risk of operational incidents, decrease start-up time, increase plant on-stream time, and serve as a test-bed for engineering analysis. The OTSS emulate plant behavior with high fidelity, ensuring minimal differences from the real plant DCS interface. This realistic simulation helped operators practice and improve responses to various scenarios, preventing equipment damages and enhancing overall operational efficiency.   |



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| Project Type             | Customer   | Project Title   | Process Simulator | Year | Country              | Company Type           | Industry     | Short Description  |
|--------------------------|--|---|-------------------|------|----------------------|------------------------|--------------|--|
| Dynamic Simulation Study | Korean Compressor Manufacturer Company for a Polish CC Power Plant | Dynamic Simulation Study for Fuel Gas Compressor in a Combined Cycle Power Plant in Poland    | Aspen HYSYS       | 2023 | Poland               | Equipment Manufacturer | Power Plants | The project has achieved its main objective of delivering a dynamic simulation study, analyzing the fuel gas compressor system's dynamic behavior during various transient operations. Key study objectives were successfully met, including verifying compressor operability, assessing the positioning of the anti-surge valve and Inlet Guide Vanes (IGV), confirming the need for a pressure throttling valve at the feed gas line, verifying the sizing of Anti-Surge Control Valves (ASCV), and ensuring the overall performance of the anti-surge system. The study contributes to the operational reliability and efficiency of the fuel gas compressor system, enhancing the project's overall effectiveness.                                       |
| Dynamic Simulation Study | Italian EPC for a Middle East National Oil Company                 | Dynamic Simulation Study and Low Temperature Study for an Oil & Gas field development project | Aspen HYSYS       | 2023 | United Arab Emirates | EPC                    | Oil & Gas    | Following the successful realization of the project, the Dynamic Simulation Study for the Oil and Gas Development Project has achieved its objectives by executing up to thirty dynamic simulation scenarios using Aspen HYSYS® Dynamics as the chosen process simulation engine. This comprehensive verification process ensures the reliability and efficiency of the project under various operational conditions. Simultaneously, the Low Temperature Study has successfully reconfirmed expected low temperatures resulting from depressuring in the facilities. A critical review of liquid formation in systems handling dense phase during depressuring has been conducted, leading to the incorporation of suitable recommendations into the design |
| Online Application       | Polish Petrochemical company                                       | A Digital Twin for a petrochemical distillation column  | PetroSIM          | 2023 | Poland               | Operator               | Petrochem    | The delivered project has successfully met the client's primary objective of assessing the concentration of propylene in the bottoms of the Propylene column. The goal was achieved by providing the client with an Online Digital Twin, complete with ad-hoc functionalities, robustly supporting the realization of the project's primary objective.   |



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| Dynamic Simulation Study       | Swiss Compressors Manufacturer (German Office) for an international EPC | Dynamic Simulation Study for a PDH Reactor Effluent Compressor (REC) | Aspen HYSYS       | 2023 | Algeria     | Equipment Manufacturer | Petrochem | Inprocess, having previously developed a dynamic simulation for a feasibility project involving the same compressor system in a Propane Dehydrogenation (PDH) plant, has expanded its evaluation to cover five scenarios under two operating conditions. The assessment includes normal operation, start-up from settle-out/process conditions, normal (delayed) shutdown, emergency shutdown (undelayed), and operation on the anti-surge control line (turn-down). This extended analysis provides a comprehensive understanding of the compressor system's dynamics in diverse operational situations, surpassing the previous focus solely on start-up analysis.  |
| Dynamic Simulation Study       | Swiss Compressors Manufacturer (German Office) for an international EPC | Dynamic Simulation Study for Heat Pump Compressor (HPC)              | Aspen HYSYS       | 2023 | Algeria     | Equipment Manufacturer | Petrochem | The project has successfully achieved its main objective by employing a dynamic model to simulate and obtain results for the entire process of machine start-up. The simulation encompassed the progression until the compressor reached its operating speed, with the Anti-Surge Valves (ASVs) fully open. This successful delivery demonstrates the effective utilization of dynamic modeling for comprehensive analysis and simulation of the machine start-up process.  |
| Operator Training System (OTS) | European site of a Saudi chemical manufacturing company                 | Operator Training System for a Steam Cracker                         | Aspen HYSYS       | 2023 | Netherlands | Operator               | Petrochem | The delivered Operator Training System (OTS) successfully addresses the scarcity of hands-on opportunities for new operational staff in plant operations. The system provided a risk-free environment for practicing start-ups, shutdowns, and emergencies, achieving key objectives such as training staff on processes and control systems, reducing operational risks, minimizing start-up time, enhancing plant performance, serving as a test-bed for engineering analysis, and preventing equipment damages. This "Hybrid OTS" accurately mirrors the Distributed Control System (DCS) with a standalone software package, ensuring staff confidence in safe and efficient plant operation under diverse scenarios. |





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| Operator Training System (OTS) | Main Automation Contractor working for an USA Natural Gas company | Direct-Connect OTS for a north american LNG project                      | UniSim Design                              | 2023 | USA      | Instrumentation Provider | Natural Gas         | Inprocess has successfully delivered a Direct-Connect Operator Training System (OTS) utilizing the proprietary Inprocess Infrastructure Suite (IIS) programming environment, coupled with Honeywell UniSim® Design as the process simulation engine. This OTS has facilitated the certification of operators for competence, providing the operational staff, including control room operators, operating supervisors, and process engineers, with practical hands-on experience in operating the facilities across diverse scenarios. |
| Steady State Simulation Study  | Spanish Oil Company (Refining Division)                           | Flare study  | Aspen HYSYS; Flarenet/Aspen Flare Analyzer | 2023 | Spain    | Operator                 | Refining            | The project has successfully achieved its main objective, conducting a comprehensive analysis of the impact on the flare network following a Hazop study. The focus of the analysis was on the integration of new Pressure Safety Valves (PSVs) connected to a recently added sub-collector, strategically linked to the refinery's general collector within the flare network. The project's successful delivery provides valuable insights into the implications and efficiencies of the new configuration for the flare network.    |
| Dynamic Simulation Study       | Spanish Petroleum Company   | Technological scoping of an open-source simulation technology            | DWSIM                                      | 2023 | Spain    | Operator                 | Refining; Petrochem | Inprocess executed a scouting for the open-source simulation technology for the client. Inprocess also prepared a proof of concept that is required for the implementation, development and analysis. This helped the client to analyze and decide based on the results of POC on the feasibility of the project and to proceed with projects subsequent phases.   |
| Training                       | Colombian Oil Company   | Training Courses for Plant Operators about processing units using INGENO | UniSim Design                              | 2023 | Colombia | Operator                 | Refining            | Inprocess has successfully delivered a series of courses using INGENO, focusing on the training of operational procedures for generic production units. The courses, targeted at specific units such as Turbogenerador, Calderas, and Hornos, includes a comprehensive technical and commercial description of the INGENO training solution, along with its hardware/software requirements.  |



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| Operator Training System (OTS) | Dutch FPSO constructor and International EPC Joint Venture | Lifecycle OTS for an FPSO in Guyana                                     | Aspen HYSYS       | 2023 | Guyana  | Operator     | Oil & Gas (FPSO) | Inprocess has successfully delivered the oil development project, utilizing its advanced IIS software, recognized as a premier OTS orchestration tool. This project included a Lifecycle OTS with a Virtual Start-up initiative. The solution aimed to proactively identify issues in the FPSO system before actual start-up, saving time, reducing risks, and improving overall process safety. The Testing and Training Simulator, a key component, served various purposes, such as OTS, ICSS testing, Virtual Start-up, controller tuning, verification of process control narratives, and commissioning support. The successful completion underscores the effectiveness of Inprocess IIS software in optimizing critical processes for clients. |
| Dynamic Simulation Study       | North American Refinery                                    | Dynamic Simulation Study of Gas blow of a Distillate Hydrotreating Unit | Aspen HYSYS       | 2023 | USA     | Operator     | Refining         | Inprocess has successfully completed the execution of the dynamic simulation project. The team developed a comprehensive dynamic simulation model incorporating all the specified equipment. Subsequently, the selected scenarios were meticulously executed. The project culminated in the delivery of a thorough dynamic simulation report, presenting detailed insights and outcomes obtained during the course of the project's implementation.   |
| Operator Training System (OTS) | Greek Refining Company                                     | Update of CDU's OTS according to latest column revamp                   | UniSim Design     | 2023 | Greece  | Operator     | Refining         | Inprocess has updated the previously delivered OTS for the refinery CDU with the information coming from the latest revamp of the column  |
| Online Application             | Spanish branch of a multinational petrochemical company    | Digital Twin for the C3 Splitter + Deethanizer columns in a PDH plant   | Aspen HYSYS       | 2023 | Spain   | Operator     | Petrochem        | The client has achieved the primary objective with the successful delivery of the Digital Twin, aiming to enhance process control efficiency. The implemented Digital Twin facilitates the reporting of key variables, contributing to a more streamlined control of the overall process. Additionally, a set of Key Performance Indicators (KPIs) has been established to promptly alert and signal any deviations between the model and plant data. This proactive approach serves to highlight potential anomalies related to process or equipment, enabling timely intervention and optimization.   |



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| Operator Training System (OTS) | Spanish branch of a multinational petrochemical company | Direct-Connect OTS for Depropanizer and Deethanizer  | Aspen HYSYS       | 2023 | Spain   | Operator     | Petrochem        | Inprocess developed a Direct-Connect OTS using the proprietary Inprocess Infrastructure Suite (IIS) programming environment. Thanks to this OTS it was possible to certify operators for competence and allow the operational staff (control room Operators, operating Supervisors, Process Engineers...) to gain practical experience on how to operate the facilities in various situations  |
| Dynamic Simulation Study       | Italian EPC for a Swedish CCS plant                     | Dynamic Simulation Study for for the compressors in a Carbon Capture and Storage facility in a power plant in Sweden | Aspen HYSYS       | 2023 | Sweden  | EPC          | Power Plants     | The dynamic simulation study successfully achieved its objectives, validating start-up and shut-down procedures, optimizing hot gas bypass valves, and assessing the impact of equipment trips on the process system. The project ensured the adequacy of safety systems, including anti-surge protection, valve sizing, and control system effectiveness. Through a comprehensive evaluation of expander and motor load dynamics, the study provided valuable insights into system stability during transient operations and load variations.   |
| Operator Training System (OTS) | Dutch FPSO constructor                                  | Testing and Training Simulator for an FPSO located in offshore Brazil  | Aspen HYSYS       | 2023 | Brazil  | EPC          | Oil & Gas (FPSO) | Inprocess has successfully delivered the OTS as a versatile and integrated component with Digital Twin of the FPSO. The simulator have been serving various purposes, including ICSS testing, Virtual Startup, verification of process control narratives, Operator Training Simulator (OTS), and operations support during initial start-up and ongoing phases. The primary objective of the OTS was to certify operators for competence. This enabled the operational staff, including control room operators, operating supervisors, and process engineers, to gain practical experience in operating facilities across diverse situations, encompassing normal operation, shutdown, start-up after a trip or shutdown, control of emergencies, abnormal situations, process control strategies, advanced control logics, communication with field operators, and handling equipment malfunctions and emergency conditions. |





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| Dynamic Simulation Study   | Spanish EPC working for an Emirates NOC                                 | Holistic Dynamic Simulation for a gas development project in Emirates | Aspen HYSYS; OLGA | 2023 | United Arab Emirates | EPC                    | Oil & Gas   | The completed dynamic simulation study successfully ensured stable and controlled plant operation following Water Heat Treater (WHT) trips. Assessments of compressor operability and control, along with verification of system responses to major upsets, were conducted. The study also examined anti-surge systems, settle-out conditions, and proposed modifications for optimization. Additionally, the optimum set pressure for Pressure Control Valves (PCV) and Pressure Safety Valves (PSV) was defined to prevent flaring. Identified shortcomings were addressed through modifications.  |
| Dynamic Simulation Study   | North American Refinery   | Dynamics modelling and HMI interface of a crude distillation unit     | Aspen HYSYS       | 2023 | USA                  | Operator               | Refining    | Inprocess has successfully delivered a dynamic process model for the crude distillation unit, featuring a DCS-like graphical user interface mirroring the real DCS screens. This model is a valuable asset for training on new unit operations and facilitating process optimization throughout the revamp project – spanning pre-revamp, during, and post-start-up phases. Leveraging Inprocess' expertise in dynamic modeling, we efficiently constructed a simulation model that accurately represents the CDU design with planned revamp changes. This virtual CDU enables engineers to validate the new process configuration, assess equipment sizing, explore operating windows, and test control schemes. It serves as a robust tool for troubleshooting any issues that may arise during the restart process. |
| Dynamic Simulation Studies | French office of an US Compressor Manufacturer for a Qatari Gas company | Dynamic Simulation Study for Compression Systems in Qatar LNG plants  | Aspen HYSYS       | 2023 | Qatar                | Equipment Manufacturer | Natural Gas | Inprocess delivered a dynamic simulation study for 3 different types of compressors (Helium, LP and HP) of a LNG plant for transient conditions. Thanks to this study, it was possible to evaluate the design of compressor as well as confirm the adequacy of the control system.   |

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| Dynamic Simulation Studies     | Malaysia office of an Australian EPC Company for a Qatari Gas company | Dynamic Simulation study for Compression Systems in Platform Complexes                   | Aspen HYSYS                       | 2023 | Qatar   | EPC          | Oil&Gas   | Inprocess has created a dynamic simulation model for 2 compression platform complexes for a natural gas field on the north of Qatar. This dynamic study has been divided into 5 section: Well head to compression platform, inlet separator level control, HIPPS for Condensate export system, fuel gas system and slipstream mode. The compression platform is tested for different scenarios that enabled the test and fine tune of the compressor's PID control parameters |
| Operator Training System (OTS) | French Oil Major Company  | Assistance to Global Review of Operator Training programs based on existing and new OTSs | Unisim Design, DynSim, Indissplus | 2023 | France  | Operator     | Refining  | Inprocess has been selected as the company responsible for the review and maintenance of all existing OTSs in different plants as well as for the implementation of any future OTSs, as a single supplier (Total 14 OTSs).  |
| Dynamic Simulation Studies     | Italian consulting company for an Italian Oil Major company           | Dynamic Simulation Study for a Fractionation Section in an Italian bio-refinery          | Aspen HYSYS                       | 2023 | Italy   | Operator     | Refining  | Inprocess has built a dynamic simulation model of the newly built fractionation unit that consists of 13 different equipment. It is verified if maximum temperature will reach to the design temperature for 5 different scenarios including general and partial power failure, loss of cooling, lack of reflux and blow bygas from HP separator  |
| Operator Training System (OTS) | French Oil Major Company  | Assistance to Global Review of Operator Training programs based on existing and new OTSs | Unisim Design, DynSim, Indissplus | 2023 | France  | Operator     | Refining  | Inprocess has been selected as the company responsible for the review and maintenance of all existing OTSs in different plants as well as for the implementation of any future OTSs, as a single supplier (Total 14 OTSs).  |
| Dynamic Simulation Studies     | Spanish Petroleum Refinery  | Feasibility studies for capacity increase of a refinery alkylation Unit                  | Aspen HYSYS                       | 2023 | Spain   | Operator     | Petrochem | Inprocess has realized a dynamic simulation study for an alkylation unit whose capacity has been increased and where iso-butane purity on top must be maintained at 95%. Thanks to this study, the client was able to verify and modify its revamp parameters. In a second project phase, the model was used to design a better heat integration due to the increase in vapor needs in the column reboiler  |

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| Dynamic Simulation Studies                       | Korean Compressor Manufacturer Company for an UAE oil company           | DSS for Ethylene Compressor   | Aspen HYSYS       | 2023 | United Arab Emirates | Equipment Manufacturer | Natural Gas      | Inprocess has delivered a dynamic simulation study for Low Pressure Ethylene Compressor Suction Drum and Low pressure Ethylene Compressor for the following scenarios: <ul style="list-style-type: none"> <li>• Verification report</li> <li>• Surge analysis and reports including ESD.</li> <li>• Requirement of hot bypass valve for surge avoidance</li> </ul>  |
| Dynamic Simulation Studies                       | Dutch FPSO constructor for a US Oil Major                               | Dynamic Simulation Study for an oil development Project in Guyana                       | Aspen HYSYS       | 2023 | Guyana               | Operator               | Oil & Gas (FPSO) | Inprocess has created a high fidelity dynamic simulation model. This model enabled: <ol style="list-style-type: none"> <li>1. The demonstration that the configuration of the process equipment and the control philosophy applied meets the functional requirements,</li> <li>2. Verification of the performance of the process control scheme and confirm control, alarm, and trip settings,</li> <li>3. Verification of start-up and shut-down procedures</li> </ol> |
| Dynamic Simulation Studies                       | French office of an US Compressor Manufacturer for a Qatari Gas company | Dynamic Simulation Study for Compression Systems in Qatar LNG plants                    | Aspen HYSYS       | 2023 | Qatar                | Equipment Manufacturer | Natural Gas      | Inprocess delivered a dynamic simulation study for 3 different types of compressors (Helium. LP and HP) of a LNG plant for transient conditions. Thanks to this study, it was possible to evaluate the design of compressor as well as confirm the adequacy of the control system.  |
| Dynamic Simulation Study; Flare Systems Analysis | Oil refinery in Spain   | Dynamic Simulation Study for Coker Relief Load in a refinery                            | Aspen HYSYS       | 2023 | Spain                | Operator               | Refining         | Inprocess has carried out a dynamic simulation model including all the equipment detail in order to evaluate the impact of a power failure scenario for the low-pressure section of the coker unit, including the shutdown curve for the coker drums.   |
| Dynamic Simulation Study; Flare Systems Analysis | Spanish Petroleum Refinery  | Dynamic Relief Study for critical areas on GPF analysis for the Alkylation Flare System | Aspen HYSYS       | 2023 | Spain                | Operator               | Refining         | A previous Inprocess study in steady state showed that current flare system was not able to assume all discharges to flare in worst case scenarios. As dynamic simulation can give more accurate results, a dynamic simulation study has been requested. A flare network model has been built with Aspen HYSYS® to analyze the dynamic effects of the reliefs (non-simultaneity of the peaks) on those systems that have been modelled in dynamic.                      |

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| Dynamic Simulation Studies | Korean Compressor Manufacturer Company         | Dynamic Simulation Studies of Fuel Gas Compressor for a Mexican Combined Cycle Power Plant           | Aspen HYSYS       | 2023 | México  | Equipment Manufacturer | Power Plants | A dynamic simulation study has been delivered that shows the analysis of the dynamic behavior of the Fuel Gas Compressor for selected transient operations, verifying the anti-surge valve size, including the trim characteristics and to evaluate the need of additional protection, hot gas bypass valve and to check the settle-out pressure conditions.  |
| Dynamic Simulation Studies | Korean Compressor Manufacturer Company         | Dynamic Simulation Studies of Fuel Gas Compressor for a Mexican Combined Cycle Power Plant           | Aspen HYSYS       | 2023 | México  | Equipment Manufacturer | Power Plants | A dynamic simulation study has been delivered that shows the analysis of the dynamic behavior of the Fuel Gas Compressor for selected transient operations, verifying the anti-surge valve size, including the trim characteristics and to evaluate the need of additional protection, hot gas bypass valve and to check the settle-out pressure conditions.  |
| Dynamic Simulation Studies | Korean Compressor Manufacturer Company         | Dynamic Simulation Studies of Fuel Gas Compressor for a Mexican Combined Cycle Power Plant           | Aspen HYSYS       | 2023 | México  | Equipment Manufacturer | Power Plants | A dynamic simulation study has been delivered that shows the analysis of the dynamic behavior of the Fuel Gas Compressor for selected transient operations, verifying the anti-surge valve size, including the trim characteristics and to evaluate the need of additional protection, hot gas bypass valve and to check the settle-out pressure conditions.  |
| Dynamic Simulation Studies | Korean Compressor Manufacturer Company         | Dynamic Simulation Studies of Fuel Gas Compressor for a Mexican Combined Cycle Power Plant           | Aspen HYSYS       | 2023 | México  | Equipment Manufacturer | Power Plants | A dynamic simulation study has been delivered that shows the analysis of the dynamic behavior of the Fuel Gas Compressor for selected transient operations, verifying the anti-surge valve size, including the trim characteristics and to evaluate the need of additional protection, hot gas bypass valve and to check the settle-out pressure conditions.  |
| Dynamic Simulation Studies | Spanish E&P company operating in the North Sea | Plant controllability studies at low flow condition analysis at an oil&gas platform in the North Sea | Aspen HYSYS       | 2023 | Norway  | Operator               | Oil&Gas      | Tasks that have been carried out during the project are: <ul style="list-style-type: none"> <li>• Validate the Plant Simulation (Aspen HYSYS stationary model) at actual operative conditions.</li> <li>• Built and validated the dynamic model on Aspen Hysys.</li> <li>- Perform the tuning of the process control loops.</li> <li>- Validate the tuning with the dynamic model and evaluate the stability with the process with the historical data.</li> <li>• Improve the tuning across process control loops to optimize and increase the stability in YME Plant.</li> <li>• Train Operators on “Basic Control loop Tuning” and provide general Support during field visits.</li> </ul> |



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| Flow Assurance Analysis        | Indian EPC Emirates office                              | Steady State & Transient Analysis for 3 offshore pipelines                           | OLGA; PIPESIM     | 2023 | United Arab Emirates | EPC          | Oil&Gas      | The scope of work consisted of modelling of three offshore pipelines. Steady state and transient state scenarios are considered to ensure the operability of the pipeline. Transient analysis scenarios were surge volume during ramp-up and surge volume during pigging operation. Summer and winter cases are also considered for each scenario.   |
| Operator Training System (OTS) | European site of a Saudi chemical manufacturing company | Operator Training System for Steam Cracker   | Aspen HYSYS       | 2023 | Netherlands          | Operator     | Petrochem    | A Direct-Connect OTS of a Steam Cracker was delivered. This project included the design, engineering, delivery, testing and installation of the Steam Cracker OTS. It consisted of training scenarios configuration, KPI configuration/customization, Instructor Station software and configuration.   |
| Operator Training System (OTS) | Major American Petroleum Company                        | Operator Training Simulator for Electric Submersible Pumps in a Gulf of Mexico field | Aspen HYSYS; OLGA | 2023 | USA                  | Operator     | Oil&Gas      | Inprocess have developed the OTS using our proprietary Inprocess Infrastructure Suite (IIS) platform alongside Aspen HYSYS Dynamics for the topsides process simulation engine and OLGA for the subsea process simulation engine. The resulting holistic model was created leveraging the existing OLGA models provided by the client.   |
| Dynamic Simulation Studies     | Spanish EPC company                                     | Dynamic Simulation Studies on gas system for a Combined Cycle Power Plant            | Aspen HYSYS       | 2023 | Mozambique           | EPC          | Power Plants | A dynamic simulation study of the plant's gas system was delivered in order to verify if the process requirements were satisfied under transient scenarios such as compressors failure, turbine failure, loading rejection. The equipment that was included in the dynamic model:<br>- Five (5) Gas Turbines-Generators<br>- Five (5x25%) Gas Compressors<br>- Fuel Gas Conditioning (FGCS): Five (5) Performance Heater skids (1x100%) & Five (5) Fine Filter Coalescing skids (1x100%) |





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| Operator Training System (OTS)                   | Norwegian Oil&Gas operator | Integration of an additional well and pipeline into an existing Norwegian platform OTS   | UniSim Design                     | 2023 | Norway  | Operator     | Oil & Gas | The existing Direct-Connect OTS was extended keeping current models and OTS architecture. Three new process units and flowlines of the platform were included in the Unisim Dynamic model. Regarding the instructor station, new additional screens were added (screens related to the DCS and for the FODS) to extend the instructor navigation and the FOD and instructor actions execution. The initial conditions were re-generated, and the new scenarios were tested with the training instructor. |
| Operator Training System (OTS)                   | French Major Oil Company   | Assistance to Global Review of Operator Training programs based on existing and new OTSs | Unisim Design, DynSim, Indissplus | 2023 | France  | Operator     | Oil & Gas | Inprocess has been selected as responsible for the review and maintenance of all existing OTSs in different plants as well as for the implementation of any future OTSs, as a single supplier (Total 14 OTSs).   |
| Dynamic Simulation Study; Flare Systems Analysis | Oil refinery in Spain      | Dynamic Simulation Study for Coker Relief Load in a refinery                             | Aspen HYSYS                       | 2023 | Spain   | Operator     | Refining  | Inprocess has carried out a dynamic simulation model including all the equipment detail in order to evaluate the impact of a power failure scenario for the low-pressure section of the coker unit, including the shutdown curve for the coker drums.  |
| Dynamic Simulation Study; Flare Systems Analysis | Spanish Petroleum Refinery | Dynamic Relief Study for critical areas on GPF analysis for the Alkylation Flare System  | Aspen HYSYS                       | 2023 | Spain   | Operator     | Refining  | A previous Inprocess study in steady state showed that current flare system was not able to assume all discharges to flare in worst case scenarios. As dynamic simulation can give more accurate results, a dynamic simulation study has been requested. A flare network model has been built with Aspen HYSYS® to analyze the dynamic effects of the reliefs (non-simultaneity of the peaks) on those systems that have been modelled in dynamic.   |

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| Operator Training System (OTS) | Malaysian FPSO constructor                        | Multi-purpose Dynamic Simulator (Lifecycle OTS) for an FPSO to be located offshore Angola   | Aspen HYSYS         | 2023 | Angola               | EPC                   | Oil & Gas (FPSO) | <p>Phase I – Dynamic Process Model Development, Dynamic Simulation Studies and Steady State Simulations Verification: Based on the design and equipment data, a complete dynamic Aspen HYSYS® Dynamics model will be built against H&amp;MB and/or Steady State model provided.</p> <p>In parallel, the Steady State simulations will be verified according to existing design conditions.</p> <p>Phase II – Operating Procedures Validation &amp; Early-Emulated OTS</p> <p>Phase III – ICSS Database Checkout</p> <p>Phase IV – OTS Direct-Connect</p> <p>Phase V - Start-up Support</p>  |
| Dynamic Simulation Study       | Japanese FPSO constructor                         | Operating scenarios for an FPSO using an integrated transient model (subsea + topside facilities)   | OLGA; UniSim Design | 2023 | Senegal              | EPC                   | Oil & Gas (FPSO) | Additional transient scenarios necessary obtain conclusions on how to ensure the correct operation of the subsea production line of the FPSO  |
| Dynamic Simulation Study       | Emirati consulting company working for an UAE NOC | Dynamic Simulation Analysis to determine the operability limits of new main gas line that is deemed necessary for an increase in gas production | Aspen HYSYS; OLGA   | 2023 | United Arab Emirates | Consulting & Services | Oil & Gas        | <p>Dynamic Simulation study to verify the following:</p> <ul style="list-style-type: none"> <li>• The facilities can operate in a stable and controlled manner in case of any spurious trip.</li> <li>• The control system can ensure safe operation and equipment protection during transient conditions.</li> <li>• The set points of the controllers as suggested during detailed engineering stage can maintain the plant in a safe and operable window.</li> <li>• Confirm the proposed control scheme by demonstrating the flow distribution through the 34" NMGL and existing 18" pipeline during Pre-LTDP and Post-LTDP operating scenario.</li> <li>• Estimate the indicative controller set points for the new pressure controllers added as part NMGL Project and identify the set point change required for existing pressure controllers.</li> </ul> |
| Dynamic Simulation Study       | Spanish EPC working for a Middle East gas company | Additional (9) scenarios for the BOG compressors protection   | Aspen HYSYS         | 2023 | Qatar                | EPC                   | Natural Gas      | Additional scenarios necessary to ensure the compression system protection (right ASV sizes) during possible emergency situations   |



## Inprocess References List: 2008-2023

| Project Type                   | Customer                         | Project Title  | Process Simulator | Year | Country              | Company Type          | Industry       | Short Description   |
|--------------------------------|----------------------------------|--|-------------------|------|----------------------|-----------------------|----------------|---|
| Dynamic Simulation Study       | Emirates EPC for an Emirates NOC | Blowdown and Minimum Design Metal Temperature Determination (MDMT) for a new pipeline from an offshore platform to onshore facilities in the UAE | Aspen HYSYS; OLGA | 2023 | United Arab Emirates | Consulting & Services | Oil & Gas      | Blowdown and Minimum Design Metal Temperature Study to addresses the assessment of depressurization rate, depressurization time, hydrate formation temperature, calculation of blowdown orifice areas and calculation of MDMT for a new main gas pipeline to be installed connecting an offshore platform with an onshore processing facilities   |
| Operator Training System (OTS) | German Ammonia Process Licensor  | Emulated OTS for an ammonia plant to be located in Egypt   | Aspen HYSYS       | 2023 | Germany              | Process Licensor      | Bulk Chemicals | Development of an Emulated Operator Training Simulator for an ammonia plant to be built by our client (ammonia process licensor) in Egypt, using the proprietary Inprocess Infrastructure Suite (IIS) environment as the basic platform, as well as Aspen HYSYS Dynamics as the process simulation engine. The Emulated OTS solution does not use any additional software component to simulate the behavior of the Distributed Control System (DCS). The control narrative and the simulation of the control loops are part of the dynamic process simulation model. A similar approach is followed with the Safety Instrumented System (SIS). |
| Dynamic Simulation Study       | Spanish Petrochemical Site       | Hydraulic study of the cold water network in the polypropylene plant   | Aspen HYSYS       | 2023 | Spain                | Operator              | Petrochem      | Construction of a dynamic model of the cold water network of the polypropylene plant with the objective of:<br>* Owning a dynamic model that allows knowing the current state of the cold water network in the polypropylene plant<br>* Evaluate the impact of high temperatures in the cooling tower<br>* Evaluate the possible optimization alternatives of the cold water network  |



**Inprocess References List: 2008-2023**

| Project Type                   | Customer   | Project Title   | Process Simulator | Year | Country | Company Type                 | Industry         | Short Description   |
|--------------------------------|--|---|-------------------|------|---------|------------------------------|------------------|---|
| Dynamic Simulation Study       | Brazilian midstream company  | New gas processing and Inventory analysis and application development                             | Aspen HYSYS       | 2023 | Brazil  | Operator                     | Natural Gas      | <p>Development of applications to determine the gas inventory (stock in the pipeline) and the daily schedule (production forecast) for the natural gas processing plant. This will support client in calculating the gas inventory within two hours' time horizon. This application will be fed with plant data from EnergySys Cloud Platform the calculated results will be also sent to EnergySys. The EnergySys Cloud Platform enables users to connect to the database for reporting and export purpose via a secure web interface. This interface uses an open-standards data transfer protocol called OData. The applications will:</p> <ul style="list-style-type: none"> <li>* determine the gas inventory (gas stock in the pipeline) and</li> <li>* calculate the production forecast for the natural gas processing plant (production schedule for daily, 30 days and 90 days periods).</li> </ul> |
| Operator Training System (OTS) | Brazilian office of a software technology provider for a Brazilian oil company | Multi-Purpose Dynamic Simulator and Operators Training for an FPSO (P-78) located offshore Brazil | Aspen HYSYS       | 2023 | Brazil  | Software Development Company | Oil & Gas (FPSO) | <p>Development of a multi-purpose dynamic simulator (MPDS) in order to train control room and field operators of a Brazilian FPSO. The project is scheduled in five modules, comprising</p> <ol style="list-style-type: none"> <li>1. the development of the dynamic simulation model (to rigorously replicate the behavior of the processing facilities)</li> <li>2. the simulation of the control system using the soft-controller supplied by the control system provider</li> <li>3. the configuration of the training system with the instructor and operators consoles</li> <li>4. the development of an immersive environment, based on 3D virtual reality, to simultaneously train the field operators and the CROs</li> <li>5. development and implementation of the Start-up and Commissioning Monitoring System by connecting the MPDS to the real-time database</li> </ol>                        |

## Inprocess References List: 2008-2023

| Project Type                   | Customer   | Project Title   | Process Simulator | Year | Country | Company Type                 | Industry         | Short Description  |
|--------------------------------|--|---|-------------------|------|---------|------------------------------|------------------|--|
| Operator Training System (OTS) | Brazilian office of a software technology provider for a Brazilian oil company | Multi-Purpose Dynamic Simulator and Operators Training for an FPSO (P-79) located offshore Brazil | Aspen HYSYS       | 2023 | Brazil  | Software Development Company | Oil & Gas (FPSO) | Development of a multi-purpose dynamic simulator (MPDS) in order to train control room and field operators of a Brazilian FPSO. The project is scheduled in five modules, comprising <ol style="list-style-type: none"> <li>1. the development of the dynamic simulation model (to rigorously replicate the behavior of the processing facilities)</li> <li>2. the simulation of the control system using the softcontroller supplied by the control system provider</li> <li>3. the configuration of the training system with the instructor and operators consoles</li> <li>4. the development of an immersive environment, based on 3D virtual reality, to simultaneously train the field operators and the CROs</li> <li>5. development and implementation of the Start-up and Commissioning Monitoring System by connecting the MPDS to the real-time database</li> </ol> |
| Operator Training System (OTS) | Brazilian office of a software technology provider for a Brazilian oil company | Multi-Purpose Dynamic Simulator and Operators Training for an FPSO (P-80) located offshore Brazil | Aspen HYSYS       | 2024 | Brazil  |                              | Oil & Gas (FPSO) | Development of a multi-purpose dynamic simulator (MPDS) in order to train control room and field operators of a Brazilian FPSO. The project is scheduled in five modules, comprising <ol style="list-style-type: none"> <li>1. the development of the dynamic simulation model (to rigorously replicate the behavior of the processing facilities)</li> <li>2. the simulation of the control system using the softcontroller supplied by the control system provider</li> <li>3. the configuration of the training system with the instructor and operators consoles</li> <li>4. the development of an immersive environment, based on 3D virtual reality, to simultaneously train the field operators and the CROs</li> <li>5. development and implementation of the Start-up and Commissioning Monitoring System by connecting the MPDS to the real-time database</li> </ol> |



## Inprocess References List: 2008-2023

| Project Type                   | Customer   | Project Title   | Process Simulator | Year | Country | Company Type                 | Industry         | Short Description  |
|--------------------------------|--|---|-------------------|------|---------|------------------------------|------------------|--|
| Operator Training System (OTS) | Brazilian office of a software technology provider for a Brazilian oil company | Multi-Purpose Dynamic Simulator and Operators Training for an FPSO (P-82) located offshore Brazil | Aspen HYSYS       | 2024 | Brazil  | Software Development Company | Oil & Gas (FPSO) | Development of a multi-purpose dynamic simulator (MPDS) in order to train control room and field operators of a Brazilian FPSO. The project is scheduled in five modules, comprising <ol style="list-style-type: none"> <li>1. the development of the dynamic simulation model (to rigorously replicate the behavior of the processing facilities)</li> <li>2. the simulation of the control system using the softcontroller supplied by the control system provider</li> <li>3. the configuration of the training system with the instructor and operators consoles</li> <li>4. the development of an immersive environment, based on 3D virtual reality, to simultaneously train the field operators and the CROs</li> <li>5. development and implementation of the Start-up and Commissioning Monitoring System by connecting the MPDS to the real-time database</li> </ol> |
| Operator Training System (OTS) | Brazilian office of a software technology provider for a Brazilian oil company | Multi-Purpose Dynamic Simulator and Operators Training for an FPSO (P-83) located offshore Brazil | Aspen HYSYS       | 2025 | Brazil  | Software Development Company | Oil & Gas (FPSO) | Development of a multi-purpose dynamic simulator (MPDS) in order to train control room and field operators of a Brazilian FPSO. The project is scheduled in five modules, comprising <ol style="list-style-type: none"> <li>1. the development of the dynamic simulation model (to rigorously replicate the behavior of the processing facilities)</li> <li>2. the simulation of the control system using the softcontroller supplied by the control system provider</li> <li>3. the configuration of the training system with the instructor and operators consoles</li> <li>4. the development of an immersive environment, based on 3D virtual reality, to simultaneously train the field operators and the CROs</li> <li>5. development and implementation of the Start-up and Commissioning Monitoring System by connecting the MPDS to the real-time database</li> </ol> |

## Inprocess References List: 2008-2023

| Project Type             | Customer  | Project Title   | Process Simulator | Year | Country | Company Type           | Industry         | Short Description   |
|--------------------------|---|---|-------------------|------|---------|------------------------|------------------|---|
| Dynamic Simulation Study | Compressor Manufacturer in USA for an EPC for an oil company                                    | CO2 Compressor System Dynamic Simulation  | UniSim Design     | 2023 | USA     | Equipment Manufacturer | Oil & Gas        | <p>Analysis of the transient behavior of a 2-stages CO2 compression system.</p> <p>The analysis will allow to confirm following points:</p> <ul style="list-style-type: none"> <li>• Anti-surge valve sizing and response time, recommendation of anti-surge control line</li> <li>• ESD valve / confirmation of location, sizing and number of blow off valve/requirements (if needed), this may be HOT or COLD Gas Bypass as required or selected by client (It will be included in Emergency shutdown from worst conditions scenario).</li> <li>• Confirmation of system settle out pressure</li> <li>• Motor size confirmation:</li> </ul> <p>The dynamic model will also provide the following information about motor size:</p> <ul style="list-style-type: none"> <li>- From all analyzed transitory cases in the proposed scenarios, it will be verified the compressor capacity (Power). It will be possible to see if available power is enough to cover all transitory cases of this study.</li> <li>- Torque margin will be calculated and compared with the provided design torque curve.</li> </ul> |
| Dynamic Simulation Study | Swiss Compressors Manufacturer (German Office) for a Singapore FPSO constructor (Norway office) | Dynamic Simulation Studies for compressors in an FPSO to be located offshore Angola | Aspen HYSYS       | 2022 | Germany | Equipment Manufacturer | Oil & Gas (FPSO) | <p>Dynamic simulation study analyzing of the dynamic behavior of the MP, HP and HP injection Gas Compressor Packages for various transient operations (e.g., start-up from settle out conditions, normal shutdown, emergency shutdown, ASV failure, blocked outlet, etc.) in order to determine the adequacy of the dimensions of the protecting systems</p>  |



## Inprocess References List: 2008-2023

| Project Type                   | Customer        | Project Title   | Process Simulator | Year | Country | Company Type | Industry  | Short Description  |
|--------------------------------|-----------------|---|-------------------|------|---------|--------------|-----------|--|
| Operator Training System (OTS) | Polish Refinery | Development of an emulated Operator Training System for a Paraxylene production plant in a polish petrochem-refinery site | PetroSIM          | 2022 | Poland  | Operator     | Petrochem | <p>Detecting the competence deterioration in many areas on the production side due to the retirement of the most experienced staff, our client decided to build a modern training infrastructure, using the newest solutions in the computer simulation field of the real production processes.</p> <p>Therefore, for its paraxylene production plant in its petrochemical/refinery complex in Poland, it decided to request Inprocess an emulated Operator Training Simulator, using PetroSIM (from KBC-Yokogawa) as dynamic process simulator.</p> <p>Being an emulated solution, the dynamic simulation model had to include not only the processing units but the emulation of the real DCS (Emerson DeltaV) and of the real safety system (Triconex)</p>  |
| Operator Training System (OTS) | Polish Refinery | Development of an emulated Operator Training System for a Reforming Unit in a polish petrochem-refinery site              | PetroSIM          | 2022 | Poland  | Operator     | Refining  | <p>Detecting the competence deterioration in many areas on the production side due to the retirement of the most experienced staff, our client decided to build a modern training infrastructure, using the newest solutions in the computer simulation field of the real production processes.</p> <p>Therefore, for its continuous catalytic reforming unit (gasoline desulphurization, UOP's platforming, catalyst regeneration and PSA unit) in its petrochemical/refinery complex in Poland, it decided to request Inprocess an emulated Operator Training Simulator, using PetroSIM (from KBC-Yokogawa) as dynamic process simulator.</p> <p>Being an emulated solution, the dynamic simulation model had to include not only the processing units but the emulation of the real DCS (Honeywell Experion) and of the real safety system (Triconex)</p> |



## Inprocess References List: 2008-2023

| Project Type                   | Customer                                    | Project Title   | Process Simulator | Year | Country | Company Type            | Industry  | Short Description  |
|--------------------------------|---|---|-------------------|------|---------|-------------------------|-----------|--|
| Operator Training System (OTS) | Polish Refinery                             | Development of an emulated Operator Training System for a Vacuum Residue Upgrading unit in a polish petrochem-refinery site | PetroSIM          | 2022 | Poland  | Operator                | Refining  | <p>Detecting the competence deterioration in many areas on the production side due to the retirement of the most experienced staff, our client decided to build a modern training infrastructure, using the newest solutions in the computer simulation field of the real production processes.</p> <p>Therefore, for its vacuum residue upgrading unit in its petrochemical/refinery complex in Poland, it decided to request Inprocess an emulated Operator Training Simulator, using PetroSIM (from KBC-Yokogawa) as dynamic process simulator. Being an emulated solution, the dynamic simulation model had to include not only the processing units but the emulation of the real DCS (Honeywell Experion) and of the real safety system (Triconex)</p> |
| Operator Training System (OTS) | Polish Refinery                             | Development of an emulated Operator Training System for a Ethylene Oxide plant in a polish petrochem-refinery site          | PetroSIM          | 2022 | Poland  | Operator                | Petrochem | <p>Detecting the competence deterioration in many areas on the production side due to the retirement of the most experienced staff, our client decided to build a modern training infrastructure, using the newest solutions in the computer simulation field of the real production processes.</p> <p>Therefore, for its ethylene oxide production plant in its petrochemical/refinery complex in Poland, it decided to request Inprocess an emulated Operator Training Simulator, using PetroSIM (from KBC-Yokogawa) as dynamic process simulator. Being an emulated solution, the dynamic simulation model had to include not only the processing units but the emulation of the real DCS (ABB 800xA) and of the real safety system (Honeywell FSC)</p>   |
| Software Licenses              | A Vocational Oil Training Institute in Iraq | Two INGENO Modules for an Educational Institution in Iraq   | UniSim Design     | 2022 | Iraq    | Educational Institution | Oil & Gas | <p>As an initial step in its modernization and digitalization strategy, the Missan Training Oil Institute (MOTI) located in Amarah (Iraq) has acquired a couple of modules (Gas Oil Separation Plant - GOSP, and Desalter Unit) of Inprocess' Generic OTS - INGENO to train their students in the operation of such processing facilities.</p>   |

## Inprocess References List: 2008-2023

| Project Type                   | Customer   | Project Title   | Process Simulator | Year | Country     | Company Type | Industry         | Short Description   |
|--------------------------------|--|---|-------------------|------|-------------|--------------|------------------|---|
| Operator Training System (OTS) | Nigerian EPC for a Nigerian E&P Oil Company      | Multi-Purpose Dynamic Simulation for a Nigerian FPSO Rehabilitation                                   | Aspen HYSYS       | 2022 | Nigeria     | EPC          | Oil & Gas (FPSO) | The Multi-Purpose Dynamic Simulation project for this FPSO includes engineering studies, validation of operating procedures, ICSS and OEM configuration revision, operator training and operations support. This means 5 project stages covering the development of the dynamic model in Aspen HYSYS for engineering studies; a Process Trainer to develop and validate operating procedures; connection to the emulation of the control and safety system from Siemens PCS7; the development of the training scenarios and the instructor-devoted console; and the training of the operators |
| Operator Training System (OTS) | Norwegian office of a Singapore FPSO constructor | Implementation of the Safety System in the dynamic model of a Process Trainer for an FPSO             | Aspen HYSYS       | 2022 | Norway      | EPC          | Oil & Gas (FPSO) | During the development of the Process Trainer (early-OTS) in one of the stages of a Multi-Purpose Dynamic Simulator project, client requested to expand it including the Safety System in the simulation model, something that usually is not part of a Process Trainer   |
| Dynamic Simulation Study       | Dutch FPSO constructor                           | Dynamic Simulation Study for a Combined Cycle Power Plant   | UniSim Design     | 2022 | Netherlands | EPC          | Oil & Gas        | Dynamic simulation study for a combined cycle power plant to evaluate different scenarios: normal operation, start-up / ramp-up, and transient scenarios such as sudden gas turbine trip, mal-functions, pump trips, steam turbine trip, etc. With the objective of:<br>* Checking that the configuration of the process equipment and the control philosophy applied meets the functional requirements<br>* Confirming the adequacy of the control system  |
| Dynamic Simulation Study       | Spanish EPC for a Spanish pipeline operator      | Pressurization study of the initial pumping and final distribution installations of a subsea pipeline | Aspen HYSYS       | 2022 | Spain       | EPC          | Oil & Gas        | Dynamic simulation study to determine the process conditions reached during the pressurization of the two battery limits of the subsea line: the compressing station in one of the boundaries and the reception facilities at the other end   |
| Dynamic Simulation Study       | Spanish Petrochemicals Company                   | Operational enhancement of two distillation columns in a petrochemical process                        | Aspen HYSYS       | 2022 | Spain       | Operator     | Petrochem        | Using a dynamic simulation model built, adjusted and validated on-purpose, Inprocess helped this operating company to minimize loses of one key component, by the top of the column in the recovery plant. The model was also used to infer values of non-measured process variables, as well as to generate Advanced Process Control models.   |





## Inprocess References List: 2008-2023

| Project Type                   | Customer   | Project Title   | Process Simulator | Year | Country   | Company Type           | Industry  | Short Description  |
|--------------------------------|--|---|-------------------|------|-----------|------------------------|-----------|--|
| Steady State Simulation Study  | German producer of pure aromatic chemicals                                 | Expansion of an already developed steady state model  | Aspen HYSYS       | 2022 | Germany   | Operator               | Petrochem | After the satisfactory conclusions extracted from a previous project carried out developing a steady state with a reduced scope, client has requested to extend the original model, with additional plant sections, to execute complementary studies with new operating scenarios  |
| Dynamic Simulation Study       | Oil refinery in Spain  | Dynamic Simulation Study to determine the flare load during a power failure scenario for three refinery columns                                 | Aspen HYSYS       | 2022 | Spain     | Operator               | Refining  | As part of an ongoing flare revalidation study for the refinery, it has been decided to extend the scope, including three columns and its dynamic simulation model in order to precisely determine the load that they bring to the flare system in case of a power failure scenario  |
| Maintenance                    | Oil refineries in Argentina  | Multi-year maintenance contract for the four Inprocess' OTSs (3xFCC + CDU)  | Aspen HYSYS       | 2022 | Argentina | Operator               | Refining  | Client has entered into a multi-year maintenance program to receive support and software updates on the three custom-made OTSs for three of their FCC units, and on the generic one (CDU)  |
| Dynamic Simulation Study       | German Compressors Manufacturer for a Gas Operating Company in Middle East | Dynamic Simulation Study to determine the adequacy of the control and protection systems for a series of compressors in four offshore platforms | Aspen HYSYS       | 2022 | Germany   | Equipment Manufacturer | Oil & Gas | Confirmation by dynamic simulation (with the incorporation of the emulation of the CCC controller) of the adequacy of the: <ul style="list-style-type: none"> <li>• Anti-surge valve sizing</li> <li>• ESD valve requirements (if needed) this may be HOT or COLD Gas Bypass as required or selected by client</li> <li>• Confirm settle-out pressure and temperature of the system</li> <li>• Capacity Control Valve sizing</li> <li>• Recycle Line sizing</li> </ul> Additionally, the study did show: <ul style="list-style-type: none"> <li>• The pressure and temperature profile at various defined locations of the compression recycle loop.</li> <li>• Optimized tuning of anti-surge controller parameters and load sharing control</li> </ul> |
| Operator Training System (OTS) | American Oil Major for its Nigerian subsidiary                             | Upgrade of an existing OTS of a Syngas plant to the Inprocess Infrastructure Suite technology   | UniSim Design     | 2022 | USA       | Operator               | Refining  | As part of a larger project involving up to four OTSs, Inprocess moved an existing OTS of a Syngas plant, based on UniSim for Operations user interfaces to Inprocess Infrastructure Suite ones, maintaining the existing dynamic models in UniSim Design  |



## Inprocess References List: 2008-2023

| Project Type                            | Customer   | Project Title   | Process Simulator | Year | Country   | Company Type | Industry         | Short Description   |
|---|--|---|-------------------|------|-----------|--------------|------------------|---|
| Other Sales                             | Argentinian Fertilizers Producer                 | Development of Extended Training Content (Instructor Book)  |                   | 2022 | Argentina | Operator     | Bulk Chemicals   | The base scope considered in the execution of an OTS is the delivery of the simulator user manual for the instructor and a specific course for the use of the simulator also by the instructor. Both are intended to allow the instructor the most effective use possible, through an exhaustive knowledge of the capabilities and full functionalities of the simulator, as a tool to carry out the training and evaluation of operators. However, Inprocess develops as well when requested the Inprocess Instructor Book (IIB), an extended document that can allow the Instructor to have a deeper knowledge on the OTS solution instead of the general view provided by the manual on scope. |
| Operator Training System (OTS)          | Argentinian Fertilizers Producer                 | Development of Emulated OTSs for Ammonia and Urea plants  | Aspen HYSYS       | 2022 | Argentina | Operator     | Bulk Chemicals   | The client's fertilizers plant produces granular urea and natural-gas based ammonia. Inprocess has developed the OTS for these plants including its design, engineering, and testing of the Aspen HYSYS Dynamics models of the Ammonia and Urea sections and its associated control logic, and the configuration of the Instructor and Operator Stations, based on the emulation of the existing Schneider DCS  |
| DirectConnect OTS: Kongsberg-K-Chief700 | Norwegian Office of a Singapore FPSO constructor | Multi-Purpose Dynamic Simulator for an FPSO to be located in the Jubarte Field, North Campos Basin (Brazil) | Aspen HYSYS       | 2022 | Brazil    | EPC          | Oil & Gas (FPSO) | The Multi-Purpose Dynamic Simulator project will include the development of the dynamic model in Aspen HYSYS, validation of both operating procedures and ICSS (Kongsberg's K-Chief 700) application code, operator training and operations support. The MPDS supplied by Inprocess comprises the following phases: <ul style="list-style-type: none"> <li>• Phase I (Process Model Development and Dynamic Simulation Studies)</li> <li>• Phase II (Procedures Validation &amp; Early-Emulated OTS)</li> <li>• Phase III (Database Checkout)</li> <li>• Phase IV (OTS Direct-connect)</li> <li>• Phase V (Start-up Support)</li> </ul>   |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer                                | Project Title   | Process Simulator | Year | Country   | Company Type | Industry         | Short Description  |
|--|---|---|-------------------|------|-----------|--------------|------------------|--|
| Software Licenses                                | Argentinian Fertilizers Producer        | ITOP: Inprocess Generic OTS for Unit Operations   | Aspen HYSYS       | 2022 | Argentina | Operator     | Bulk Chemicals   | As part of the deployment of the emulated custom-made OTSs for the Ammonia and Urea plants, client wanted as well to acquire the Inprocess platform devoted to train operators on the functioning of the different equipment (unit operations) that they face in their day-to-day tasks  |
| Dynamic Simulation Study                         | Indian branch of an FPSO constructor    | Determination of the Process Safety Time by dynamic simulation of a HIPPS protecting a gas turbine in an FPSO | UniSim Design     | 2022 | India     | Operator     | Oil & Gas (FPSO) | Due to an inconsistency detected in the safety documentation, the FPSO operator requested to carry out a dynamic simulation study of the Process Safety Time of a HIPPS system protecting one of the gas turbines in order to find a permanent solution to the issue after having applied a temporary short-term action in the FPSO                    |
| Flow Assurance Analysis                          | Spanish EPC working for an Emirates NOC | Transient Analysis Condensate Pipeline Study for a Gas Development Project                                    | PIPELINE Studio   | 2022 | Spain     | EPC          | Oil & Gas        | Inprocess carried out the transient analysis of a pipeline (subsea condensate export line) in order to confirm that the maximum and minimum peak pressures, which are generated by a sudden variation of the fluid velocity, are within acceptable values. It was also requested to identify mitigation actions, in case they were deemed necessary    |
| Flow Assurance Analysis                          | Spanish EPC working for an Emirates NOC | Transient Analysis to evaluate pigging and surge handling capacity in oil&gas pipeline                        | OLGA              | 2022 | Spain     | EPC          | Oil & Gas        | Inprocess was requested to carry out an additional study to assess the feasibility of the operation of pipelines to be soon commissioned in terms of piggeability and surge handling capacities, evaluating different alternatives like pigging with motive gas and surge evaluation   |
| Dynamic Simulation Study for Compression Systems | Indian EPC working for a Saudi NOC      | Dynamic Simulation Study for Gas Compression Plants   | Aspen HYSYS       | 2022 | India     | EPC          | Oil & Gas        | With the overall objective of detecting potential operating problems, a dynamic simulation study was carried out for the different compression systems that were part of Gas Compression Plants (two-stages gas compressors (13 scenarios) , and propane refrigeration compressors (12 scenarios), as well as for the whole of the plant (6 scenarios) |

## Inprocess References List: 2008-2023

| Project Type  | Customer   | Project Title   | Process Simulator                | Year | Country | Company Type | Industry    | Short Description  |
|---|--|---|----------------------------------|------|---------|--------------|-------------|--|
| Dynamic Simulation Modelling Study; Flow Assurance Analysis | Indian EPC working for a Saudi NOC               | Dynamic Simulation Study for a Produced Water Injection Station (PWIS)                    | Synergi Pipeline Simulator (SPS) | 2022 | India   | EPC          | Oil & Gas   | Rigorous assessment of fast transient effects associated with water-column separation, vapor pockets formation and their subsequent collapse due to pump trips/valve closure to determine the effect of various predefined upset scenarios with the objectives to develop a control strategy that prevents or minimizes unnecessary pump trips or total shut-downs, ensures the system stability after an upset, and maximizes system throughput by ensuring stable and reliable operation   |
| Documentation   | Norwegian office of a Singapore FPSO Constructor | Training Program Development and Train the Trainer for the operators in an FPSO using OTS | Aspen HYSYS                      | 2022 | Norway  | EPC          | Oil & Gas   | The complexity of the production process that takes place in a FPSO and the high degree of specialization of the different job positions, makes it necessary to setup a training program based on the OTS supported by a team of instructor and OTS support engineers.<br>The training program and the team set up was performed in the following steps:<br>1. Develop the training program based on training material generated for the OTS and the training needs according to the group of instructors and/or operators' level of competency.<br>2. Train the trainers sessions<br>3. Operators training sessions |
| Dynamic Simulation Study for Compression Systems            | Spanish EPC for a Qatar gas company              | Dynamic Simulation Study for BOG compressors in LNG trains                                | Aspen HYSYS                      | 2022 | Spain   | EPC          | Natural Gas | The objective of this study was mainly to carry out a dynamic simulation study for the C3 BOG Compressors of the onshore facilities, in order to confirm that the anti-surge control system is correctly sized in capacity and fast enough to prevent surge during any of the analyzed transient scenarios.  |
| Operator Training System (OTS)                              | Singapore FPSO Constructor                       | Lifecycle Operator Training System for an FPSO located offshore Brazil                    | Aspen HYSYS                      | 2022 | Norway  | EPC          | Oil & Gas   | Multi-Purpose Dynamic Simulator (MPDS) or Lifecycle OTS for an FPSO that will be operating offshore the Brazilian coast. Besides using the MPDS to train the future operators of the control room in the FPSO, it will also be used to carry out dynamic simulation studies to validate the correct sizing of the equipment; to validate the initially drafted operating procedures; to virtually commission the ICSS database; to train the operators; and to support operations during wells and FPSO start-up   |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title   | Process Simulator              | Year | Country  | Company Type            | Industry       | Short Description  |
|--|---|---|--------------------------------|------|----------|-------------------------|----------------|--|
| Dynamic Simulation Modelling Study               | Spanish Petrochemical Company                                     | Estimation of process emissions based on real plant data  | Aspen HYSYS                    | 2022 | Spain    | Operator                | Petrochemicals | Dynamic Simulation of a plant section in order to estimate the Volatile Organic Compounds (VOC) emissions and compare those results with the values measured in the real plant. In this way, the dynamic model would be validated and it will be possible to use it in the future for such a purpose.  |
| Dynamic Simulation Study for Compression Systems | German Compressors Manufacturers for a Norwegian FPSO constructor | Dynamic Simulation Study for some compressors in an FPSO (CO <sub>2</sub> , Flash Gas and Export Gas) | Aspen HYSYS                    | 2022 | Germany  | EPC                     | Oil & Gas      | Development of dynamic simulation models to validate the systems design including motor, recycle valves sizing, response time and piping volumes, compressors anti-surge and performance control system.<br>The models shall be used to simulate the compressors train start-up including verification of motor horsepower and torque requirements (motor torque margin vs speed curve) for the start-up from settle-out conditions. |
| Flare Systems Analysis                           | Olefines plant of a Spanish refinery                              | Modelization and study of the olefins flare system  | Flarenet/ Aspen Flare Analyzer | 2022 | Spain    | Operator                | Petrochemicals | Steady State Flare System Analysis for an olefins plant that is part of a refinery complex in Spain. The project consisted in two phases, being the first one the revalidation of the PSVs, determining the discharge loads associated to everyone of the services; and the second one the revalidation of the flare network, considering all common contingencies, checking its hydraulic behavior                                  |
| ITOP   | Public Vocational Education Institutes in a Spanish state         | Licensing and implementation of ITOP in the public Vocational Education Institutes of Catalunya       | Aspen HYSYS                    | 2022 | Spain    | Educational Institution | Bulk Chemicals | Licensing and implementation of ITOP (the Inprocess Training Platform to educate operators and students in the functioning of the Unit Operations in the chemical and hydrocarbon processing industries) in the public Vocational Education Institutes of Catalunya  |
| Dynamic Simulation Modelling Study               | Spanish EPC working for a Mexican energy company                  | Dynamic Simulation Study for the turbines and compressors in two Combined Cycle Power Plants          | Aspen HYSYS                    | 2022 | Spain    | EPC                     | Power Plants   | Dynamic Simulation studies for the rotating equipment installed in two combined cycle power plant, in order to determine their correct sizing and their transient responses in front of unexpected operating incidents   |
| Training Courses for Operators                   | Colombian Oil Company   | Training Program on for Plant Operators on Unit Operations using ITOP                                 | Aspen HYSYS                    | 2022 | Colombia | Operator                | Refining       | After having acquired the ITOP license, the client requested as well the delivery of the associated training sessions to Inprocess. Along the last 2022 quarter, the Inprocess instructors have been lecturing unit operations topics, and have guided the simulation-based practical exercises of ITOP in the two refineries that client owns in the country  |

All information contained herein is confidential and may not be disclosed to a third party without the prior written consent of Inprocess Technology and Consulting Group, S.L.



## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title   | Process Simulator | Year | Country              | Company Type           | Industry  | Short Description   |
|--|---|---|-------------------|------|----------------------|------------------------|-----------|---|
| Dynamic Simulation Study for Compression Systems | Compressors Manufacturer for an EPC for a refinery operator               | Dynamic Simulation Study for the compressor in the H2 recycle line in a refinery hydrocracker                   | Aspen HYSYS       | 2022 | Czech Republic       | Equipment Manufacturer | Refining  | The compressor manufacturer contracted Inprocess to carry out a dynamic simulation study of a compressor in the hydrogen recycle line of a hydrocracker unit in a refinery. The study helped to evaluate the design of the equipment as well as identified potential operating problems   |
| Dynamic Simulation Study for Compression Systems | French compressors manufacturer for an Italian FPSO constructor in Brazil | Dynamic Simulation Study for the compressor in the processing facilities of an FPSO in Brazil                   | Aspen HYSYS       | 2022 | France               | Equipment Manufacturer | Oil & Gas | Dynamic Simulation Study to determine the necessity of a cooler in the antisurge circuit of a compressor in a FPSO. Along project phase I (Antisurge cooler validation) it was studied for how long the compressor can recirculate flow on its recirculation loop without reaching the compressor suction temperature trip settings. In project phase II a series of upset and operational scenarios (emergency shutdown, blocked inlet/outlet, start-up, etc.) to study the transient behavior of the compressor. The antisurge recycle cooler will be included or not depending on the results obtained in phase I. |
| HIPPS or other Depressurization                  | Spanish EPC working for a Middle East NOC                                 | Depressuring and MDMT Dynamic Study for the Onshore facilities of a new gas development project in Emirates     | Aspen HYSYS       | 2022 | United Arab Emirates | EPC                    | Oil & Gas | Inprocess to carried out the dynamic simulation studies for emergency depressurization and maintenance/manual depressurization; determined the minimum metal design temperature (MDMT) through an additional analysis and performed the Low Temperature study for the onshore facilities of this New Gas Development Project. BLOWDOWN Technology of Aspen HYSYS, based on Imperial College's developments, was selected as the modelling tool for these analysis.  |
| Flow Assurance Analysis                          | Spanish EPC working for a Middle East NOC                                 | Revision of alternatives for the sequential pigging with bypass plus detailed surge evaluation in floating mode | OLGA              | 2022 | United Arab Emirates | EPC                    | Oil & Gas | As a result of the comments from final client for the assessment of new Jump Over configuration of the facilities, and after clarification meeting held between the three parties, it is noted that some additional scenarios and modifications on existing OLGA models are required to properly address final client comments. Specifically:<br>- Sequential pigging with bypass: to maintain minimum 2 hours between each pig launching<br>- CDS inlet manifold modelling for detailed surge evaluation in floating mode  |

## Inprocess References List: 2008-2023

| Project Type                       | Customer                         | Project Title   | Process Simulator | Year | Country              | Company Type | Industry  | Short Description  |
|------------------------------------|----------------------------------|---|-------------------|------|----------------------|--------------|-----------|--|
| Online Application                 | Spanish Oil Company              | Artificial Intelligence Optimized Control for a Bolivian Gas Plant          | Aspen HYSYS       | 2022 | Bolivia              | Operator     | Oil & Gas | Our client is exploring the possibility of incorporating some Advanced Process Control to its gas processing plant (three trains) operating close to the producing field in Bolivia. The technology they are considering is an Artificial Intelligence brain based on Microsoft's Bonsai technology. In order to train such AI system, a dynamic simulation model has been considered a suitable source of simulated operating data. Inprocess did develop an OTS for this plant some years ago and the dynamic model inside that OTS has been periodically updated with all plant changes. Therefore, after some additional adaptations, this model will be used for this new objective   |
| Dynamic Simulation Modelling Study | FPSO Constructor                 | Engineering Studies (Depressurization) for an FPSO, located offshore Brazil | Aspen HYSYS       | 2022 | Brazil               | EPC          | Oil & Gas | The FPSO constructor requested Inprocess the execution of the FPSO Depressurization Study regarding production and gas lift risers through 1st Stage Separator and/or HP Flare KO Drum, in order to evaluate if the General Technical Description requirements are met. The Blowdown Utility in Aspen HYSYS was used for this transient analysis   |
| Dynamic Simulation Modelling Study | Emirates EPC for an Emirates NOC | Holistic Dynamic Simulation Study for an oil & gas field                    | Aspen HYSYS; OLGA | 2022 | United Arab Emirates | EPC          | Oil & Gas | The main objectives of the studies carried out with the Holistic Dynamic Simulation Model of the production facilities were: <ul style="list-style-type: none"> <li>• Verify that project facilities can operate in a stable and controlled manner in case of any spurious trip.</li> <li>• Verify operability and controllability of the compressors under steady state and transient conditions, and to recommend acceptable solutions where the control scheme or proposed methodology if found deficient or unsuitable.</li> <li>• Verify that control systems can ensure safe operation and equipment protection during major upset conditions such as feed reductions, trips, blocked compressor suction / discharge, parallel machine trips, etc.</li> <li>• Identify specific requirement to be included in the start-up and shutdown procedures.</li> <li>• Demonstrate the operation capacity of MP compressor and slug catcher control scheme, integrated with pipeline transient simulation model built in OLGA</li> </ul> |



## Inprocess References List: 2008-2023

| Project Type                       | Customer                                     | Project Title  | Process Simulator   | Year | Country | Company Type | Industry  | Short Description  |
|------------------------------------|--|--|---------------------|------|---------|--------------|-----------|--|
| Online Application                 | Norwegian Exploration and Production Company | Digital Twin for an oil & gas platform in the Norwegian North Sea    | OLGA; UniSim Design | 2022 | Norway  | Operator     | Oil & Gas | <p>The main objectives of the project were to deliver an out-of-the-box software platform to orchestrate different simulation models (UniSim / OLGA) in different modes (Steady State / Dynamics) and with Digital Twin functionalities (Monitoring and What-if) connected to different real-time databases (CDF, PI, etc.).</p> <p>The Inprocess Infrastructure Suite (IIS) software was considered the suitable tool to achieve such objectives and did have the following functionalities in this project:</p> <ul style="list-style-type: none"> <li>• Orchestration of multiples data flows and multiples models</li> <li>• Simulation Control / What-if Scenarios</li> <li>• Operation View and Control</li> <li>• Simulator Native HMI Access</li> <li>• Connecting with Cognite Data Fusion (CDF)</li> </ul>       |
| Dynamic Simulation Modelling Study | Dutch FPSO constructor                       | Dynamic Simulation Studies for an FPSO to be located offshore Brazil | UniSim Design       | 2022 | Brazil  | EPC          | Oil & Gas | <p>A dynamic Simulation study was performed in order to identify the dynamic behavior of individual process components and of the overall topside process &amp; utility systems for major scenarios such as normal operation, startup, shutdown, pressure packing &amp; depacking, and transient scenarios, such as sudden closure of ESDV, malfunctions, pump trips etc.</p> <p>The main design objectives of this dynamic simulation study were the following:</p> <ul style="list-style-type: none"> <li>• To demonstrate that the configuration of the process equipment and the control philosophy applied meets the functional requirements.</li> <li>• Confirm control and trip settings</li> <li>• Verify the start-up and shutdown procedures</li> <li>• Provide input to close relevant HAZOP actions</li> </ul> |

## Inprocess References List: 2008-2023

| Project Type                       | Customer               | Project Title  | Process Simulator                          | Year | Country | Company Type | Industry  | Short Description  |
|------------------------------------|------------------------|--|--|------|---------|--------------|-----------|--|
| Dynamic Simulation Modelling Study | FPSO Operator in Ghana | Simulation Studies for the installation of the 3rd HP compressor in an FPSO offshore Ghana | Aspen HYSYS                                | 2022 | Ghana   | Operator     | Oil & Gas | Client is interested in increasing the FPSO gas processing capacity. For that reason, it is interested in evaluating the possible installation of a 3rd train HP compression system, with higher flowrates to supplement associated gas processing and reduce process flaring. Inprocess was requested to provide the compressor analysis of the effect of the addition of the new 3rd HP compressor train. The results of this study will be the input to the Feasibility and Constructability study executed by the engineering company, which shall highlight any potential showstoppers focusing on technical debottlenecking in order to operate the 3rd HP compression system at a maximum flow of 130 MMSCFD.   |
| Flare Systems Analysis             | Spanish Refinery       | Modelization and Study of the acid flare system in the alkylation zone of the refinery     | Aspen HYSYS; Flarenet/Aspen Flare Analyzer | 2022 | Spain   | Operator     | Refining  | <p>The objective of this study was to verify the suitability of the Alkylation Flare System to absorb the discharges coming from the safety valves of the process units, indicating those modifications or relocations necessary to be able to absorb all the necessary discharges. Said analysis was carried out with the Aspen HYSYS® and Aspen Flare System Analyzer software.</p> <p>This study focuses specifically on the Alkylation flare system. With this study, it was intended to review the entire Alkylation flare system in order to adapt those elements that were not correctly designed. The scope of the study included: review of the design cases of the safety valves that discharge to this flare with redesign and definition of a new orifice where applicable; validation of PSVs discharge lines and validation of KO-Drums and main collectors. Within this scope, these three points must be specifically validated:</p> <ul style="list-style-type: none"> <li>• Vibration of the valve</li> <li>• Chattering of the valves</li> <li>• Accumulation of liquid in the relief system</li> </ul> |



## Inprocess References List: 2008-2023

| Project Type   | Customer         | Project Title  | Process Simulator                          | Year | Country | Company Type | Industry | Short Description   |
|--|------------------|--|--|------|---------|--------------|----------|---|
| Dynamic Simulation Modelling Study                         | Spanish Refinery | Dynamic Study of the refinery chilling water network | Aspen HYSYS                                | 2022 | Spain   | Operator     | Refining | <p>Inprocess provided its consulting services to carry out the hydraulic study, through dynamic simulation, by developing a model that allowed analyzing the hydraulic behavior of the cooling water network, with the objective to:</p> <ul style="list-style-type: none"> <li>• Have a dynamic model that allows knowing the current state of the cooling water network of one of the plants in the refinery.</li> <li>• Evaluate the cooling circuit with the implementation of a heat pump</li> <li>• Evaluation of optimization alternatives to the cooling network</li> <li>• Training of the Processes department in the use and modification of the dynamic model developed and delivered.</li> </ul>   |
| Dynamic Simulation Modelling Study; Flare Systems Analysis | Spanish Refinery | Dynamic Study of the refinery flare network          | Aspen HYSYS; Flarenet/Aspen Flare Analyzer | 2022 | Spain   | Operator     | Refining | <p>The main objective of the project was to carry out an Assessment of the current flare system for some new proposed installations in the refinery in order to confirm that the Flare system will not require substantial modifications, as a result of the new overall flare limiting case, with the addition of the incremental load of the new units to the current flare total power failure event.</p> <p>On this first project step, Inprocess will make a dynamic model of the currently units in operation: isomerization and reformat splitter. The relief loads obtained will be compared with the loads calculated in the existing steady state Flarenet model. It is expected to have lower loads in dynamic case. Dynamic case loads will be added to the existing steady state Flarenet model in which total power failure of the plant is considered.</p> |

## Inprocess References List: 2008-2023

| Project Type                       | Customer  | Project Title  | Process Simulator | Year | Country      | Company Type             | Industry  | Short Description  |
|------------------------------------|---|--|-------------------|------|--------------|--------------------------|-----------|--|
| Dynamic Simulation Modelling Study | Italian EPC for a Saudi NOC                               | Dynamic Simulation for the Compression System in an Arabian Oil & Gas field  | Aspen HYSYS       | 2022 | Saudi Arabia | EPC                      | Oil & Gas | <p>Final client intends to increase the oil production of an Oil &amp; Gas field from 250 MBCD to 500 MBCD by installing a new GOSP with Crude Stabilization Units. The incremental condensate and sour gas generated in the offshore plant is exported onshore utilizing the existing as well as a new pipeline, where a new pipeline to transport sour hydrocarbon condensates. The new facilities will require some additional compressors to be installed that require to be analyzed by dynamic simulation. Currently, the EPC has requested Inprocess to perform the dynamic simulation study for the compressors associated to the above production increase.</p> <p>The purpose of this dynamic simulation study was to perform a process simulation analysis focusing on the dynamic behavior of each compressor system during start-up, shutdown and pressure upset scenarios.</p> |
| Operator Training System (OTS)     | Instrumentation Provider for a Malaysian FPSO constructor | Development of a direct-connect OTS for an FPSO offshore Brazil (Mero field) | Aspen HYSYS       | 2022 | Brazil       | Instrumentation Provider | Oil & Gas | <p>Development of an OTS for an FPSO to be located in the Mero field, offshore Brazil. The system will be direct-connect using the software provided by Emerson in order to simulate the behavior of their DeltaV ICSS. The simulation of the processing facilities will be carried out with Aspen HYSYS Dynamics and Inprocess Infrastructure Suite will provide the Instructor capabilities of the tool, the data transmission among applications and the qualification of the students. A deep checkout of the ICSS database will be as well carried out as one of the phases of the OTS construction.</p>  |
| ITOP                               | Greek Refinery  | ITOP Furnace Module for Corinth Refinery                                     | UniSim Design     | 2022 | Greece       | Operator                 | Refining  | <p>Corinth Refinery complemented their current collection of twelve ITOP modules with the one representing the functioning of a fired heater (Furnace module). Through the hands-on exercises in this module the refinery operators will get a deeper understanding of the fundamental principles of this type of heaters.</p>   |



## Inprocess References List: 2008-2023

| Project Type                            | Customer   | Project Title  | Process Simulator | Year | Country    | Company Type | Industry       | Short Description   |
|---|--|--|-------------------|------|------------|--------------|----------------|---|
| Steady State Simulation Modelling Study | German Chemicals Company                           | Steady State Model to Evaluate Feedstock Changes                       | Aspen HYSYS       | 2022 | Germany    | Operator     | Bulk Chemicals | Foreseeing a future change in the feedstocks composition that the company processes (subproducts from coking plants) to produce benzene and derivatives, they have asked Inprocess to prepare a steady state model of their processing facilities to check what would be the implications of this changes in feedstocks.  |
| Dynamic Simulation Modelling Study      | Singapore FPSO Constructor                         | Detailed Depressuring Study for an FPSO offshore Brazil (Marlim field) | VMGSim/Simmetry   | 2022 | Brazil     | EPC          | Oil & Gas      | As a Variation Order for the main project (Lifecycle OTS), Inprocess was requested to perform a detailed depressurization analysis in dynamics for the GL Riser, using the Simmetry process simulator from Schlumberger. The study had to consider dynamic changes of composition and temperature at the HP Flare Cold header, taking into account the heat transfer phenomena. A sensitivity analysis was included on three options, modifying the key parameters and combining the effects of the different options.  |
| Operator Training System (OTS)          | Japanese FPSO constructor                          | Emulated OTS for an FPSO offshore Brazil                               | UniSim Design     | 2022 | Brazil     | EPC          | Oil & Gas      | Inprocess developed and commissioned an emulated OTS for a new FPSO to be placed in the Marlim field, offshore Brazil. The characteristic of an emulated solution is that it does not use an additional software component to simulate the behavior of the Distributed Control System. The control narrative and the simulation of the control loops are part of the dynamic process simulation model. A similar approach is followed with the Safety Instrumented System. This approach ensures that operators can be trained with the OTS independently of the delays in the delivery of the ICSS database. |
| Dynamic Simulation Modelling Study      | Italian EPC for a Kazakhstan Oil Operating Company | Dynamic Simulation Studies for KEP (Karachaganak Expansion Project)    | Aspen HYSYS       | 2022 | Kazakhstan | EPC          | Oil & Gas      | The EPC company requested Inprocess to carry out dynamic simulation studies for a gas condensates field in Kazakhstan. The study comprised an analysis of the re-injection compressor; a dynamic study of the PSVs protecting the slug-catcher section; and a controllability analysis of the overall plant. The original model was owned by the EPC company and has been enhanced by Inprocess in order to be able to carry out the requested analysis   |

## Inprocess References List: 2008-2023

| Project Type                       | Customer                                 | Project Title   | Process Simulator | Year | Country | Company Type | Industry  | Short Description  |
|------------------------------------|--|---|-------------------|------|---------|--------------|-----------|--|
| Dynamic Simulation Modelling Study | North American Liquid Pipelines Operator | Terminal Pump and Piping Configuration Study  | Aspen HYSYS       | 2022 | USA     | Operator     | Oil & Gas | Client wanted to ensure by dynamic simulation results that its ethylene system operated in an optimized way. Inprocess developed the dynamic model and carried out several hydraulic scenarios, for four possible process configurations, to identify bottlenecks and other possible constrains  |
| Flare Systems Analysis             | Italian EPC for a Libyan operator        | Study for the HP flare in an offshore platform in Libya                                   | Aspen HYSYS       | 2022 | Libya   | EPC          | Oil & Gas | The main objective of the project was to carry out an analysis to provide client with the expected P/T curve (with special focus on the minimum wall temperature) during depressurization scenario for three (3) depressurization areas of the HP Flare, and provide a benchmark for their current model and results.  |
| Online Application                 | Spanish Oil Company                      | Digital Twin for AI / ML  | Aspen HYSYS       | 2022 | Spain   | Operator     | Refining  | Inprocess developed a Digital Twin with the scope of training Artificial Intelligence (AI) and Machine Learning (ML) algorithms. The basis would be the dynamic simulation models that Inprocess developed for two propane splitter distillation columns of the ethylene cracker in a Spanish petrochemicals complex. Inprocess was in charge of adapting the models and generating valuable data with them. Client's engineering team was in charge of configuring and training the AI/ML models. |
| Online Application                 | Norwegian Oil Company                    | Digital Twin Development with a Chemical Advisory Tool (CAT) for an FPSO in the North Sea | UniSim Design     | 2022 | Norway  | Operator     | Oil & Gas | Development of a Digital Twin focused on chemical injection system using the results to feed a tool under client's development: CAT (Chemical Advisory Tool). An on-line digital Twin is able to provide additional key information derived from real-time instrumentation data and steady state / dynamic process models. For this project, Inprocess did take advantage of client knowledge in the North Sea platform and will reuse the simulation models already available.                    |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer                                | Project Title  | Process Simulator | Year | Country  | Company Type | Industry       | Short Description  |
|--|---|--|-------------------|------|----------|--------------|----------------|--|
| Dynamic Simulation Study for Compression Systems | Petrochemical French Company            | Analysis of the new propylene refrigeration compressor for the Vinyl Chloride Monomer (VCM) unit | Aspen HYSYS       | 2022 | France   | Operator     | Petrochemicals | <p>Analysis of the dynamic behavior of the New Propylene Refrigeration Compressor for various transient operations (Phase I).<br/>                     Dynamic model integration with the compressor controller emulator (ECT emulator) (Phase II). The integration will require the usage of the Inprocess Infrastructure Suite plus the Rockwell emulator software. The system allowed to fine-tune the real plant controller.<br/>                     Additionally, the dry gas seal system (Phase III) was modelled and analyzed to verify the margin of protection to leakage in the case of pressure disturbance in the seal gas circuit. The study of the dry seal gas system was focused on the shutdown and settle out conditions cases.</p> |
| Dynamic Simulation Modelling Study               | FPSO Constructor and Operator           | Migration of an existing OTS for a Brazilian FPSO  | UniSim Design     | 2021 | Oman     | EPC          | Oil & Gas      | <p>The scope of Inprocess involved the development of a dynamic simulation model to be used as a design evaluation and validation tool for the natural gas 48" pipeline. Later on, Inprocess will carry out the dynamic analysis for a set of pre-defined operating scenarios. The results obtained with the model will allow identifying potential problems both, in steady state conditions, when blending composition changes, and in transient conditions when either some of the consumers trip or some of the suppliers also do.</p>   |
| ITOP   | Technology Lab of a Spanish oil company | Simulation for synthetic fuels (e-fuels) production processes                                    | Aspen HYSYS       | 2021 | Colombia | Operator     | Refining       | <p>The Ecopetrol refinery sited in Barrancabermeja (Colombia) has selected ITOP (Inprocess Training for Operators) tool to train their plant operators in the functioning of the most common unit operations existing in a refinery. Exercises simulating the behavior of pumps, compressors, heat exchangers, distillation columns, etc. will support the learning path of the operators in a modern and rigorous environment</p>   |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer                      | Project Title  | Process Simulator | Year | Country | Company Type           | Industry       | Short Description  |
|--|-------------------------------|--|-------------------|------|---------|------------------------|----------------|--|
| Steady State Simulation Modelling Study          | Emirates Consulting Company   | Feasibility study and dynamic simulation of an MP compression system               | Aspen Plus        | 2021 | Italy   | EPC                    | Petrochemicals | As a continuation of a successfully previously executed project with Inprocess, the client has requested to enhance their current simulation models, involving from now on the proprietary high-octanes technologies around Etherification, Iso-Octene synthesis and related side reactions, and Butene-1 Recovery.<br>The enhanced steady state simulation models should allow client engineers and researchers to exploit further the commercial usage of their know-how.  |
| Dynamic Simulation Study for Compression Systems | FPSO Constructor and Operator | Determination of gas emissions during FPSO operation                               | Aspen HYSYS       | 2021 | Mexico  | Equipment Manufacturer | Oil & Gas      | Dynamic Simulation Studies to determine the correction of the designed protection systems against surge for a one-stage regeneration gas compressor  |
| Operator Training System (OTS)                   | FPSO Constructor and Operator | Sea Water Treatment and Water Injection System dynamic model for an FPSO in Brazil | Aspen HYSYS       | 2021 | Spain   | Operator               | Petrochemicals | After the execution of the Dynamic Simulation Study (DSS) of the Depropanizer Unit and, client has requested Inprocess to develop a Direct-Connect Operator Training System (OTS) for the C3 Splitter Units. The OTS proposed by Inprocess will allow familiarization and provide direct offline operator control, response and intervention experience for Production Department personnel and trainees in all non-frequent events, shutdown and emergency shutdown operations.<br>This project is the continuation of the previous projects of the Dynamic Simulation Studies of the Depropanizer and C3 Splitter Units and the Online Digital Twin of the Depropanizer. Client will take advantage of the evolution of these projects and will benefit from extraordinary conditions from licensing point of view and from service development point of view. |
| Operator Training System (OTS)                   | FPSO Constructor and Operator | Migration of an existing OTS for a Brazilian FPSO                                  | Aspen HYSYS       | 2021 | Brazil  | Operator               | Oil & Gas      | Migration of the current four direct-connect OTS that Inprocess has developed in the past for this FPSO client to current virtual environment in place in their corporate training center  |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer                                | Project Title  | Process Simulator | Year | Country              | Company Type          | Industry  | Short Description   |
|--|---|--|-------------------|------|----------------------|-----------------------|-----------|---|
| Steady State Simulation Modelling Study          | Technology Lab of a Spanish oil company | Simulation for synthetic fuels (e-fuels) production processes                      | Aspen Plus        | 2021 | Spain                | Operator              | Refining  | The steady state simulation model is intended to evaluate configurations and optimizations of this process at different client projects. Inprocess will identify potential problems in the operating envelope. In principle, the model will be developed based on public information available and considering not information from licensor will be available  |
| Dynamic Simulation Study for Compression Systems | Emirates Consulting Company             | Feasibility study and dynamic simulation of an MP compression system               | Aspen HYSYS       | 2021 | United Arab Emirates | Consulting & Services | Oil & Gas | The objective of the project is to carry out a feasibility study for the provision of the interconnecting lines between Phase-I/II and Phase-III MP Compressors at Suction and Discharge, as well as detailed engineering works. Through this project, Inprocess will analyze the demand of tripping the compressor upon additional load sharing due to integration.  |
| Dynamic Simulation Modelling Study               | FPSO Constructor and Operator           | Determination of gas emissions during FPSO operation                               | Aspen HYSYS       | 2021 | Malaysia             | Operator              | Oil & Gas | Dynamic Simulation Study to calculate and monitor the expected amounts of gas (and VOCs) that are lost (sent to flare) during FPSO tanks loading and offloading operations  |
| Dynamic Simulation Modelling Study               | FPSO Constructor and Operator           | Sea Water Treatment and Water Injection System dynamic model for an FPSO in Brazil | UniSim Design     | 2021 | Brazil               | Operator              | Oil & Gas | Inprocess will build a dynamic model for the Seawater treatment and water injection systems for an existing FPSO in Brazil. The purpose of this project is to allow the FPSO operator to obtain a dynamic simulation model ready to be connected to the ICSS system (SIMATIC PCS7) through SIMIT and taking advantage of the Inprocess Infrastructure Suite (IIS) software  |
| Dynamic Simulation Modelling Study               | FPSO Constructor and Operator           | OTS Models update and Non-Associated Gas (NAG) studies                             | Aspen HYSYS       | 2021 | Ghana                | Operator              | Oil & Gas | Existing simulation model in an OTS will be updated and used to determine the possible limitation in the major main process equipment: LP/MP/HP flash gas compressor, HP flash gas compressor common suction cooler, dehydration inlet scrubber, TEG contactor, TEG regeneration package and gas injection train. There is the intention to increase the topside gas injection capacity, therefore there are interest to determine the maximum injection rate without any major modification on the FPSO. |



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| Project Type                                     | Customer   | Project Title  | Process Simulator                           | Year | Country | Company Type             | Industry  | Short Description  |
|--|--|--|---|------|---------|--------------------------|-----------|--|
| Dynamic Simulation Study for Compression Systems | German office of a Swiss compressor manufacturer                 | Dynamic Simulation Study for a Refinery Reactor Effluent Compressor                    | Aspen HYSYS                                 | 2021 | Germany | Equipment Manufacturer   | Refining  | The main objective of the project was to use a dynamic model to obtain by simulation the results of performing a machine start-up, until the compressor's operating speed is reached (AntiSurge Valves completely open).                               |
| Hydrogen Network Study                           | Serbian Oil Refinery   | Feasibility study for a hydrogen network management tool                               | Aspen HYSYS                                 | 2021 | Serbia  | Operator                 | Refining  | Initial feasibility study of the hydrogen networks in the refinery for a potential optimization of the consumers, avoiding to waste hydrogen to the fuel network   |
| Operator Training System (OTS)                   | US Major Oil Company   | Operator Training Systems for a Gas To Liquids facility in Nigeria                     | UniSim Design                               | 2021 | Nigeria | Operator                 | Refining  | The operator of the facility owned already 3 OTSs that became obsolete. They asked Inprocess to update, in a phased approach, the existing ones (Syngas, Fischer-Tropsch and Product Work-Up) and to build a new one for the Air Separation Unit (ASU) |
| Flare Systems Analysis                           | Spanish Refinery Operator  | Flare study of the acid flare systems from conversion and refinery                     | Aspen HYSYS; Flarenet/ Aspen Flare Analyzer | 2021 | Spain   | Operator                 | Refining  | A study of the flare system that collects all discharge loads from the acid zones of the conversion and some refinery zones was carried out, revalidating the PSVs and the headers of the whole system   |
| Dynamic Simulation Modelling Study               | FPSO Operator in Ghana   | Dynamic Simulation Study to determine the gas emissions during FPSO common operations  | Aspen HYSYS                                 | 2021 | Ghana   | Operator                 | Oil & Gas | A dynamic simulation study was requested by the FPSO operator in order to evaluate how much gas was vented and flared due to common operation of the internal oil tanks  |
| Dynamic Simulation Modelling Study               | German Instrumentation provider for a Norwegian Oil&Gas operator | Update of current OTS with a newly developed DCS database                              | UniSim Design                               | 2021 | Norway  | Instrumentation Provider | Oil & Gas | The instrumentation provider, responsible for the DCS system in the platform did update the DCS with a new database configuration that was necessary to upload to the OTS that was previously built by Inprocess                                       |
| Dynamic Simulation Modelling Study               | FPSO building company  | Dynamic Simulation Study of the FPSO subsea lines to determine operational limitations | OLGA  | 2021 | USA     | EPC                      | Oil & Gas | More operability studies were carried out for the Houston-based office in charge of designing a new FPSO. The studies were necessary for the subsea lines that will connect the wells to the FPSO  |



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| Project Type                            | Customer   | Project Title  | Process Simulator                           | Year | Country     | Company Type | Industry       | Short Description  |
|---|--|--|---|------|-------------|--------------|----------------|--|
| Dynamic Simulation Modelling Study      | Dutch producing site of an Austrian petrochemicals company | Dynamic Simulation Studies to determine operating profiles of a propane dehydration plant            | Aspen HYSYS                                 | 2021 | Netherlands | Operator     | Petrochemicals | A Propane DeHydration plant works with two sources of propane, a conventional one, with propane from oil&gas and another one, with propane from biorefineries. The dynamic study will determine what percentage, depending on the operating conditions, of each source is being processed                  |
| Online Application                      | Norwegian Oil&Gas operator                                 | Online Process Digital Twin for an offshore platform   | UniSim Design                               | 2021 | Norway      | Operator     | Oil & Gas      | An online process Digital Twin will be built for an oil&gas operator in the North Sea to be used for equipment monitoring and process optimization   |
| Online application                      | Norwegian Oil&Gas operator                                 | Online Process Digital Twin for energy optimization in an offshore platform                          | UniSim Design                               | 2021 | Norway      | Operator     | Oil & Gas      | An online process Digital Twin and additional software applications will be built for an oil&gas operator in the North Sea to be used for energy optimization while operating the asset  |
| Flare Systems Analysis                  | Canadian operator of an oil sands field                    | Flare system analysis for one of the sections of the refinery  | Aspen HYSYS; Flarenet/ Aspen Flare Analyzer | 2021 | Canada      | Operator     | Refining       | After several studies to revalidate the flare systems of different sections of the refinery, the client requested an additional one for another plant zone. As always, valves and headers revalidation was carried out to determine the adequacy of current equipment                                      |
| Steady State Simulation Modelling Study | German refinery  | Process Modelling Support and Connectivity Tool  | Flarenet/ Aspen Flare Analyzer              | 2021 | Germany     | Operator     | Refining       | The refinery Inprocess is already involved with, carrying out a full flare system revalidation, requested onsite support to improve the steady state simulation models they already own. They have also requested a software tool capable of connecting those models                                       |
| Operator Training System (OTS)          | Spanish petrochemical operator                             | Improvement of current OTS with enhanced dynamic model, and re-defined KPIs for operators evaluation | Aspen HYSYS                                 | 2021 | Spain       | Operator     | Petrochemicals | After some plant modifications the dynamic simulation model of the Operator Training System required an actualization. On top of that, the OTS was improved by incorporating the calculation of certain operating Key Performance Indicators that will help to better qualify the operators being trained. |
| Steady State Simulation Modelling Study | Italian EPC  | Steady State modelling support for a complex refinery distillation column                            | Aspen HYSYS                                 | 2021 | Italy       | EPC          | Refining       | Inprocess supported the EPC engineers in the definition of complex property packages required for the correct steady state process simulation of refinery columns  |
| Dynamic Simulation Modelling Study      | German refinery  | Dynamics modelling support for a complex refinery distillation column                                | Aspen HYSYS                                 | 2021 | Germany     | Operator     | Refining       | An on-site Inprocess engineer carried out some dynamic simulation studies for the columns in the refinery in order to detect some operating bottlenecks  |

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## Inprocess References List: 2008-2023

| Project Type                                     | Customer   | Project Title   | Process Simulator | Year | Country  | Company Type             | Industry       | Short Description  |
|--|--|---|-------------------|------|----------|--------------------------|----------------|--|
| Dynamic Simulation Study for Compression Systems | Malaysian FPSO constructor and operator                | Dynamic Simulation Study for the Export Gas compressors of an offshore facility             | Aspen HYSYS       | 2021 | Malaysia | EPC                      | Oil & Gas      | Analysis by dynamic simulation of the behavior and the required protection systems of the export gas compressor, that is part of an FPSO located offshore Malaysia   |
| Online application                               | Swedish site of an Austrian petrochemicals company     | Support for the development of an Offline Digital Twin as demonstration of IIS capabilities | UniSim Design     | 2021 | Sweden   | Operator                 | Petrochemicals | Client will create the Honeywell Unisim Design (USD) models for the Demo, including two (2) loop reactors in two (2) separate flowsheets. Then, these models will be handed over to Inprocess. The mapping between model variables and I/O tags will be a joint effort between Inprocess and client. The main objective of the Demo is to demonstrate the capabilities of IIS in terms of the following:<br>1. Communication among different flowsheets (two or more)<br>2. Graphics interface (static / dynamic graphic, faceplates, trending, etc....)<br>3. To gain insight in the IIS tool.                                    |
| Flare Systems Analysis                           | German refinery (British owner)                        | Pressure Relief Valves Revalidation Project of a German refinery                            | Salus             | 2021 | Germany  | Operator                 | Refining       | A German refinery, in order to bring the site to comply with corporate internal safety standards and procedures, needed to carry out the revalidation of 1404 of its Pressure Relief Valves (PRV) and, as a consequence, ensure the site had a sustainable way to manage the PRVs life cycle and ensure as well that the disposal systems are adequate in their design. The project scope included the major process PRVs but excluded vents and thermal expansion PRVs. As per client specific request, the revalidation project needed to be carried out with SALUS, a software developed and commercialized by Smith & Burgess. |
| Dynamic Simulation Study for Compression Systems | German Compressors Manufacturer for a Turkish Operator | Dynamic Simulation Study for the compressors in an underground gas storage project          | Aspen HYSYS       | 2021 | Turkey   | Instrumentation Provider | Natural Gas    | The manufacturer has requested Inprocess to perform a Dynamic Simulation Study for Kuzey Marmara Underground Gas Storage Project. Inprocess will build a model for the system by identifying and collecting the process data required to build the dynamic simulation involved in this project. With that simulation model, Inprocess will carry out the dynamic analysis for a set of operating scenarios, corresponding to the start-up and the shutdown at different conditions   |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title  | Process Simulator | Year | Country | Company Type           | Industry                       | Short Description  |
|--|---|--|-------------------|------|---------|------------------------|--------------------------------|--|
| Dynamic Simulation Study for Compression Systems | German Compressor Manufacturer for a Qatar oil company      | DSS for Gas Turbo Compressors for an upstream field                    | Aspen HYSYS       | 2021 | Qatar   | Equipment Manufacturer | Oil & Gas                      | Inprocess delivered a dynamic simulation study in order to analyze the dynamic behaviour of a 3-stage compressor driven by a gas turbine with speed variation for various transient operations. The simulation scenarios evaluated the adequacy of the antisurge valve sizing, the ESD valve requirements, this may be hot or cold gas as needed as well as the confirmation settle-out conditions of the system.  |
| Dynamic Simulation Study for Compression Systems | German Compressor Manufacturer (US Office)                  | Dynamic Simulation Study for the treatment compressors in an oil field | Aspen HYSYS       | 2021 | Iraq    | Equipment Manufacturer | Oil & Gas                      | Inprocess developed a dynamic simulation model in Aspen HYSYS of the compression system with the objective of determining its adequacy and the need for any additional protection system that might be required. Therefore, Inprocess analyzed the adequacy of the anti-surge valve size and its timing to avoid surge during the compressor shutdown; we evaluated the requirements of a hot/cold gas bypass valve; we confirmed the settle-out conditions of the system; we demonstrated the effectiveness of the control system in different scenarios such as variation of the feed gas pressure, turndown or blocked outlet; we performed the compressor system start-up to validate the start-up procedure, confirm the process control performance, verify the trip settings and identify possible limitations. |
| Steady State Simulation Modelling Study          | Japanese Multinational Petrochemical company (Spanish site) | Steady State Model development of the triple effect evaporator         | Aspen HYSYS       | 2021 | Spain   | Operator               | Petrochemicals; Bulk Chemicals | Inprocess helped the client in the development of a steady state simulation model of the triple effect evaporator system to be used by client to improve the understanding of the process, its constraints and interactions, in order to improve the current and future operation of the triple effect columns.<br><br>The project was carried out in three phases: a) To study the historical data of the plant during one-year and looking for issues or bad operations; b) To build a steady state model of the plant, the model was calibrated to a representative day; c) To analyse with the model a number of operational scenarios   |



## Inprocess References List: 2008-2023

| Project Type                   | Customer  | Project Title  | Process Simulator | Year | Country              | Company Type             | Industry       | Short Description   |
|--------------------------------|---|--|-------------------|------|----------------------|--------------------------|----------------|---|
| Operator Training System (OTS) | German Instrumentation Provider for a French Oil&Gas Operator   | Connection of an Operator Training System to the plant Historian database  | UniSim Design     | 2021 | Denmark              | Instrumentation Provider | Oil & Gas      | Inprocess will adapt its Historian_Link application to the needs of this client, operator of an FPSO in the Danish sector of the North Sea, who wants to connect the OTS that Inprocess is currently developing for them with the historian database in a way that it is possible to upload operating conditions recorded in the historian and use them as initial conditions for an OTS exercise   |
| Operator Training System (OTS) | US Chemicals Company  | Development of a direct-connect OTS for a steam-reformer hydrogen producing plant  | Aspen HYSYS       | 2021 | USA                  | Operator                 | Fine Chemicals | <p>Inprocess has developed an Operator Training Simulator (OTS) for a hydrogen producing plant located in the USA.</p> <p>This hydrogen plant is part of the production plant that meets the growing, global demand for high-quality chemical compounds.</p> <p>Inprocess project comprises the design, engineering, delivery, testing and installation of the OTS, as well as training scenarios and project management. For the execution of this project, Inprocess has been using Aspen HYSYS® Dynamics as the process simulation engine, Emerson's SimulatePro as the DCS emulation package, and Inprocess Infrastructure Suite (IIS) to provide all the required data connectivity and instructor functionalities.</p> <p>This Direct-Connect OTS by Inprocess utilizes a high-fidelity dynamic model of the process, including the following plant areas: Natural Gas Preparation, Catalytic Reformation furnace, Catalytic Shift conversion, PSA, Vent Gas Recovery, Waste Heat Recovery/Steam Generation, and Water Treatment.</p> |
| Operator Training System (OTS) | Implementation Services Provider for a UAE National Oil Company | Operator Training Simulators for four processing facilities (and their associated utilities) in four Emirates oil&gas fields | Aspen HYSYS       | 2021 | United Arab Emirates | Consulting & Services    | Oil & Gas      | <p>Inprocess is in charge of developing the emulated OTS that will comprise the processing facilities and their associated utilities of four United Emirates.</p> <p>The Operator Training Simulator OTS will be developed for the main process units in the four plants as well as their associated Utilities. The scope for this project includes the complete delivery and commissioning of the OTS including design, development, engineering, configuration, training, and commissioning activity for this emulated ABB 800xA</p>  |

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| Project Type                            | Customer                               | Project Title   | Process Simulator | Year | Country | Company Type | Industry       | Short Description  |
|---|--|---|-------------------|------|---------|--------------|----------------|--|
| Dynamic Simulation Modelling Study      | FPSO Operator in a WestAfrican field   | Simulation for new throttle valve upstream High Pressure Fuel Gas Compressors                 | Aspen HYSYS       | 2021 | Ghana   | Operator     | Oil & Gas      | Taking advantage of the dynamic simulation model developed for the OTS currently in use in the FPSO, our client requested us to carry out additional operability analysis of the throttle valve located upstream of the compressors in the high-pressure fuel gas system.  |
| Steady State Simulation Modelling Study | German Refinery Operator               | In-House Technical Support during the development and usage of the refinery unit SS model     | Aspen HYSYS       | 2021 | Germany | Operator     | Refining       | A German refinery operator requested one of the Inprocess engineers to work on-site to provide Technical Support to the refinery engineers during the development of the Steady State model of the refinery unit and as well to monitor its usage and the benefits obtained from it.   |
| Flare Systems Analysis                  | Belgian Refinery                       | Dynamic Simulation Study to revalidate the NC3 valves in the refinery                         | Aspen HYSYS       | 2021 | Belgium | Operator     | Refining       | Revalidation by dynamic simulation of some of the valves in this Belgian refinery  |
| Dynamic Simulation Modelling Study      | Japanese FPSO constructor (USA office) | Dynamic Simulation Studies for the FPSO subsea lines  | OLGA              | 2021 | USA     | EPC          | Oil & Gas      | Dynamic Simulation Study to analyze the operational behaviour of the subsea lines that connect the many wellheads with the FPSO  |
| Dynamic Simulation Modelling Study      | Italian EPC                            | Dynamic Simulation Study for a Steam & Power Generation System in an Ammonia and Urea complex | Aspen HYSYS       | 2021 | Qatar   | EPC          | Bulk Chemicals | The simulation project main purpose was to deliver to the EPC the results of the dynamic simulation studies in order to evaluate (with the new data, after an improvement study to optimize the operating modes and to increase the NH3 and Urea production) the response of the system and the suitability of the protective controls and devices currently installed in the Steam & Power System.<br>To validate the planned strategy, it was considered necessary to carry out operating tests using an already existing dynamic simulation model for both Steam and CO2 Networks, after updating and improving it, before carrying out the necessary series of simulation scenarios. |
| Operator Training System (OTS)          | Brazilian Chemical Company             | Training Simulator for the chlorine processing system in a VCM complex                        | Aspen HYSYS       | 2021 | Brazil  | Operator     | Bulk chemicals | Inprocess entered into a framework agreement with client to develop a series of training tools based on dynamic simulations (OTS). The initial project has been to develop an OTS for the chlorine processing system in the VCM plant  |



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| Project Type                                     | Customer  | Project Title  | Process Simulator | Year | Country              | Company Type           | Industry       | Short Description   |
|--|---|--|-------------------|------|----------------------|------------------------|----------------|---|
| Online Application                               | PDH plant in the Spanish site of a German chemicals company       | Online Digital Twin for the depropanizer unit in the PDH plant                 | Aspen HYSYS       | 2021 | Spain                | Operator               | Petrochemicals | Inprocess has developed a Digital Twin (rigorous dynamic simulation model) of two units of the PDH complex (depropanizer and C3 splitter) and has connected it online with the instrumentation database. The DT will then serve to monitor equipment performance and to run what-if studies   |
| Technical Support & Consultancy                  | Process Licensor  | Migration of an existing Inprocess OTS to a new client's online platform       | VMGSim            | 2021 | Denmark              | Process Licensor       | Bulk chemicals | Client decided to change the online platform where the existing OTS that was delivered by Inprocess was being hosted. Client requested technical support to facilitate the migration project from the old platform to the new one   |
| Dynamic Simulation Study for Compression Systems | Swiss Compressor Manufacturer for a Japanese FPSO constructor     | Dynamic Simulation Study for six compressors trains in a FPSO offshore Senegal | Aspen HYSYS       | 2021 | Senegal              | Equipment Manufacturer | Oil & Gas      | Under the contract with the FPSO constructor, client will deliver six centrifugal compressor trains: one low pressure (LP), three medium pressure (MP) and two high pressure (HP), which are all driven by fixed speed electric motors. The whole application will have the following capacities for each compression system: <ul style="list-style-type: none"> <li>• LP - One Train with 100% capacity</li> <li>• MP - Three trains with 50% capacity each</li> <li>• HP - Two trains with 100% capacity each.</li> </ul> Client has requested Inprocess to carry out a Dynamic Simulation Study for all these FPSO Compressors |
| Dynamic Simulation Study for Compression Systems | Abu Dhabi office of an Egyptian EPC working for a Middle East NOC | Dynamic Simulation Study for Off Gas Compressor at an Offshore Gas Plant       | Aspen HYSYS       | 2021 | United Arab Emirates | EPC                    | Natural Gas    | The existing Export Gas Compressor in the offshore gas plant, is expected to become a bottleneck beyond year 2021 to handle the forecasted export gas profile. During a FEED study, it was proposed to augment the export gas handling capacity by operating Amine Bypass Unit Compressor in 'export mode' permanently in parallel with the Export Gas Compressor and to install a new Off Gas Compressor to handle low pressure gas. The detailed dynamic simulation study needed to determine the adequacy of the proposed arrangement  |



## Inprocess References List: 2008-2023

| Project Type  | Customer                                   | Project Title  | Process Simulator | Year | Country              | Company Type | Industry       | Short Description   |
|---|--|--|-------------------|------|----------------------|--------------|----------------|---|
| HIPPS or other Depressurization                       | Emirates EPC for an Emirates NOC           | De-Pressurisation, MMDT and Hydrate study for the 85 MBD Wellhead Towers | OLGA              | 2020 | United Arab Emirates | EPC          | Oil & Gas      | After deciding to increase production in an Emirates field to 85 MSTBOPD of crude oil, the depressurization, MDMT and hydrates formation study already carried out by Inprocess in 2015 needed to be updated with the new production levels and compositions performing simulated topside depressurizations for all WHT and pipelines determining the minimum temperature achieved and determining if selected metals are valid and if hydrates will be formed  |
| Operator Training System (OTS)                        | Japanese FPSO constructor (Mexican office) | Lifecycle OTS for an FPSO to be located in the Gulf of Mexico            | UniSim Design     | 2020 | Mexico               | EPC          | Oil & Gas      | Development and commissioning of a Lifecycle OTS whose main purpose will be to train the control room operators of an FPSO located in the Gulf of Mexico. On top of that, because this OTS is going to be built following Inprocess' Lifecycle approach: <ul style="list-style-type: none"> <li>• Client's engineers will benefit from the results obtained with the dynamic simulation model (built in Honeywell's UniSim Design) during the design phase of the FPSO's topsides,</li> <li>• The proposed operating procedures will be validated and tested in a preliminary Process Trainer (emulated OTS),</li> <li>• The configuration of the Integrated Control and Safeguarding System (ICSS) provided by ABB will be checked out in a virtual FAT (against the results of the process simulation model),</li> <li>• The control room operators will be deeply trained well before first oil in the risk-free environment provided by the direct-connect OTS,</li> <li>• Client's Operations team will be supported during the start-up of the FPSO by the Inprocess' engineers which would have gained extensive process, control, and procedures knowledge during the development of the OTS</li> </ul> |
| Dynamic Simulation Study for Process Control Analysis | German Chemical Company (Spanish site)     | Dynamic Simulation Study for a C3 Splitter Unit                          | Aspen HYSYS       | 2020 | Spain                | Operator     | Petrochemicals | Development of a dynamic simulation model of a C3 splitter in a PDH plant in order to improve the understanding of the process, controls, constraints and interactions, in order to improve the current and future operation of the unit (e.g. hydraulic conditions and flooding limits, optimal sensitive tray, etc.)  |



## Inprocess References List: 2008-2023

| Project Type   | Customer                                       | Project Title  | Process Simulator | Year | Country   | Company Type           | Industry    | Short Description  |
|--|--|--|-------------------|------|-----------|------------------------|-------------|--|
| Dynamic Simulation Study for Compression Systems                                     | Swiss Compressors Manufacturer (German Office) | Dynamic Simulation Study for the revamping of an existing compression system | Aspen HYSYS       | 2020 | Germany   | Equipment Manufacturer | Refining    | Dynamic Simulation Study to determine the revamp possibilities of a compression system that included as driver a fix-speed electrical motor, a speed increasing gear box and one-barrel compressor, type RV 35-4. For future operation the barrel compressor will be revamped and E-motor and gear box will be reused  |
| Dynamic Simulation Study for Compression Systems                                     | Swiss Compressors Manufacturer (German Office) | Feasibility Study for Propylene Compressor                                   | Aspen HYSYS       | 2020 | Germany   | Equipment Manufacturer | Natural Gas | Feasibility study by dynamic simulation to determine the adequacy of a 4-stage propylene compressor evaluating any driver limitation during the start-up of the compression system   |
| Dynamic Simulation Study for Compression Systems; Software Extension and Programming | German Compressors Manufacturer                | MRC Simulation Model and Application   | UniSim Design     | 2020 | Germany   | Equipment Manufacturer | Natural Gas | Project to evaluate by dynamic simulation the Start-up of the Refrigeration Compressor in the Mixed Refrigerant Cycle system. Additionally, Inprocess developed a software application that facilitated Atlas Copco's engineers to interface with the Dynamic Simulation model, allowing changing key selected data of the models and perform sensitivity analyses of the different predefined configurations. The application had a library of different possible compressor configurations with the capability of expand it by users when required.  |
| Operator Training System (OTS)   | Singapore FPSO Constructor                     | Lifecycle OTS for an FPSO located in a Brazilian field                       | Aspen HYSYS       | 2020 | Singapore | EPC                    | Oil & Gas   | Development of a Lifecycle Operator Training Simulator (LC-OTS) for a Floating Production Storage and Offloading (FPSO) platform, which will be deployed offshore Brazil.<br>Although the LC-OTS's main purpose is to train the control room operators on a direct-connect OTS, the FPSO operator, like it has done before with other LC-OTS with Inprocess, will benefit from a wider scope during the engineering phases including:<br>* Dynamic Simulation studies, operating procedures validation.<br>* Early operators and engineers training with an Early-Emulated OTS.<br>* Virtual commissioning of the ICSS configuration.<br>* Processing facilities start-up support.<br>* Post start-up support with the resulting Digital Twin. |



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| Project Type  | Customer                               | Project Title  | Process Simulator                          | Year | Country    | Company Type            | Industry    | Short Description  |
|---|--|--|--|------|------------|-------------------------|-------------|--|
| Dynamic Simulation Modelling Study                    | FPSO Constructor                       | Engineering Studies for Operations Support for an FPSO                           | Aspen HYSYS                                | 2020 | Norway     | EPC                     | Oil & Gas   | Inprocess has performed a complete dynamic model for the FPSO topside facility. This dynamic model has been planned to be used for some initial verification of the process unit during the initial phase of the production start of the plant. Up to fifteen different upset production scenarios have been tested in this project  |
| HIPPS or other Depressurization                       | Italian EPC                            | Depressurization for a Domestic Gas Unit in Mozambique                           | Aspen HYSYS                                | 2020 | Mozambique | EPC                     | Natural Gas | Depressurization calculations using dynamic simulation to accurately determine the Minimum Design Metal Temperature (MDMT) in a small domestic gas unit that is dedicated to produce a stream of treated gas to be sent to local distribution grid   |
| Flare Systems Analysis                                | Spanish Refinery                       | Study and Modelization of the system to discharge to flare of a refinery section | Aspen HYSYS; Flarenet/Aspen Flare Analyzer | 2020 | Spain      | Operator                | Refining    | Two-phase Flare System Revalidation project where the PSVs of a plant section, associated to several services will be revalidated by simulation results for different possible operating contingencies. In the second project phase, the complete flare network will also be revalidated with the new loads calculated during the PSV revalidation phase                         |
| Dynamic Simulation Study for Process Control Analysis | French E&P Company                     | Process Control Dynamic Simulation Study for 1st Stage Separator                 | Aspen HYSYS                                | 2020 | France     | Operator                | Oil & Gas   | Client was interested in developing a methodology to operate the liquid side of the 1st stage separator (having a slug catcher functionality) and improving the process control philosophy and the PID parameters of the 1st stage separator. Such a controllability study was carried out with the help of a dynamic simulation model of the system and the subsequent analysis |
| Operator Training System (OTS)                        | Oil & Gas Training Institution in Iraq | Generic OTSs for up to nine units in an upstream processing plant                | UniSim Design                              | 2020 | Iraq       | Educational Institution | Oil & Gas   | Collection of nine Generic OTSs for upstream units intended to train the students of an Iraq educational institution in the operation of an Oil Gas Separation Unit, a Gas Compression Unit, a Gas Sweetening with Amines unit, a Dehydration Unit with glycol, an NGL Unit, an LNG Unit, an LPG Unit, an Energy Unit and a Treatment Unit                                       |
| Operator Training System (OTS)                        | Spanish E&P Company                    | Update of the existing OTS simulation model with new equipment                   | Aspen HYSYS                                | 2020 | Bolivia    | Operator                | Oil & Gas   | Update of an OTS developed by Inprocess to the new version of the DCS (Emerson DeltaV). Additionally, the dynamic model was also updated with the inclusion of a new booster compressor, a new gas turbine and the associated filters  |

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|---|--|---|-------------------|------|--------------|------------------------|----------------|---|
| Flow Assurance Analysis                               | Multinational EPC for a Middle East NOC            | Flow Assurance Analysis for an increase in production in a Middle East field                | OLGA              | 2020 | Saudi Arabia | EPC                    | Oil & Gas      | Planning for a platform production capacity increase, a flow assurance (steady state and transient) was required by the operating company in order to ensure current equipment was capable to cope with the increase. After receiving a existing pipelines simulation models in SPS and OLGA, Inprocess did update them with newer information. With the updated models, Inprocess executed different simulation scenarios (SPS for Steady State, OLGA for Transient) in order to obtain results to confirm the project objectives. |
| Dynamic Simulation Study for Process Control Analysis | Spanish branch of a multinational chemical company | Dynamic Simulation Study for the controllability and debottlenecking of a Depropanizer Unit | Aspen HYSYS       | 2020 | Spain        | Operator               | Petrochemicals | Inprocess was requested to develop a dynamic simulation model of a depropanizer column, part of a PDH plant, in order to help to solve client's current issues with the multivariable process controller in operation and to support client's plan to increase production the following year. Once the rigorous model will be ready, it will also be used to infer the values of certain process variables that are difficult (if not, impossible) to measure in the real plant   |
| Dynamic Simulation Modelling Study                    | Omani EPC for a Middle East Gas company            | Phase 2 of the Dynamic Simulation Study for the debottlenecking of a gas grid               | UniSim Design     | 2020 | Oman         | EPC                    | Natural Gas    | The project main objective is to build a dynamic simulation model for the rich and lean gas segregation pipelines in the country national gas grid. The results obtained for a series of scenarios, carried out with the model will allow identifying potential problems both, in steady state conditions, when blending composition changes (up to six cases), and in transient conditions when either some of the consumers trip or some of the suppliers also do.  |
| Dynamic Simulation Modelling Study                    | Italian EPC  | Dynamic Simulation Study for a series of Boil-Off Gas Compressors in an African LNG plant   | Aspen HYSYS       | 2020 | Mozambique   | EPC                    | Natural Gas    | Dynamic Simulation Study (DSS) for a BOG compression system in order to analyse different operating scenarios and upset cases and considering all the piping, controls and equipment handling BOG in the abovementioned plant.  |
| Dynamic Simulation Study for Compression Systems      | Swiss Compressors Manufacturer                     | Dynamic Simulation Study for Ethylene Refrigeration Compressor (ERC)                        | Aspen HYSYS       | 2020 | Germany      | Equipment Manufacturer | Petrochemicals | Dynamic Simulation Study of an Ethylene Refrigeration Compressor, for only one initial condition, to evaluate if the acceleration phase during the start-up to identify driver limitation or requirement based on the calculated load curve and if the compressor behaviour in the compressor map when the system accelerates   |

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| Project Type                       | Customer  | Project Title  | Process Simulator                 | Year | Country   | Company Type           | Industry       | Short Description  |
|------------------------------------|---|--|-----------------------------------|------|-----------|------------------------|----------------|--|
| Operator Training System (OTS)     | Major FPSO constructing and operating company   | Lifecycle Operator Training Simulator for Almirante Barroso (MV32) FPSO  | UniSim Design                     | 2020 | Singapore | EPC                    | Oil & Gas      | Development of the Lifecycle Operator Training Simulator (LC-OTS) for a Floating Production Storage and Offloading (FPSO) platform, which will be installed offshore Brazil. This LC-OTS will be installed in the same training center in Rio where Inprocess is already deploying LC-OTS for other two FPSOs.<br><br>Although the LC-OTS's main purpose is to train the control room operators on a direct-connect OTS, client will benefit from a wider-scope during the engineering work including: Flare system validation, operating procedures drafting, early operators and engineers training with an emulated OTS, virtual commissioning of the ICSS configuration, start-up and post start-up support. |
| Flare Systems Analysis             | Spanish Oil Major (petrochemicals branch)       | Flare system revalidation study for the butadiene plant                  | Aspen HYSYS; Aspen Flare Analyzer | 2020 | Spain     | Operator               | Petrochemicals | Revalidation study for the flare system of a butadiene plant, comprising the resizing of a number of safety valves, together with the revalidation of the flare network, by steady state simulation  |
| Flow Assurance Analysis            | Norwegian EPC for a Norwegian Oil & Gas Company | Dynamic Process Simulation of a North Sea installation Oil Export System | OLGA                              | 2020 | Norway    | Operator               | Oil & Gas      | Dynamic hydraulic study for an oil export pipeline. The possibility of wax deposition along the line was also investigated   |
| Dynamic Simulation Modelling Study | Compressors Manufacturer                        | Dynamic Simulation Study for a Turboexpander                             | Aspen HYSYS                       | 2020 | USA       | Equipment Manufacturer | Oil & Gas      | Dynamic Simulation Study to determine the correct setup of the turbo expander machinery, its process control and its protection system   |
| HIPPS or other Depressurization    | Italian EPC for an FPSO constructor             | HIPPS Study for an FPSO in Angola coast                                  | Aspen HYSYS                       | 2020 | Angola    | EPC                    | Oil & Gas      | Dynamic Simulation Study for a HIPPS protection system in order to determine the setpoint of operation   |
| Flow Assurance Analysis            | Portuguese EPC                                  | Slug and Pigging Analysis for a Libyan O&G field                         | OLGA                              | 2020 | Libya     | EPC                    | Oil & Gas      | Flow Assurance study for two pipelines and two different scenarios for each one  |
| Dynamic Simulation Modelling Study | FPSO Constructor                                | Dynamic Simulation Model of a FPSO                                       | Aspen HYSYS                       | 2020 | Norway    | EPC                    | Oil & Gas      | Planning for a future Operator Training System to be developed following the concept of Lifecycle Simulator, Inprocess' client requested to start separately the dynamic simulation studies around the equipment to be installed in the processing facilities of an FPSO   |

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| Project Type                                     | Customer                                     | Project Title  | Process Simulator | Year | Country | Company Type           | Industry       | Short Description  |
|--|--|--|-------------------|------|---------|------------------------|----------------|--|
| Steady State Simulation Modelling Study          | Austrian Petrochemical Company, Swedish site | Steady State Modelling of a C3 splitter and de-ethanizer distillation columns in a cracker plant | Aspen HYSYS       | 2019 | Sweden  | Operator               | Petrochemicals | A cracker plant was having trouble when operating the propane/propylene splitter distillation column. Inprocess oversaw building the steady state simulation model and running a Sensitivity Analysis in order to evaluate the options to limit propylene losses in the bottom stream and to analyse how MAPD can be limited to the maximum allowable concentration in the column with the current instrumentation.  |
| Dynamic Simulation Study for Compression Systems | French Compressor Manufacturer               | Dynamic Simulation Study for the Overhead Compressor in an LNG train                             | Aspen HYSYS       | 2019 | Russia  | Equipment Manufacturer | Natural Gas    | A French compressor manufacturer (providing the overhead compressor to a Russian LNG plant) required Inprocess to determine by means of dynamic simulation the protection requirements (anti-surge circuit, hot gas bypass valve requirements, etc.)   |
| Dynamic Simulation Study for Compression Systems | French Compressor Manufacturer               | Dynamic Simulation Study for the Regeneration Compressor in an LNG train                         | Aspen HYSYS       | 2019 | Russia  | Equipment Manufacturer | Natural Gas    | The French compressor manufacturer (providing the regeneration compressor to a Russian LNG plant) required Inprocess to determine by means of dynamic simulation the protection requirements (anti-surge circuit, hot gas bypass valve requirements, etc.)   |
| Dynamic Simulation Modelling Study               | Austrian Petrochemical Company, Belgian site | Dynamic Simulation Model for a Propane dehydrogenation plant                                     | Aspen HYSYS       | 2019 | Belgium | Operator               | Petrochemicals | The client wanted to process an alternative feedstock (from bio sources) into their PDH and PP3 plants, and it was in need of testing the evolution of the concentration of this alternative feedstock at the exit of the polymerization plant, once the feedstock tank at their logistic partner was connected to the pipeline feeding the PDH plant. Therefore, a dynamic simulation model of the plant was built, and it was used to determine the residence time of the new feedstock, after switching from the traditional one. |



## Inprocess References List: 2008-2023

| Project Type   | Customer  | Project Title   | Process Simulator | Year | Country   | Company Type           | Industry       | Short Description  |
|--|---|---|-------------------|------|-----------|------------------------|----------------|--|
| Dynamic Simulation Modelling Study; Flare Systems Analysis | Italian EPC for an Austrian petrochemicals company (Belgian Site) | Dynamic Flare Network Analysis for safety gas evaluation in a Propane dehydrogenation (PDH) plant | Aspen HYSYS       | 2019 | Belgium   | EPC                    | Petrochemicals | <p>Inprocess built the dynamic model of the flare network of a propane dehydrogenation plant for an Italian engineering company who was in charge of carrying out a safety gas evaluation in the plant</p> <p>Final client was facing a problem with the Flare system for which the reduction load applied was not properly supported by a simulation, and the HIPS implementation is not enough to close the safety gap coming from a LOPA analysis.</p> <p>Inprocess carried out a flare simulation for the design scenario (power failure) in order to check if the time-dependence of the overpressure phenomena can give additional credit to close the safety gap going to safe reduce the flare design.</p> |
| Dynamic Simulation Study for Compression Systems           | French Compressor Manufacturer for an Indonesian Oil&Gas company  | Dynamic simulation study for a three stages centrifugal compression system                        | Aspen HYSYS       | 2019 | Indonesia | Equipment Manufacturer | Oil & Gas      | <p>Inprocess built a dynamic simulation model of the three-stages compression system to validate the sizing of the proposed anti-surge valves and the configuration of the recycle loops</p>   |
| Dynamic Simulation Modelling Study                         | Process Licensor division of an Italian EPC                       | Dynamic Simulation for a high-pressure gas circuit in a hydroconversion type unit                 | Aspen HYSYS       | 2019 | Italy     | EPC                    | Refining       | <p>Inprocess updated an existing dynamic simulation case in order to match Steady State conditions, according to H&amp;MB, in order to tune up controllers and instrumentation as well as to check dynamics to verify that in three different scenarios, no overpressure and overtemperature will occur</p>  |
| Dynamic Simulation Modelling Study                         | Italian EPC   | DSS to study start-up procedures for two units in a green refinery                                | Aspen HYSYS       | 2019 | Italy     | EPC                    | Refining       | <p>During the start-up of two units of a green refinery lots of operational problems were detected, actually leading to the impossibility of starting them. Inprocess created a dynamic simulation model of the units and helped out the engineers there to find and define the right procedure to smoothly start the refinery units</p>   |
| Dynamic Simulation Modelling Study                         | Emirates EPC working for an Middle East NOC                       | Dynamic Simulation Study for Desalter trains in new GCs   | Aspen HYSYS       | 2019 | Kuwait    | EPC                    | Oil & Gas      | <p>Due to the construction of new processing facilities in gathering center of an oil &amp; gas field, new desalter treating trains need to be built. Inprocess did carry out the dynamic simulation of such series of desalter trains in order to assess their dimensions, their desalting capacity, and their control and safety strategy for start-up and shutdown sequences</p>  |



## Inprocess References List: 2008-2023

| Project Type            | Customer   | Project Title  | Process Simulator  | Year | Country | Company Type | Industry       | Short Description   |
|-------------------------|--|--|--|------|---------|--------------|----------------|---|
| Flow Assurance Analysis | Italian EPC for a Russian Oil Company in Middle East | Surge Analysis Study for a Crude Oil Export Pipeline between two tank farms (121 km) | OLGA   | 2019 | Iraq    | EPC          | Oil & Gas      | A FEED surge analysis of a 121 km long crude oil export pipeline, between two tank farms, was carried out by Inprocess using OLGA with PVTsim in order to determine the adequate line size (48"), the NPSHA for booster and shipper pumps, the cool down, as well as testing other different operational and emergency situations   |
| Flare Systems Analysis  | Spanish site of a Multinational Chemicals company    | Flare Network Evaluation for the whole producing site (several plants)               | Flarenet/Aspen Flare Analyzer                              | 2019 | Spain   | Operator     | Bulk Chemicals | Client wanted an updated Aspen Flare Analyzer model of their flare network (93 sources relieving). Inprocess built the model and run the proposed scenarios (Power Failure, Cooling Water Failure, Instrument Air Failure and Fire) and suggested possible ways of overcoming the detected bottlenecks  |
| Hydrogen Network Study  | Serbian Refining Company                             | Feasibility Study for Hydrogen Network Modelling and Optimization                    | Aspen HYSYS  | 2019 | Serbia  | Operator     | Refining       | Inprocess' refinery experts did analyse the status of the existing Hydrogen Network with the aim to investigate different alternatives to optimize hydrogen utilization at the refinery. Afterwards, Inprocess, in collaboration with its EPC partner, did conduct the Technical and Economic Evaluation of the proposed alternatives as well as created the required technical documentation for the selected solution.  |
| Flare Systems Analysis  | Spanish Refinery                                     | Modelling and Study for the Flare System of the Conversion Section of the Refinery   | Aspen HYSYS;<br>Flarenet/Aspen Flare Analyzer;<br>Flaresim | 2019 | Spain   | Operator     | Refining       | <p>* Revalidation of the PSVs: Determination of the load associated with each of the services, for each of the defined contingencies, and calculation of the required dimensions of each service. This will be applicable for those PSVs that do not have this information in their original specsheet. If this information is available, it should only be collected for use in the following project points.</p> <p>In turn, Inprocess will calculate the isometrics necessary to carry out the revalidation study.</p> <p>* Revalidation of the Network: Determination of the services affected by common contingencies and development of a model of the flare network in order to analyze its hydraulic behaviour and determine its possible limitations.</p> <p>* Revalidation of the Flare: Design of the Seal and the Tip, plus radiation study with Flaresim</p> |

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## Inprocess References List: 2008-2023

| Project Type  | Customer   | Project Title   | Process Simulator | Year | Country              | Company Type           | Industry  | Short Description  |
|---|--|---|-------------------|------|----------------------|------------------------|-----------|--|
| Dynamic Simulation Study for Compression Systems; HIPPS or other Depressurization | Spanish EPC working for and Emirates' NOC                    | Minimum Metal Temperature Study (FEED) for a Gas-Lift Compression System in an Abu Dhabi offshore field | Aspen HYSYS       | 2019 | United Arab Emirates | EPC                    | Oil & Gas | Development of a Minimum Metal Temperature Study for the Gas-Lift Compressor System in an oil & gas field (offshore Abu Dhabi) using BLOWDOWN technology available in Aspen HYSYS. This technology has been incorporated by Aspentech in Aspen HYSYS keeping the code unchanged in order to maintain the accuracy of the original depressurization technology developed by Dr. Graham Saville and Prof. Stephen Richardson |
| Dynamic Simulation Study for Compression Systems                                  | FPSO Constructor   | Dynamic Simulation Study of the Gas Injection Compressor in an FPSO in Ghana                            | Aspen HYSYS       | 2019 | Ghana                | Operator               | Oil & Gas | Dynamic Simulation Studies, with different operational scenarios, to calculate sizes of equipment and of safety devices for the Gas Injection compressor installed in a FPSO in Africa   |
| Dynamic Simulation Study for Compression Systems                                  | Swiss Compressor Manufacturer                                | Dynamic Simulation Study for three compression systems in an oil & gas plant                            | Aspen HYSYS       | 2019 | Indonesia            | Equipment Manufacturer | Oil & Gas | Dynamic study to confirm the design of the Anti-Surge Valve, including the trim characteristic, and to evaluate the need of hot gas bypass valve; to detect potential reverse rotation of the compressor; to perform the compressor system start-up, including interfaces with the process sequence identification of required starting torque, starter driver sizing, and the required acceleration limitations           |
| Dynamic Simulation Study for Compression Systems                                  | British Compressor Manufacturer                              | DSS for the LLP and LP compressors in a FPSO in Africa  | Aspen HYSYS       | 2019 | Senegal              | Equipment Manufacturer | Oil & Gas | Dynamic Simulation Studies, with different operational scenarios, to calculate sizes of equipment and of safety devices for the LLP and LP compressors installed in a FPSO in the west coast of Africa   |
| Flare Systems Analysis  | German Engineering Company for a German Refinery             | PSVs and Flare network revalidation for a German refinery   | UniSim Design     | 2019 | Germany              | EPC                    | Refining  | An Inprocess modelling expert remotely supported the EPC firm to carry out a PSVs and flare network revalidation study for a refinery in Germany   |
| Dynamic Simulation Study for Compression Systems                                  | Swiss Compressor Manufacturer for an Uzbek oil & gas company | Dynamic simulation study for a booster compressor station (two stages)                                  | Aspen HYSYS       | 2019 | Uzbekistan           | Equipment Manufacturer | Oil & Gas | A compressor manufacturer wanted Inprocess to build a dynamic model and to run simulation scenarios to determine if their compressor design was satisfying final client needs to boost the pressure of a declining field to keep desired discharge pressure (by moving from one-stage to two-stages compression system)  |

## Inprocess References List: 2008-2023

| Project Type  | Customer   | Project Title   | Process Simulator                          | Year | Country  | Company Type     | Industry       | Short Description  |
|---|--|---|--|------|----------|------------------|----------------|--|
| Operator Training System (OTS)                        | Malaysian Fertilizers Company                      | Operator Training System for an Ammonia, Methanol and Urea Plant                      | UniSim Design                              | 2019 | Malaysia | Operator         | Bulk Chemicals | An Operator Training System for the Ammonia, Urea and Methanol plants (plus the associated Utilities plant) has been built for a fertilizers company in Malaysia. The dynamic process model has been built using UniSim Design, the emulation of the Yokogawa DCS has been included in the process model, the Advanced Process Control Module has been connected to the process model and the emulated HMI has been developed with Inprocess Instructor Station that is also acting as the communication hub for the whole of the system |
| Dynamic Simulation Study for Compression Systems      | FPSO Constructor                                   | Dynamic study to select adequate compressors in an FPSO                               | Aspen HYSYS                                | 2019 | Ghana    | EPC              | Oil & Gas      | Dynamic Simulation studies carried out for different compressor alternatives in order to select the best suited one  |
| Dynamic Simulation Modelling Study                    | EPC (Italian office) working for a Middle East NOC | Dynamic analysis of a steam network in a desalination plant during shutdown           | Aspen HYSYS                                | 2019 | Bahrain  | EPC              | Refining       | Inprocess carried several operation scenarios to determine the operability of the steam network of the utilities section of a desalination plant in Middle East  |
| Dynamic Simulation Study for Process Control Analysis | Spanish Metallurgical Company                      | Dynamic Model and Technology Transfer for a Sulphur Oxide Plant                       | Aspen HYSYS                                | 2019 | Spain    | Operator         | Metallurgy     | A dynamic model of one section of the sulphur oxide gas treatment plant has been built in Aspen HYSYS dynamics to help client engineers to improve current process control setup. The model development activity will be supported by a series of knowledge transfer sessions that will guide control engineers on how to benefit from the dynamic simulation results to improve plant controllability   |
| Dynamic Simulation Modelling Study                    | FPSO Constructor in Singapore                      | Depressurization and re-pressurization dynamic study for a gas export sealine         | Aspen HYSYS                                | 2019 | Ghana    | Operator         | Oil & Gas      | Dynamic Study to determine the operating procedure for the switch from automatic to manual in the gas export line from FPSO to the continent   |
| Flare Systems Analysis                                | Spanish Refinery                                   | Revalidation of the PSVs protecting the coker, the HGO and the CLE & LVN              | Aspen HYSYS; Flarenet/Aspen Flare Analyzer | 2019 | Spain    | Operator         | Refining       | After several successful previous projects, the refinery owner has requested Inprocess to carry out another project to revalidate the sizing of the Pressure Safety Valves protecting some other units in the refinery (Coker, HGO, CLE & LVN)   |
| Steady State Simulation Modelling Study               | Canadian Process Licensor                          | Steady State Model Improvement and Exergy Analysis of a Compressed Air Storage System | Aspen HYSYS                                | 2019 | Canada   | Process Licensor | Bulk Chemicals | An existing Steady State model in Aspen HYSYS will be reviewed and enhanced in terms of convergence time and redundant information. Once validated, the model will be used to identify potential energy improvements by exergy analysis  |

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## Inprocess References List: 2008-2023

| Project Type                                     | Customer   | Project Title  | Process Simulator | Year | Country | Company Type           | Industry       | Short Description   |
|--|--|--|-------------------|------|---------|------------------------|----------------|---|
| Dynamic Simulation Study for Compression Systems | Swiss Compressors Manufacturer (German branch) for an Oil Major operating in Qatar | DSS for a compressor train changing from VSD drive/control to fixed speed drive      | Aspen HYSYS       | 2019 | Germany | Equipment Manufacturer | Refining       | The main objective of the project was to deliver a dynamic simulation study for a compression system to confirm the viability of eliminating VDS, though the verification of the operation under a number of defined procedural and upset conditions. The model will allow evaluating the design and identifying potential problems.  |
| Dynamic Simulation Study for Compression Systems | German Compressor Manufacturer for an FPSO constructor                             | Dynamic Simulation Study for three Different Compressor Trains Systems in a FPSO     | Aspen HYSYS       | 2019 | Brazil  | Equipment Manufacturer | Oil & Gas      | Inprocess has developed a dynamic simulation model of the three compression systems designed to work in a FPSO offshore Brazil with the objective of determining the anti-surge requirements for the three systems; to evaluate the compressor start-up procedures and the driver ability to provide sufficient torque at the settle out pressure with/without soft starter; and to evaluate an emergency shutdown or trip event. |
| Dynamic Simulation Modelling Study               | Spanish Synthetic Rubber Producer  | Dynamic Simulation Study for the rubber plant chilling water network                 | Aspen HYSYS       | 2019 | Spain   | Operator               | Petrochemicals | Inprocess has developed a dynamic simulation model of the chilling water network in Aspen HYSYS in order to help client to determine hydraulic bottlenecks in its chilling water network and to help client to find solutions that could lead to its removal  |
| Dynamic Simulation Study for Compression Systems | German Compressors Manufacturer  | Dynamic Simulation Study for Feed Gas Booster Compressor and Boil Off Gas Compressor | Aspen HYSYS       | 2019 | Germany | Equipment Manufacturer | Natural Gas    | The main objective of the project is to deliver a dynamic simulation study for the Feed Gas Booster compression system and for the Boil-Off Gas compression system in order to confirm its proper operation under several defined procedural and upset conditions. The model will allow evaluating the design and identifying potential problems.   |
| Operator Training System (OTS)                   | Middle East Control Systems Implementor  | Operator Training Simulator for a gas plant in Basrah (Iraq)                         | Aspen HYSYS       | 2019 | Iraq    | EPC                    | Natural Gas    | Operator Training Simulator for a Gas Utilization Plant that will use Siemens PCS7 as distributed control system. Inprocess has developed a direct-connect OTS, with a dynamic model of the process based on Aspen HYSYS, the emulation of the Siemens DCS based on PCS7Sim and SIMIT, and an instructor station developed with Inprocess Instructor Station  |





## Inprocess References List: 2008-2023

| Project Type                                 | Customer                                    | Project Title   | Process Simulator | Year | Country | Company Type | Industry       | Short Description  |
|--|---|---|-------------------|------|---------|--------------|----------------|--|
| Steady State Simulation Modelling Study      | Process Licensor division of an Italian EPC | On-site Support for Aspen Plus MTBE Reactor Modelling                         | Aspen Plus        | 2019 | Italy   | EPC          | Petrochemicals | <p>Within the innovation process on going, client is evaluating the use of Aspen Plus to perform integrated process simulation models for High-Octanes Technologies, more specifically MTBE, ETBE and TAME synthesis and related side reactions.</p> <p>Client is currently simulating the whole process (reaction, product separation and reactant recovery) using different tools with an important effort related to the integration of the results from one tool to the other until a stable convergence is reached. The reason of this is linked to the reliability of each tool results that were confirmed over the years with data coming from several operating plants all over the world.</p> <p>Client requested Inprocess its support to implement the whole of the existing models and routines into a single process simulation tool, like Aspen Plus.</p> |
| Research, Development and Innovation (R+D+I) | Norwegian Oil and Gas company               | Development of a Bad Actors Detection Application                             | Aspen HYSYS       | 2019 | Norway  | Operator     | Oil & Gas      | <p>Inprocess and client will jointly devote R&amp;D resources to develop a software tool capable of detecting process anomalies due to the deviation between the real equipment behaviour and that expected from a rigorous first-principles dynamic process simulator</p>   |
| Operator Training System (OTS)               | Greek Refining Company                      | Upgrading of an existing Operator Training Simulator for an MHC refinery unit | UniSim Design     | 2019 | Greece  | Operator     | Refining       | <p>Inprocess updated and upgraded an existing simulation system for the complexes of Fluidized Catalytic Cracking (FCC) and Mild Hydrocracker (MHC) to the new process simulator (UniSim Design), matching current plant conditions. On top of the new model, Inprocess created an Operator Training Simulator, simulating the Honeywell control system and the safety system with Proconex software and developing the instructor capabilities with Inprocess Instructor Station</p>  |
| Operator Training System (OTS)               | Greek Refining Company                      | Operator Training Simulator of a continuous catalytic reforming refinery unit | UniSim Design     | 2019 | Greece  | Operator     | Refining       | <p>Inprocess developed an OTS for continuous catalytic reforming unit (CCR) in the refinery, developing the process model with UniSim Design, simulating the Honeywell control system and the safety system with Proconex software and developing the instructor capabilities with Inprocess Instructor Station</p>  |

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|--------------------------------|---|---|-------------------|------|---------|--------------|-----------|--|
| Operator Training System (OTS) | Greek Refining Company                        | Operator Training Simulator of a topping refinery unit                | UniSim Design     | 2019 | Greece  | Operator     | Refining  | Inprocess developed an OTS for an old topping complex in the refinery, developing the process model with UniSim Design, simulating the Honeywell control system and the safety system with Proconex software and developing the instructor capabilities with Inprocess Instructor Station  |
| Operator Training System (OTS) | Major FPSO constructing and operating company | Lifecycle project and OTS for one FPSOs to be located offshore Brazil | UniSim Design     | 2019 | Brazil  | Operator     | Oil & Gas | A major FPSO constructing and operating company has awarded Inprocess the construction of an Operator Training Simulator for their new Floating Production Storage and Offloading (FPSO) platform, which is soon to be installed off the coast of Brazil. These fields produce a natural gas with a high CO2 content, thus a careful design of the processing facilities in the FPSO is required as well as precise operating procedures in order to be able to adequately process the fluids produced. The OTS being built to train the control room operators are, however, part of a wider-scope simulation lifecycle project which will include dynamic simulation studies to be executed before the actual construction of the topsides, as well as validation of the proposed operating procedures, checkout of the ICSS databases, operator training, start-up support and post start-up updates. |



## Inprocess References List: 2008-2023

| Project Type  | Customer                                       | Project Title   | Process Simulator | Year | Country  | Company Type | Industry       | Short Description  |
|---|--|---|-------------------|------|----------|--------------|----------------|--|
| Operator Training System (OTS)  | Major FPSO constructing and operating company  | Lifecycle project and OTSs for one FPSO to be located offshore Brazil             | UniSim Design     | 2019 | Brazil   | Operator     | Oil & Gas      | A major FPSO constructing and operating company has awarded Inprocess the construction of an Operator Training Simulator for their new Floating Production Storage and Offloading (FPSO) platform, which is soon to be installed off the coast of Brazil. These fields produce a natural gas with a high CO2 content, thus a careful design of the processing facilities in the FPSO is required as well as precise operating procedures in order to be able to adequately process the fluids produced. The OTS being built to train the control room operators are, however, part of a wider-scope simulation lifecycle project which will include dynamic simulation studies to be executed before the actual construction of the topsides, as well as validation of the proposed operating procedures, checkout of the ICSS databases, operator training, start-up support and post start-up updates. |
| Operator Training System (OTS)  | German Resins Company                          | OTS for a Hydrogenated Hydrocarbon Resin plant                                    | Aspen HYSYS       | 2019 | Germany  | Operator     | Bulk Chemicals | Inprocess will take advantage of existing models in Aspen Dynamics to build an OTS based on Aspen HYSYS Dynamics to train control room operators on the behaviour of the plant that is controlled by a PCS7 Simatic from Siemens. Inprocess Instructor Station will be the software acting as data hub and providing the Instructor functionalities  |
| Software Extension and Programming; Steady State Simulation Modelling Study | Norwegian Exploration & Production Company     | Steady State model expansion and software extension upgrade for a North Sea field | Aspen HYSYS       | 2019 | Norway   | Operator     | Oil & Gas      | Inprocess will build new steady state standalone models for two new fields to be integrated with an existing CORF model. Models will be fed with real plant data from PI system. Software extensions will be upgraded to cope with the new feeds   |
| Dynamic Simulation Modelling Study  | Slovak EPC for a Slovak petrochemicals company | Dynamic Simulation Study for Ethylene Storing Facility Subcooling Section         | Aspen HYSYS       | 2019 | Slovakia | EPC          | Petrochemicals | EPC dynamic simulation studies to verify basic engineering calculations for the facilities of the storing complex of an ethylene production plant  |

## Inprocess References List: 2008-2023

| Project Type                            | Customer                                | Project Title   | Process Simulator | Year | Country              | Company Type | Industry       | Short Description  |
|---|---|---|-------------------|------|----------------------|--------------|----------------|--|
| Flow Assurance Analysis                 | Spanish EPC for an Emirates oil company | Flow Assurance Study for an oil field in Middle East  | OLGA              | 2019 | United Arab Emirates | EPC          | Oil & Gas      | The purpose of this hydraulic analysis was to establish the line size requirements for the new transfer lines from PADs and Main Transfer line forming a Fish Bone Network for the Oil Gathering Network. The analysis also evaluated and identified the various problems that could be faced during start-up, shutdown, pigging operations of the gathering network facility  |
| Operator Training System (OTS)          | Petrochemical Spanish Company           | Operator Training Simulator with Immersive 3D-VR for a greenfield linear alkylbenzene (LAB) plant based on DETAL technology | Aspen HYSYS       | 2019 | Spain                | Operator     | Petrochemicals | <p>A Spanish petrochemicals site contracted Inprocess to develop a Digital Twin based on a rigorous dynamic process simulation model of their revamped Linear Alkylbenzene (LAB) plant (which was moved to Detal technology), which is also connected to a detailed 3D Virtual Reality model of the plant. That Digital Twin is being used in a number of key project tasks including:</p> <ul style="list-style-type: none"> <li>- Verify the complex and automatic regeneration sequences of absorbers and reactors, and all the control and safety narratives of the project.</li> <li>- Verify and tune the new operating procedures for Start-up/Shutdown and operability of the plant</li> <li>- Tune all new controllers and configure the right settings for alarms.</li> <li>- Train control room operators on replicas of their CR operator consoles communicating with field operators in the 3DVR environment.</li> <li>- Train AI systems to infer product qualities on distillation units</li> </ul> <p>The Digital Twin was delivered on Dec-2019 and it was being used intensively prior to plant start-up, scheduled for May-2020. The expected benefits were safer, shorter and smoother start-up.</p> |
| Steady State Simulation Modelling Study | German EPC                              | Aspen + Conceptual Design of Distillation Sequence  | Aspen Plus        | 2019 | Germany              | EPC          | Bulk Chemicals | Client requested Inprocess technical support to help them to build a model in Aspen Plus that should help them to select the best distillation sequence configuration  |



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| Project Type                       | Customer   | Project Title   | Process Simulator | Year | Country | Company Type             | Industry  | Short Description   |
|------------------------------------|--|---|-------------------|------|---------|--------------------------|-----------|---|
| Operator Training System (OTS)     | Brazil office of a Dutch FPSO constructor                    | Operator Training System for one FPSO located offshore Brazil | UniSim Design     | 2019 | Brazil  | Operator                 | Oil & Gas | Development of an Operator Training system for one FPSO located offshore Brazil. The dynamic model will be developed taking advantage of a previously built dynamic model for EPC studies. The control and safety system (from Siemens) will be simulated with Siemens softcontroller based on SIMIT  |
| Operator Training System (OTS)     | Brazil office of a Dutch FPSO constructor                    | Operator Training System for one FPSO located offshore Brazil | UniSim Design     | 2019 | Brazil  | Operator                 | Oil & Gas | Development of an Operator Training system for one FPSO located offshore Brazil. The dynamic model will be developed taking advantage of a previously built dynamic model for EPC studies. The control and safety system (from Siemens) will be simulated with Siemens softcontroller based on SIMIT  |
| Operator Training System (OTS)     | Brazil office of a Dutch FPSO constructor                    | Operator Training System for one FPSO located offshore Brazil | UniSim Design     | 2019 | Brazil  | Operator                 | Oil & Gas | Development of an Operator Training system for one FPSO located offshore Brazil. The dynamic model will be developed taking advantage of a previously built dynamic model for EPC studies. The control and safety system (from Siemens) will be simulated with Siemens softcontroller based on SIMIT  |
| Operator Training System (OTS)     | Brazil office of a Dutch FPSO constructor                    | Operator Training System for one FPSO located offshore Brazil | UniSim Design     | 2019 | Brazil  | Operator                 | Oil & Gas | Development of an Operator Training system for one FPSO located offshore Brazil. The dynamic model will be developed taking advantage of a previously built dynamic model for EPC studies. The control and safety system (from Siemens) will be simulated with Siemens softcontroller based on SIMIT  |
| Dynamic Simulation Modelling Study | Finish Refinery  | Yield Shift Reactor Modelling for Hydrocracker                | Aspen HYSYS       | 2018 | Finland | Operator                 | Refining  | Our client needed a dynamic model of the refinery hydrocracker, in the format of yield shift reactor, to be built using Aspen HYSYS Dynamics for its future use in their internal operators training tool. As the source of information, Inprocess used an existing steady state PetroSIM model, previously developed by client.  |
| Operator Training System (OTS)     | Norwegian Instrumentation Provider for an Oil & Gas Operator | OTS for a Danish O&G field in the North Sea                   | UniSim Design     | 2018 | Denmark | Instrumentation Provider | Oil & Gas | Inprocess will use the dynamic models developed by third parties (in UniSim Design) to develop and commission an OTS for the control room operators in the oil & gas field facilities. The ICSS emulator will be provided by Siemens AS, who is the instrumentation provider of the field. Inprocess will use its own Instruction Station software to act as the data connectivity hub as well as the provider of the instruction capabilities. |

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## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title  | Process Simulator | Year | Country              | Company Type             | Industry  | Short Description   |
|--|---|--|-------------------|------|----------------------|--------------------------|-----------|---|
| Dynamic Simulation Study for Compression Systems | Italian EPC for a Russian refinery                                    | Dynamic Simulation Studies for the compressors in a Delayed Coker Unit | Aspen HYSYS       | 2018 | Russia               | EPC                      | Refining  | Through a series of simulated operating scenarios, using an on-purpose developed dynamic simulation model, Inprocess determined the adequacy and effectiveness of the compression system in the delayed coker unit. Certain shutdown procedures are also evaluated taking into account the anti-surge protection and control and trip settings, including the need for hot/cold gas bypass valves and circuits. The impact on flaring following system depressurization will as well be checked   |
| Operator Training System (OTS)                   | Main Automation Contractor working for an Abu Dhabi Oil & Gas company | Operator Training System for an Abu Dhabi Oil Field Facilities         | Aspen HYSYS       | 2018 | United Arab Emirates | Instrumentation Provider | Oil & Gas | Inprocess is developing for an Instrumentation Provider a Direct-Connect Operator Training System based on their 800xA DCS. Inprocess will use Aspen HYSYS as the dynamic process simulator for the processing facilities of the oil & gas field; it will use Inprocess Instructor Station as the data connectivity hub as well as the provider of the instruction capabilities; and the softcontroller for the 800xA simulation provided by the provider   |
| Dynamic Simulation Study for Compression Systems | Swiss Compressor Manufacturer   | Dynamic simulation study for a compression system                      | Aspen HYSYS       | 2018 | Switzerland          | Equipment Manufacturer   | Oil & Gas | The compressor manufacturer wanted Inprocess to build a dynamic model and to run simulation scenarios to determine if their compressor design was satisfying final client needs   |
| Dynamic Simulation Modelling Study               | Chinese EPC working for an Abu Dhabi Oil & Gas company                | Dynamic Simulation for an Abu Dhabi Oil Field Facilities               | Aspen HYSYS; OLGA | 2018 | United Arab Emirates | EPC                      | Oil & Gas | Working in three project phases, the Inprocess simulation team will develop a dynamic simulation model of the integrated processing facilities (transfer lines, separation trains, vapor recovery, MOL lines and pumps, dewatering system, flare systems, hot water and others), using Aspen HYSYS and OLGA. A series of dynamic simulation scenarios will be run with the model to ensure the correct sizing of the equipment and of the protecting systems. Inprocess engineers will work for six months at client facilities in Abu Dhabi to facilitate and ensure the knowledge transfer to client's team |



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| Project Type   | Customer  | Project Title  | Process Simulator | Year | Country   | Company Type | Industry       | Short Description  |
|--|---|--|-------------------|------|-----------|--------------|----------------|--|
| Operator Training System (OTS); ITOP; Software Extension and Programming; Training Program | British Fine Chemicals Company. Spanish Production Site | Development of an educational platform to train operations personnel                               | Aspen HYSYS       | 2018 | Spain     | Operator     | Fine Chemicals | <p>Inprocess develops client's educational platform for operators in their Catalan site, 60 km north of Barcelona.</p> <p>In close collaboration with client's HR department, the Inprocess Services team developed an educational environment where their operations personnel will find rigorous representation of their producing lines and processes (either in the form of rigorous dynamic simulation or in the form of audio-visual content) where to learn-by-practicing how to optimally operate their real processes.</p> <p>With a bunch of batch operating lines, this site has been producing for years high-added value natural based specialties and oleo chemicals to the personal care, life sciences, and industrial chemical markets.</p> <p>The educational platform will as well contain ITOP (Inprocess' learning content about Unit Operations) and an emulated OTS to train client's CROs.</p> |
| Operator Training System (OTS)   | Argentinian Oil Company                                 | Operator Training System for a Generic CDU in a refinery   | Aspen HYSYS       | 2018 | Argentina | Operator     | Refining       | <p>Inprocess has developed an OTS for a generic refinery production CDU. The dynamic process model was built in Aspen HYSYS; the control system was emulated in the dynamic process simulator while the Operator Consoles were emulated with Aspen Operator Training software</p>  |
| Operator Training System (OTS)   | Argentinian Oil Company                                 | Operator Training System for a refinery fluid catalytic cracker (FCC) in La Plata (Argentina)      | Aspen HYSYS       | 2018 | Argentina | Operator     | Refining       | <p>Inprocess has developed an OTS for a refinery production FCC for a refinery located in La Plata (Argentina). The dynamic process model was built in Aspen HYSYS; the Schneider Serie IA control system was emulated via the softcontroller provided by Schneider and the Operator Consoles were emulated with Aspen Operator Training software</p>  |
| Operator Training System (OTS)   | Argentinian Oil Company                                 | Operator Training System for a refinery fluid catalytic cracker (FCC) in Luján de Cuyo (Argentina) | Aspen HYSYS       | 2018 | Argentina | Operator     | Refining       | <p>Inprocess has developed an OTS for a refinery production FCC for a refinery located in Luján de Cuyo (Argentina). The dynamic process model was built in Aspen HYSYS; the ABB 800xA control system was emulated via the softcontroller provided by ABB and the Operator Consoles were emulated with Aspen Operator Training software</p>  |

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## Inprocess References List: 2008-2023

| Project Type  | Customer  | Project Title   | Process Simulator | Year | Country   | Company Type | Industry       | Short Description  |
|---|---|---|-------------------|------|-----------|--------------|----------------|--|
| Operator Training System (OTS)  | Argentinian Oil Company                             | Operator Training System for a refinery fluid catalytic cracker (FCC) in La Plata (Argentina)   | Aspen HYSYS       | 2018 | Argentina | Operator     | Refining       | Inprocess has developed an OTS for a refinery production FCC for a refinery located in La Plata (Argentina). The dynamic process model was built in Aspen HYSYS; the ABB 800xA control system was emulated via the softcontroller provided by ABB and the Operator Consoles were emulated with Aspen Operator Training software  |
| Flow Assurance Analysis   | Spanish Engineering Company (Chile office)          | Dynamic Flow Assurance Analysis for shutdown and restart procedures in a Bolivian oil&gas field | OLGA              | 2018 | Bolivia   | EPC          | Oil & Gas      | Transient analysis using OLGA of the behavior of a Bolivian O&G field during the last unplanned shutdown and processes restart, providing recommendations on the restart procedures, targeting at reducing the accumulation of liquids (oil & water) in the system   |
| Dynamic Simulation Modelling Study  | Norwegian Engineering and FPSO Construction Company | DSS to test and verify relief scenarios for a Non-Associated Gas line in a Ghanaian FPSO        | Aspen HYSYS       | 2018 | Ghana     | EPC          | Oil & Gas      | Inprocess executed several scenarios using the FPSO dynamic model to test and verify relief scenarios for the Non-Associated Gas processing line in John Agyekum Kufuor FPSO in Ghana coast  |
| Dynamic Simulation Study for Compression Systems; Knowledge Improvement Program (KIP) | French Chemicals Company                            | Dynamic Simulation Study for Cracked Gas Compression Trains                                     | Aspen HYSYS       | 2018 | France    | Operator     | Petrochemicals | Inprocess developed a dynamic simulation model, carrying out a series of dynamic simulation scenarios and delivering a training session (including model handover) for two compressor trains for the cracked gas process. One is driven by a turbine (CT1) and one is driven by a motor (CM2), both are constituted by five-stage compression.   |
| Flare Systems Analysis  | Canadian oil sands refining company                 | Model update and additional runs for new yields in refinery units                               | Aspen HYSYS       | 2018 | Canada    | Operator     | Refining       | After having changed the yields in the refinery units as well as the plant throughput, client wanted Inprocess to review the conclusions reached with the previous dynamic simulation study regarding the adequacy of their Over Pressure Protection System. Inprocess has updated the existing dynamic model with the new operating conditions, and has run the necessary scenarios with the model to analyse and verify the limitations, reporting the main findings and recommendations |
| Flare Systems Analysis  | Spanish Refinery Site                               | Flare Dynamic Simulation Update   | Aspen HYSYS       | 2018 | Spain     | Operator     | Refining       | Inprocess updated Naphtha Splitter simulation models for Spanish Refinery.   |





## Inprocess References List: 2008-2023

| Project Type  | Customer  | Project Title   | Process Simulator | Year | Country | Company Type           | Industry    | Short Description   |
|---|---|---|-------------------|------|---------|------------------------|-------------|---|
| Dynamic Simulation Modelling Study; HIPPS or other Depressurization | Italian Engineering Company                             | Dynamic Simulation Study HIPPS Verification for a Libyan Offshore   | Aspen HYSYS       | 2018 | Italy   | EPC                    | Oil & Gas   | Inprocess' client requested the Inprocess' services to carry out HIPPS study. The dynamic process simulation study was developed in order to verify if the HIPPS system was able to protect the existing HP separators with the new operating conditions.   |
| Dynamic Simulation Study for Compression Systems                    | Swiss compressor manufacturer for a Norwegian EPC       | Dynamic Simulation Study for Compressor Trains  | Aspen HYSYS       | 2018 | Vietnam | Equipment Manufacturer | Oil & Gas   | Inprocess client requested to carry out a Dynamic Simulation Study for Compressor Trains in a platform, located in Vietnam. In order to achieve the objectives of this project, Inprocess built a Dynamic Model and performed a series of pre-defined scenarios, according to client's comments.  |
| Dynamic Simulation Modelling Study                                  | Norwegian Engineering and FPSO Construction Company     | DSS to troubleshoot operational problems in MP and LP compressors in a Ghanaian FPSO                            | Aspen HYSYS       | 2018 | Ghana   | EPC                    | Oil & Gas   | Inprocess executed several scenarios using the FPSO dynamic model to troubleshoot operational problems in MP and LP compressors in John Agyekum Kufuor FPSO in Ghana coast  |
| Dynamic Simulation Modelling Study                                  | Norwegian Engineering and FPSO Construction Company     | DSS to test and check operational procedures to start the Non-Associated Gas processing line in a Ghanaian FPSO | Aspen HYSYS       | 2018 | Ghana   | EPC                    | Oil & Gas   | Inprocess executed several scenarios using the FPSO dynamic model to test and check operational procedures to start the Non-Associated Gas processing line in John Agyekum Kufuor FPSO in Ghana coast   |
| Dynamic Simulation Modelling Study                                  | Norwegian Engineering and FPSO Construction Company     | DSS on a Ghanaian FPSO model to analyze flare incident  | Aspen HYSYS       | 2018 | Ghana   | EPC                    | Oil & Gas   | Inprocess executed several scenarios using the FPSO dynamic model to analyze flare incident in John Agyekum Kufuor FPSO in Ghana coast  |
| Training Courses for Operators                                      | Canadian EPC for an Austrian LPG plant owner in Tunisia | Process Training Courses for the Operators of an LPG Plant  | Aspen HYSYS       | 2018 | Tunisia | EPC                    | Natural Gas | Inprocess' instructor was in charge of delivering the courses about the processing plant details to the operators in Tunisia. Part of the material was already prepared by the EPC and the Process Licensor and other part was prepared by Inprocess, taking advantage of the simulation models that were built in a separate project to help the EPC in their design phase |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title   | Process Simulator | Year | Country      | Company Type | Industry       | Short Description  |
|--|---|---|-------------------|------|--------------|--------------|----------------|--|
| Operator Training System (OTS)                   | Spanish polymers company                            | DCS Checkout activities during client DCS migration project | Aspen HYSYS       | 2018 | Spain        | Operator     | Petrochemicals | During the migration of the plant Distributed Control System from previous provider to current one (DeltaV from Emerson), Inprocess staff, involved in the lifecycle project, did carry out the checkout activities for the FAT version of the DCS, helping final client to reduce the number of onsite DCS commissioning hours  |
| Dynamic Simulation Modelling Study               | Argentinian Engineering Company                     | Feasibility CFD Study for the backwash operation of columns |                   | 2018 | Argentina    | EPC          | Bulk Chemicals | Inprocess, with the help of a local university, carried out a feasibility study, using Computational Fluid Dynamics software (open source) to check possible design alternatives for the liquid distributor in the bottom of a wash column where adsorbed components were desorbed and washed when operating with backwards flow   |
| Dynamic Simulation Study for Compression Systems | Spanish Engineering Company for a Saudi Arabian NOC | Dynamic Simulation Studies for Compression Plants           | Aspen HYSYS       | 2018 | Saudi Arabia | EPC          | Oil & Gas      | <p>A Spanish engineering company was awarded the contract to carry out the Haradh Gas Plant EPC project.</p> <p>The purpose of the EPC project is to boost the non-associated gas pressure from the gas gathering system to Haradh Gas Plant and/or Hawiyah Gas Plant, allowing the wellhead pressures to be reduced. This lower pressure will improve or extend the field production profile.</p> <p>Inprocess was requested to perform a Dynamic Simulation Analysis aimed at verifying the adequacy of the instrumented protection system, at confirming the stable operation during different operational modes with the existing control scheme and at providing support to the EPC on the design of the ASV and CGBV.</p> <p>The project consisted of three main packages:</p> <ul style="list-style-type: none"> <li>• North Haradh Gas Compression Package</li> <li>• Satellite Gas Compression Package</li> <li>• South Haradh Gas Compression Package</li> </ul> <p>Each package had three gas compression plants located at different emplacements and, in turn, each of the plants contained a certain number of compression systems</p> |



## Inprocess References List: 2008-2023

| Project Type  | Customer                                | Project Title  | Process Simulator | Year | Country | Company Type | Industry       | Short Description   |
|---|---|--|-------------------|------|---------|--------------|----------------|---|
| Dynamic Simulation Modelling Study; Steady State Simulation Modelling Study; Training Program | Spanish Oil Company (Chemical Division) | Steady State Model + Dynamic Model + Training Material for Engineers in a Petrochemicals Plant | Aspen HYSYS       | 2018 | Spain   | Operator     | Petrochemicals | Taking advantage of the dynamic simulation models already built for an OTS in a similar plant the operator owns in Shanghai, China, Inprocess modelling engineers developed the steady state version of the Spanish Cumene and Phenol producing units in order owner engineers could use it to test and check possible operating points. On top of the steady state versions, Inprocess has also been requested to create the dynamic model of the three producing lines in order to help Operations department in designing and applying operating procedures. Simultaneously, Inprocess has created training material that has been used to train owner's engineers on how models were built and how they can be used in the future |
| Dynamic Model linked to DCS   | Norwegian Oli&Gas Operator              | On-Line Model Based Application Using Process Simulation (Twin Model)                          | UniSim Design     | 2018 | Norway  | Operator     | Oil & Gas      | Development of a production software application, based on a simulation model in UniSim Design of an oil & gas field and processing units, being connected to the cloud PI database, which is capable of tuning the model with current production conditions, in order to predict future behaviour of the whole asset. The fitting algorithm, with poor data rejection, has been built in Matlab and the Inprocess Instructor Station has been used as data communication hub. The application is using as GUI the same HMI than the real DCS is using  |
| Dynamic Simulation Modelling Study  | Qatar Oil & Gas Company                 | Dynamic Simulation for Over Pressure Scenario Validation                                       | Aspen HYSYS       | 2018 | Qatar   | Operator     | Oil & Gas      | Inprocess' Client requested the dynamic simulation study for Over Pressure Scenario Validation in order to determine the capacity of the system to avoid reaching the design pressure of equipment when in the event of a Thermal Reactor' shutdown. Inprocess also studied the maximum achievable pressure in the super-heater coils under worst case conditions.  |
| Dynamic Simulation Modelling Study  | Swedish Refinery                        | Dynamic Simulation Study for Tube Rupture in SRU Furnace                                       | Aspen HYSYS       | 2017 | Sweden  | Operator     | Refining       | Inprocess developed the dynamic model of Claus Unit in order to investigate the propagation of a pressure wave through the unit to understand how high the pressure can rise.   |



## Inprocess References List: 2008-2023

| Project Type                            | Customer   | Project Title   | Process Simulator | Year | Country | Company Type | Industry       | Short Description   |
|---|--|---|-------------------|------|---------|--------------|----------------|---|
| Flow Assurance Analysis                 | Spanish Engineering Company for a Bolivian Operating Company | Dynamic Analysis of the hydraulics of the load and unload circuits of cargo ships | OLGA              | 2017 | Bolivia | EPC          | Oil & Gas      | Inprocess carried out an analysis of the hydrodynamic behaviour of the loading and unloading lines in cargo ships for a new terminal using OLGA. Special attention was devoted to analyse water hammer effects when motorized valves were closed unexpectedly   |
| HIPPS or other Depressurization         | Italian Oil & Gas Industry                                   | Dynamic Simulation Study HIPPS Verification for Oil & Gas Platform                | Aspen HYSYS       | 2017 | Libya   | EPC          | Oil & Gas      | Inprocess' client requested the Inprocess' services to carry out HIPPS study. The dynamic process simulation study was developed in order to verify if the HIPPS system was able to protect the existing HP separators with the new operating conditions.   |
| Dynamic Simulation Modelling Study      | French Chemicals Company                                     | Dynamic Simulation Study for EDC Cracking Furnaces and HCL Distillation Column    | Aspen HYSYS       | 2017 | France  | Operator     | Bulk Chemicals | Inprocess developed a dynamic simulation study in order to: <ul style="list-style-type: none"> <li>• Determinate the flowrates to be evacuated due to the furnaces shut-down.</li> <li>• Determinate the on/off valves sizes to be installed.</li> <li>• Analyse the system/flow behaviours during the furnaces shut--down.</li> <li>• Estimate the flow rates generated by a pipe rupture.</li> </ul>                                |
| Dynamic Simulation Modelling Study      | Oil Refinery in Finland                                      | Dynamic Simulation Study for Finland Refinery                                     | Aspen HYSYS       | 2017 | Finland | Operator     | Refining       | The main objectives for the model were to develop a simulation model including the modelling of seven underground caverns with connections crude oil feed and gas to be vented. The model also included the time actions like: ship and railway unloading, crude charging to process, maintenance broke when one cavern was sealed off from others. Inprocess developed the project using Petro-SIM as the process simulation engine. |
| Steady State Simulation Modelling Study | Spanish Engineering Company                                  | Steady State Study of a Phenol Column   | Aspen HYSYS       | 2017 | Spain   | EPC          | Refining       | Inprocess carried out a SS of a Phenol Column. The main objective of this study was to determinate the efficiency of the column. Furthermore, Inprocess' Client had requested the simulation of the modified column.  |

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| Project Type                       | Customer  | Project Title  | Process Simulator                                    | Year | Country        | Company Type | Industry       | Short Description   |
|------------------------------------|---|--|--|------|----------------|--------------|----------------|---|
| Flare Systems Analysis             | Czech Petrochemical Company                         | Flare Revalidation Project and Knowledge Improvement Program (KIP) | Aspen HYSYS  | 2017 | Czech Republic | Operator     | Petrochemicals | <p>During this project, Inprocess developed a complete flare network revalidation study according to API520 and API521. The common relief scenarios were analysed for all the affected units and the sizing cases were determined in order to perform the revalidation study using dynamic simulation methods.</p> <p>In addition, according to the Inprocess Client need to teach engineers on how to revalidate flare networks using Steady State and Dynamic Simulation, Inprocess provided a Knowledge Improvement Program (KIP). KIP allowed to transfer the knowledge acquired during the execution of the project.</p> |
| Dynamic Simulation Modelling Study | Norwegian Engineering and FPSO Construction Company | Debottlenecking Study for Oil & Gas Project                        | Aspen HYSYS  | 2017 | Ghana          | EPC          | Oil & Gas      | <p>Inprocess carried out a Debottlenecking Study for an Oil &amp; Gas Project. During the study, Inprocess developed a series of verification and evaluation studies for the project.</p>   |
| Operator Training System (OTS)     | Spanish Oil Company (Petrochemicals branch)         | Emulated OTS for Propylene Oxide and Styrene Monomer Plant         | Aspen HYSYS  | 2017 | Spain          | Operator     | Petrochemicals | <p>Inprocess developed an Emulated OTS for a Propylene Oxide and Styrene Monomer Plant. The different process areas of the plant were simulated separately through the execution of different project phases. This allow the early provision of the Emulated OTS for the main part of the plant for the benefit of Inprocess Client.</p>  |
| Flare Systems Analysis             | Belgian Olefins plant                               | Flare Network Revalidation Study for a naphtha cracker             | Aspen HYSYS; Flarenet/Aspen Flare Analyzer; Flaresim | 2017 | Belgium        | Operator     | Petrochemicals | <p>Inprocess reviewed the situation of the safety devices and flare network considering new feedstock added to the naphtha cracker.</p> <p>The new relief loads for all the detailed feedstock scenarios were calculated, and the evaluation of the inlet and outlet piping of each safety device were validated.</p> <p>Finally, Inprocess suggested the solutions to potential non-conformities of the installation found during the study.</p>   |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title  | Process Simulator     | Year | Country      | Company Type | Industry       | Short Description  |
|--|---|--|-----------------------|------|--------------|--------------|----------------|--|
| Dynamic Simulation Study for Compression Systems | Spanish Engineering Company for a Saudi Arabian NOC | Dynamic Simulation Study support for a refrigeration loop compression system               | Aspen HYSYS           | 2017 | Saudi Arabia | EPC          | Oil & Gas      | Inprocess Client required Inprocess to provide technical support and consultancy services for the development of a Dynamic Simulation Study for a refrigeration loop compression system.<br>During the project execution, Inprocess reviewed and validated the results obtained by Inprocess Client to ensure its quality and reliability.   |
| Dynamic Simulation Modelling Study               | French Chemicals Company                            | Dynamic Simulation Model for the Chlorine and Hydrogen Sections                            | Aspen HYSYS           | 2017 | France       | Operator     | Bulk Chemicals | Inprocess Client started-up a new chlorine and hydrogen lines downstream of an electrolysis system. This project is split in two different parts. First, Inprocess, using an existing dynamic model, improved the procedures for the start-up and shutdown of the new unit. Second, Inprocess developed a dynamic model for the Hydrogen Section to determine how to avoid high pressure differences, which could cause membranes damage.    |
| Dynamic Simulation Modelling Study               | Spanish polymers company                            | Dynamic Simulation Study for operating conditions improvements in a Synthetic Rubber Plant | Aspen HYSYS           | 2017 | Spain        | Operator     | Petrochemicals | A Dynamic Simulation Study was carried out in order to identify possible operating problems and to suggest solutions and improvements to optimize the process for obtaining synthetic rubber.<br>Inprocess executed different scenarios to determine all possible improvements. These studies were carried out for two different Process areas: Butadiene and Solvent.   |
| Dynamic Simulation Modelling Study               | Spanish - Mexican Joint Venture                     | Dynamic Simulation Study for a Combined Cycle Power Plant in Mexico                        | Aspen HYSYS           | 2017 | Mexico       | EPC          | Power Plants   | Inprocess carried out a dynamic simulation study for a Combined Cycle Power Plant. Inprocess established the necessary gas holdup between compressor and gas turbine to avoid pressure fluctuation and analysed the maximum pressure variation.  |
| Flare Systems Analysis                           | Spanish Refinery                                    | Flare System Revalidation for a Spanish Refinery   | Aspen HYSYS; Flarenet | 2017 | Spain        | Operator     | Refining       | Final Client initiated a series of modifications including a revamp to increase the intermediate Paraffin production capacity from 330,000 tm/year to 370,000 tm/year and a modification of existing LAB production facilities. Inprocess carries out the revalidation of the PSVs for different contingencies as well as of the Flare Network for four different cases, to ensure that the results obtained by Inprocess' Client are valid. |



## Inprocess References List: 2008-2023

| Project Type  | Customer  | Project Title   | Process Simulator | Year | Country     | Company Type           | Industry    | Short Description   |
|---|---|---|-------------------|------|-------------|------------------------|-------------|---|
| Dynamic Simulation Study for Compression Systems      | Swiss compressor manufacturer                   | Dynamic Simulation Studies for a MOPICO-type compression system                           | Aspen HYSYS       | 2017 | Switzerland | Equipment Manufacturer | Oil & Gas   | Inprocess client requested a Dynamic Simulation Study for a compressor system project. In the project was included two integrated high speed motor driven compressor (type MOPICO) that could be operated either in series or parallel configuration. The Inprocess' study confirmed the operation under a number of defined procedural and upset conditions.   |
| Dynamic Simulation Study for Process Control Analysis | British FPSO Operating Company                  | DSS for two Ghanaian FPSOs to check operational issue when both produce in parallel       | Aspen HYSYS       | 2017 | Ghana       | Operator               | Oil & Gas   | Inprocess's client wanted to check the impact in the operation of the gas export pipeline, from TEN and Jubilee FPSOs, specifically of the control system of the HP & GI compressors when both FPSOs were producing alone and together.   |
| Dynamic Simulation Modelling Study                    | Italian EPC                                     | Dynamic Simulation studies for an expansion project                                       | Aspen HYSYS       | 2017 | Indonesia   | Operator               | Natural Gas | Inprocess client initiated an Expansion Project to commercialize the incremental resource into high margin gas markets based on a single LNG (liquefied natural gas) train expansion. Inprocess carried out an integrated dynamic simulation model of the facilities in operation and the new ones focusing on the steam and power system, in order to achieve a N+1 operating philosophy for the steam turbine generators and auxiliary boilers. |
| Steady State Simulation Modelling Study               | Hydrocarbons exploration and production company | Upstream Steady State model update for future dynamic simulation                          | Aspen HYSYS       | 2017 | Norway      | Operator               | Oil & Gas   | Inprocess engineers updated a series of Aspen HYSYS Steady State models with new PVT data and well compositions and trained the client on the model modifications.  |
| Operator Training System (OTS)                        | Omani Consultancy and Engineering company       | Dynamic Simulation Study for a Gas Grid Integration and Emulated Operator Training System | UniSim Design     | 2017 | Oman        | EPC                    | Natural Gas | Inprocess carried out a detailed concept study of the Gas Grid pipeline system to identify and evaluate all possible options required to meet all gas delivery specifications and Gas Grid capacity for a minimum of 10 years. Once the dynamic models were created, Inprocess developed an Emulated OTS for the complete Gas Grid.   |



## Inprocess References List: 2008-2023

| Project Type                            | Customer                 | Project Title  | Process Simulator | Year | Country | Company Type     | Industry               | Short Description  |
|---|--------------------------|--|-------------------|------|---------|------------------|------------------------|--|
| Operator Training System (OTS)          | Process Licensor Company | High-fidelity Operator Training Environment for a Methanol Plant   | VMGSim            | 2017 | Denmark | Process Licensor | Bulk Chemicals         | Development of a high-fidelity Operator Training Environment, composed by a series of training modules to be used to learn about the fundamentals of unit operations (based on Inprocess' training environment: ITOP) and an emulated solution for a methanol plant OTS, founded on a dynamic simulation model built on VMGSim technology. The architecture of this training environment consisted of a web-based infrastructure. This approach allowed different thin-clients to access the different operator training functionalities from different PCs, sitting at various company locations. The remote environment allowed the interaction from clients to the central application in a smooth and non-intrusive way. |
| Dynamic Simulation Modelling Study      | Oil Refinery in Finland  | FCC Yield Shift Reactor Modelling  | Aspen HYSYS       | 2016 | Finland | Operator         | Refining               | The client was interested in the development of a Dynamic model for its FCC in order to use this model for an OTS. Inprocess performed a FCC Yield Shift Reactor Modelling based on FCC Steady State model.  |
| Steady State Simulation Modelling Study | Qatar Oil & Gas Company  | Hydraulic performance check for non-licensed process units, major lines and equipment of a train downgraded operation in a gas plant | PRO/II            | 2016 | Qatar   | Operator         | Oil & Gas; Natural Gas | The Phase I of the study was performed by Inprocess in order to determine the maximum possible operating capacity limits, by considering the safety limitation factors, when increasing the production of the wells.<br>Once capacity limits were determined, during project Phase II, Inprocess updated a series of PRO/II simulation files provided by client and it performed the hydraulic performance check for the non-licensed units, major lines and equipment in scope.   |
| Dynamic Simulation Modelling Study      | Spanish polymers company | Dynamic Modelling of a Butadiene Plant for operating transient analysis  | Aspen HYSYS       | 2016 | Spain   | Operator         | Petrochemicals         | The main objective of this project was to optimize the area alarm of the butadiene process. Inprocess developed a dynamic simulation modelling of the butadiene area in order to carry out the analysis of the plant's dynamic behaviour, which could help to identify the operating conditions that lead to the activation of the plant section alarms.   |
| Operator Training System (OTS)          | FPSO/FSO EPC             | Operator Training System for a FPSO in Brazil  | UniSim Design     | 2016 | Brazil  | EPC              | Oil & Gas              | Inprocess carried out an Operator Training System for a FPSO in Brazil.<br>The OTS was developed as a direct connect solution using Honeywell UniSim Dynamic model and Yokogawa's Centrum VP DCS emulator system.  |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer   | Project Title  | Process Simulator   | Year | Country              | Company Type | Industry  | Short Description   |
|--|--|--|---------------------|------|----------------------|--------------|-----------|---|
| Steady State Simulation Modelling Study          | Hydrocarbons exploration and production company              | Upstream Steady State model update for new production conditions     | Aspen HYSYS         | 2016 | Norway               | Operator     | Oil & Gas | <p>Inprocess engineers updated an Aspen HYSYS model used to compute the hydrocarbon allocation. The modifications consisted on:</p> <ul style="list-style-type: none"> <li>• Updated compressor performance curves for the LP compressor</li> <li>• Re-routing of LP compressor suction line form the inlet separators</li> <li>• New parameter limits under "set-up" tab in the Company Oil Recovery Factor sheet</li> </ul>   |
| Dynamic Simulation Study for Compression Systems | Middle East EPC company for a Persian Gulf Petrochem company | Dynamic Simulation Study for an Acid Gas Compression Unit            | Aspen HYSYS         | 2016 | United Arab Emirates | EPC          | Oil & Gas | <p>Dynamic simulation study of an acid gas compression system in a gas treating plant, driven by a gas turbine. The acid gas removed in the gas treating solvent units, plus the propane regeneration gas with a high sulphur contents, was compressed by the acid gas compression system, object of this dynamic study</p> <p>The main objectives of the study was to predict the behaviour in transient conditions of the compression system. To achieve this, Inprocess carried out the analysis of the different operational cases like start-up, shut down, and side stream cut off.</p> |
| Steady State Simulation Modelling Study          | Spanish Refinery Site  | Modelling and Calibration of a Platformer Unit in a Spanish Refinery | Aspen HYSYS; RefSYS | 2016 | Spain                | Operator     | Refining  | <p>The project's main objective was to deliver a calibrated Catalytic Reformer Unit (Platformer) simulation model for a Spanish Refinery. Model calibration was based on four sets of plant data provided by client. A data reconciliation step was deemed necessary in order to redistribute possible instrumentation errors. A specific model in Aspen HYSYS Refining was used for model development and calibration. Model handover meeting included a model delivery workshop, where the main model characteristics, and its possible future uses, were detailed to client.</p>           |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer                      | Project Title  | Process Simulator                                | Year | Country | Company Type | Industry    | Short Description   |
|--|-------------------------------|--|--|------|---------|--------------|-------------|---|
| Dynamic Simulation Study for Compression Systems | Spanish EPC for a Kuwait NOC  | Turbo Expander/Residue Gas Compressor Dynamic Simulation Study         | Aspen HYSYS                                      | 2016 | Kuwait  | EPC          | Natural Gas | <p>Inprocess delivered a Dynamic Simulation Study for a Turbo Expander/Residue Gas Compressor, for a Gas Plant Train in Kuwait in order to confirm high operational safety and reliability of the system. Consequently, the project:</p> <ul style="list-style-type: none"> <li>• Verified the Instrumented Protection System (response of the antisurge control system / adequacy of the Turboexpander protections)</li> <li>• Confirmed the stable operation during start-up and shutdown with existing control scheme.</li> <li>• Validated the stable Turboexpander and Residue Gas Compressor operation under minimum - maximum loadings and response to flow rate variations.</li> <li>• Confirmed the stable operation during sequencing for mode switching to / from JT mode.</li> <li>• Confirmed the adequacy of the overpressure protection system of the Demethaniser installed downstream of Turboexpander.</li> </ul> |
| Flare Systems Analysis                           | O&G Field Operator in Bolivia | Dynamic Simulation Studies for the Flare Network of an Oil & Gas field | Aspen HYSYS; Flarenet/Aspen Flare Analyzer; OLGA | 2016 | Bolivia | Operator     | Oil & Gas   | <p>In a previous project for this client, Inprocess supplied a high fidelity OTS of an oil &amp; gas field. In this new project, client requested to deliver dynamic simulation studies for the field flare network, taking advantage of the previously developed OTS dynamic model. Additionally, Inprocess updated the OTS dynamic model with current field operating data.</p>   |
| Flare Systems Analysis                           | Spanish Refinery Site         | Flare Network Analysis and Dynamic Simulation Study                    | Aspen HYSYS; Flarenet                            | 2016 | Spain   | Operator     | Refining    | <p>Inprocess was requested to deliver a rigorous analysis of the flare network requirements during GPF using dynamic simulation. Results were consequently used to re-assess flare network capacity and the safety philosophy of the refinery unit. Eight (8) units of the Refinery were analysed under dynamic mode.</p>   |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title  | Process Simulator     | Year | Country | Company Type | Industry     | Short Description  |
|--|---|--|-----------------------|------|---------|--------------|--------------|--|
| Operator Training System (OTS)                   | Norwegian Engineering and FPSO Construction Company | Lifecycle Operator Training System for a Development Project                         | Aspen HYSYS           | 2016 | Ghana   | EPC          | Oil & Gas    | <p>In a previous project, Inprocess developed a high-fidelity dynamic simulation model, including all topside equipment with detailed design data. Taking advantage of the existing model, Inprocess carried out a Lifecycle approach for the Operator Training System (OTS) of the FPSO, comprising thus three phases:</p> <ul style="list-style-type: none"> <li>• The Control Narrative Verification,</li> <li>• The ICSS Checkout, and the</li> <li>• Direct-Connect OTS (Aspen HYSYS with Kongsberg K-Chief DCS)</li> </ul> |
| Operator Training System (OTS)                   | Swedish Refinery                                    | Operator Training System for a New VDU Unit  | Aspen HYSYS           | 2016 | Sweden  | Operator     | Refining     | <p>The client had approved the construction of a new VDU. For this reason, Inprocess carried out an OTS in order to train the operators of the control room. The new OTS would be a direct connect ones to the DCS emulator software: DeltaV. The OTS architecture was reused from other OTS performed by Inprocess.</p>   |
| Dynamic Simulation Study for Compression Systems | Spanish - Mexican Joint Venture                     | Dynamic Simulation Study for a Turbine and Gas compressors in a Combined Cycle Plant | Aspen HYSYS           | 2016 | Mexico  | EPC          | Power Plants | <p>A Dynamic Simulation Study was carried out in order to analyse the transient pressure of gas turbine fluctuations. Additionally, another DSS did investigate the transient pressure when gas compressor change over.</p>  |
| Flare Systems Analysis                           | Petroleum Refinery in Spain                         | Revalidation of a PSV in a refinery Vacuum Unit and Auditing EPC work                | Aspen HYSYS           | 2016 | Spain   | Operator     | Refining     | <p>Determination and identification of the relief scenarios that needed to be considered for every unit (or group of units) that were protected by the safety device. The quantitative determination of the load associated with every relief scenarios was calculated.</p> <p>The relief load calculation was done by using an Aspen HYSYS case including the simulation model of the process unit working at current/design operating condition.</p> <p>This project includes Auditing EPC work.</p>                           |
| Flare Systems Analysis                           | Petroleum Refinery in Spain                         | Revalidation of the PSVs in a refinery Vacuum unit                                   | Aspen HYSYS; Flarenet | 2016 | Spain   | Operator     | Refining     | <p>VDU under a Cooling Water Failure and GPF was analysed under dynamic mode. Flare Network requirements were analysed using the results from the DSS of the VDU.</p>  |

## Inprocess References List: 2008-2023

| Project Type   | Customer   | Project Title   | Process Simulator | Year | Country              | Company Type | Industry       | Short Description  |
|--|--|---|-------------------|------|----------------------|--------------|----------------|--|
| Flare Systems Analysis   | Norwegian FPSO Operator                                    | Sensitivity analysis for the LP flare system in a Norwegian FPSO              | Aspen HYSYS       | 2016 | Norway               | Operator     | Oil & Gas      | Ten sensitivity runs (under dynamic steady state conditions) ranging from 10% to 100% of the Max Oil flow rate from LP separator to LP flare system were run in order to determine how system pressure is affected by increasing flow rates.   |
| Dynamic Simulation Modelling Study   | Spanish Engineering Company                                | Dynamic Simulation Study for an Oil Heater in an Abu Dhabi Surface Facilities | Aspen HYSYS       | 2016 | United Arab Emirates | EPC          | Oil & Gas      | The project main purpose was to deliver a Dynamic Simulation Study for oil field facilities in Abu Dhabi in order to evaluate the behaviour of new valves in the control loops of the inlet to one existing oil heater under pressure control and on another existing oil heater under flow control during selected operational scenarios.   |
| Dynamic Simulation Study for Compression Systems                                 | Italian Engineering Company                                | Dynamic Simulation Study for Ethylene Refrigerant Compressor                  | Aspen HYSYS       | 2016 | Mexico               | EPC          | Petrochemicals | Inprocess was requested to carry out a Dynamic Simulation Study for Ethylene Refrigerant Compressor in order to study some serious operational problems that were detected during compressor start-up after driver trip (steam turbine). The aim of the dynamic simulation study in this project was to determine possible improvements in process design that could solve the detected operational problems.                      |
| Flow Assurance Analysis; Flare Systems Analysis; HIPPS or other Depressurization | Italian Engineering company for a Russian Oil Company      | Flare system study  | Aspen HYSYS; OLGA | 2016 | Iraq                 | EPC          | Refining       | Dynamic simulation (using Aspen HYSYS® software) of existing HP/LP flare system that was upgraded by additional HP Flare. In particular, the HP-LP flare header pressure build up was investigated during different plant flaring scenarios in order to define   |
| Steady State Simulation Modelling Study  | French Exploration & Production Company (Norwegian Branch) | Update of the Steady State model used to allocate produced hydrocarbons       | Aspen HYSYS       | 2016 | Norway               | Operator     | Oil & Gas      | An Aspen HYSYS Steady State model was used by Inprocess' client to calculate the Company Oil Recovery Factor, key element to allocate production and revenue among field owner companies. Due to changes in production flows and composition, the processing plant changed its operation to a new one already planned. The Inprocess engineers updated the allocation simulation model as needed with the new plant configuration. |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer  | Project Title  | Process Simulator | Year | Country              | Company Type           | Industry  | Short Description  |
|--|---|--|-------------------|------|----------------------|------------------------|-----------|--|
| Flow Assurance Analysis                          | Spanish Engineering Company                         | Flow Assurance Study for an oil field in Abu Dhabi                       | OLGA              | 2016 | United Arab Emirates | EPC                    | Oil & Gas | <p>The Transient Analysis Study of the pipeline system was divided in two main steps:</p> <ul style="list-style-type: none"> <li>Steady state flow validation with the objective to validate pressure losses and performance of the systems installed at the pipeline inlets (well head chock valve), and to validate the inlet and outlet pressure and temperature for each pipeline.</li> <li>Transient Analysis Study was aimed at calculating transport system behaviour during flow variation associated with start-up, shut-down, pigging, etc. the blowdown operation was also analysed in order to define the discharge rate, duration, pipeline internal pressure, temperature and slug evolution.</li> </ul> |
| Dynamic Simulation Study for Compression Systems | Swiss compressor manufacturer for a Middle East NOC | Dynamic Simulation Study for a Compression System in Oman (Phase II)     | Aspen HYSYS       | 2016 | Oman                 | Equipment Manufacturer | Oil & Gas | <p>Dynamic simulation study was performed in order to confirm the operation of the HP and LP acid gas compressors, gas export compressors and flash gas LP and HP compressors under a number of defined procedurals and upset conditions. The model allowed evaluating the design and identifying potential problems. The objectives for the study were to check the proposed emergency shut-down procedures and recommend changes, if deemed necessary; to verify the suitability of the anti-surge control system and recycle valve sizing; to identify the requirement for hot or cold gas by-pass compressor cycle.</p>  |
| Dynamic Simulation Study for Compression Systems | FPSO/FSO constructor (USA office)                   | Dynamic Simulation Study for the modification of a FPSO located in Ghana | Aspen HYSYS       | 2016 | Ghana                | EPC                    | Oil & Gas | <p>New fields had been discovered in Ghana region. It was intended to produce from these discoveries to the FPSO. Based on the fact that the gas capacity was increasing, it required both trains of MP, HP, and gas Injection Compressors to be in operation to accommodate the final production. Since this was not how the gas system was originally designed, there were concerns about the control of two compression trains operating in parallel and Dynamic Simulation Studies were required to be carried out by Inprocess in order to address these concerns.</p>  |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer                         | Project Title   | Process Simulator     | Year | Country              | Company Type           | Industry       | Short Description  |
|--|----------------------------------|---|-----------------------|------|----------------------|------------------------|----------------|--|
| Flare Systems Analysis                           | Spanish Oil Company              | Relief analysis to check the adequacy of the safety devices of a petrochemical plant        | Aspen HYSYS; Flarenet | 2016 | Spain                | Operator               | Petrochemicals | Adequacy study of the safety devices of a petrochemical plant in Spain in order to evaluate the flare system. The relief requirements were reviewed for selected process units carrying out several emergency scenarios, among which: Power failure, cooling water failure, fire in main equipment and blocked outlet.   |
| Operator Training System (OTS)                   | Swedish Refinery                 | Operator Training Systems for two Swedish Refinery Units                                    | Aspen HYSYS           | 2015 | Sweden               | Operator               | Refining       | The Client had an OTS installed for the FCC unit and was interested in extending the OTS capability to two additional units: ICR and HPU units. Client requested a new OTS would be a direct connect one to the DCS emulator software: DeltaV SimulatePro. In addition, the upgrade of the instructor functionality of the existing OTS for the FCC unit with the Inprocess Instructor Station was also been part of the project scope.  |
| Operator Training System (OTS)                   | Spanish EPC and Process Licensor | Dynamic Model, Process Trainer and Operator Training System for a Nitric Acid Plant         | Aspen HYSYS           | 2015 | Spain                | Process Licensor       | Bulk Chemicals | Many nitric acid plants had been designed and erected by the Client based on its own technology. In order to complement the Client technological offer to their clients, it was required the development of a dynamic model of the plant that would be used by the Client to show the plant operability to current customers and to show plant and technology capabilities to potential customers. As an extended scope, once the dynamic model of the plant would be available, it would be evolved to a Process Trainer and then to an Operator Training System. |
| Dynamic Simulation Study for Compression Systems | Swiss compressor manufacturer    | Dynamic Simulation Studies for the Compressors in an Abu Dhabi oil & gas field              | Aspen HYSYS           | 2015 | United Arab Emirates | Equipment Manufacturer | Oil & Gas      | At client operating plant there was two compression trains in operation. The Client requested to install new compression trains whose right operation could be confirmed under a number of predefined procedural and upset conditions through dynamic simulation.  |
| Flare Systems Analysis                           | Qatar Oil & Gas Company          | PSV and Flare Network Revalidation for Safety Limitations during train downgraded operation | Flarenet              | 2015 | Qatar                | Operator               | Oil & Gas      | The Operating company of offshore field and onshore processing facilities wanted to increase the wells production. One of the main limitations was the design of the flare discharge network. It was requested to Inprocess to validate if the existing flare system was capable of handle emergencies for the proposed new production rates.  |





## Inprocess References List: 2008-2023

| Project Type  | Customer                                 | Project Title   | Process Simulator     | Year | Country | Company Type | Industry  | Short Description   |
|---|--|---|-----------------------|------|---------|--------------|-----------|---|
| Steady State Simulation Modelling Study               | O&G Field Operator in Bolivia            | Steady State Simulation of pipelines in a Bolivian O&G field                                | Aspen HYSYS           | 2015 | Bolivia | Operator     | Oil & Gas | <p>With the objective of making production forecast for different future scenarios, without making physical shunting in the field, Inprocess' client required an integrated steady state simulation model.</p> <p>Client expected to later integrate the steady state pipeline model developed by Inprocess with a reservoir simulation model (already owned by client) in order to obtain an integrated simulation system which allowed to study different production scenarios.</p>           |
| Operator Training System (OTS)                        | Dutch Exploration and Production Company | Process Trainer and Training Program for the operators in a Brazilian FPSO                  | Aspen HYSYS           | 2015 | Brazil  | Operator     | Oil & Gas | <p>A previously developed training system for a sister FPSO was be adapted to the operating conditions of FPSO. New exercises, new procedures, other small scenarios were developed and incorporated into this new Process Trainer.</p> <p>Associated with the development of the tool, there were also operator training sessions, led by Inprocess instructors, at client site.</p>   |
| Flare Systems Analysis                                | Petroleum Refinery in Spain              | Flare Network Revalidation Study using Steady State Simulation                              | Flarenet              | 2015 | Spain   | Operator     | Refining  | <p>A Spanish Refinery expressed to Inprocess the interest in applying process simulation to revalidate the flare network once a more accurate flare loads were calculated in a separate project by means of dynamic simulation.</p>   |
| Dynamic Simulation Study for Process Control Analysis | French Petroleum Refinery                | Support to integrate Dynamic Simulation model and APC Controller for a de-Propanizer Column | Aspen HYSYS           | 2015 | France  | Operator     | Refining  | <p>The intention of Inprocess' client was to integrate an in-house developed routine to specifically address non linearity issues around quality control for binary columns with MVPC technology. Before moving to testing this integration on the real plant, the client intended to validate the solution through a simulation representing a reasonable process response, being sure the simulated system exhibited a process behaviour more realistic than just simple linear behaviour</p> |
| Software Extension and Programming                    | Petroleum Refinery in Spain              | Development of a PSVs Database software for an oil refinery                                 | Aspen HYSYS; Flarenet | 2015 | Spain   | Operator     | Refining  | <p>After a previous project carried out by Inprocess, the refinery owned a series of databases for every unit that was discharging to the flare network.</p> <p>On top of that, the client wanted to own a tool that would be capable of managing all the existing PSVs databases, together with all associated documentation, and that could facilitate the work of all involved personnel in the refinery.</p>  |

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## Inprocess References List: 2008-2023

| Project Type                       | Customer                           | Project Title   | Process Simulator | Year | Country   | Company Type | Industry    | Short Description  |
|------------------------------------|------------------------------------|---|-------------------|------|-----------|--------------|-------------|--|
| Dynamic Simulation Modelling Study | British FPSO Operating Company     | Dynamic Simulation Study for a FPSO to be installed in Ghana coast          | Aspen HYSYS       | 2015 | Ghana     | Operator     | Oil & Gas   | Inprocess developed and delivered a dynamic simulation model of the entire processing facility starting from the Top of Riser (ToR) ESD Valve through to the cargo tanks. Inprocess engineers confirmed the behaviour of the systems under a number of defined procedural and production upset conditions including but not limited to start up, shut down (normal & emergency), turndown, sudden loss of refrigerant, loss of cooling and/ or heating medium, inability to export gas due to sudden shutdown of the plant.  |
| Dynamic Simulation Modelling Study | Spanish Refinery                   | Dynamic Simulation Study for the Chilling Water Network of a refinery       | Aspen HYSYS       | 2015 | Spain     | Operator     | Refining    | The cooling water circuit of Olefins plant consisted of 9 refrigeration cells, 4 pumps and various collectors that distribute water to consumers of Olefins plants, hydrogenation of pyrolysis gasoline, benzene plant and spent soda caustic treatment plant. A 1991 hydraulic study determined the distribution of cooling water and checked that all the exchangers received a rate higher than required for process water. In this study the benzene plant and the treatment of soda caustic were not included because these units were subsequently installed. Additionally, the circuit had 3 pumps and 8 cells. The aim of current project was to reproduce in a dynamic simulation the hydraulic calculation made previously by using a tool that allowed easy modifications by users trained to update the study to the installation. |
| Dynamic Simulation Modelling Study | Milan-based EPC (Indonesia Office) | DSS for the steam system of an LNG plant                                    | Aspen HYSYS       | 2015 | Indonesia | EPC          | Natural Gas | Inprocess developed an integrated dynamic simulation model of the TEO and TEP steam system on a single LNG (liquefied natural gas) train expansion. In addition, Inprocess carried out the dynamic analysis for a set of pre-defined operating scenarios.  |
| HIPPS or other Depressurization    | Italian EPC                        | Dynamic Simulation Study HIPPS verification for an offshore Libyan Platform | Aspen HYSYS       | 2015 | Libya     | EPC          | Oil & Gas   | Due to the fact that the gas treating capacity of a Libyan platform was expected to be increased, a dynamic process simulation study was required in order to verify if the HIPPS system was able to protect the existing HP separators with the new operating conditions.   |



## Inprocess References List: 2008-2023

| Project Type  | Customer  | Project Title  | Process Simulator | Year | Country   | Company Type | Industry  | Short Description  |
|---|---|--|-------------------|------|-----------|--------------|-----------|--|
| Dynamic Simulation Modelling Study                          | Norwegian Engineering and FPSO Construction Company               | Dynamic Simulation Study for a Development Project                                   | Aspen HYSYS       | 2015 | Ghana     | EPC          | Oil & Gas | Inprocess developed three dynamic simulation models of the compression, produced water and sea water systems. Inprocess detailed the results obtained when testing the process control and protection devices by means of dynamic simulation   |
| Dynamic Simulation Modelling Study; Flow Assurance Analysis | Spanish-Italian Joint Venture operating Venezuelan oil&gas fields | Dynamic Studies and Tech assistance at a Venezuelan oil&gas site                     | Aspen HYSYS; OLGA | 2015 | Venezuela | Operator     | Oil & Gas | Client requested Inprocess a process simulated on-site support and training for start-up operation based on Very Early Production Phase (150 MMSCFD) and production increase to Early Production Phase (300 MMSCFD) for the Venezuelan Field. Three on-site support and training stages took place with one Inprocess' process simulation expert working at Client premises in Venezuela.  |
| Steady State Simulation Modelling Study                     | Spanish Refinery Site   | Modelling and Calibration of a semi-regenerative reformer unit in a Spanish refinery | RefSYS            | 2015 | Spain     | Operator     | Refining  | The project's main objective was to deliver a calibrated simulation model of the reformer unit for aromatics production using Aspen HYSYS Refining. Inprocess developed the model of the unit using the Aspen HYSYS Refining reformer model and calibrated it using one set of close in time plant data provided by client.  |
| Dynamic Simulation Modelling Study                          | Canadian Engineering Company                                      | Dynamic Simulation Studies for a LPG Plant   | Aspen HYSYS       | 2015 | Canada    | EPC          | Oil & Gas | The project's main objective was to deliver a dynamic simulation model for a LPG Plant.<br>The aim of the dynamic simulation model required in this project was to verify effective in-scope process and controls during normal operating conditions. This included normal start up, ramp up, ramp down, steady state operating mode, planned shutdown, emergency shutdown without equipment depressurisation, and emergency shutdown with equipment depressurisation.<br>The project also included a Knowledge Improvement Program (KIP) through which the Client engineers acquired the know-how around dynamic model building and scenarios execution |
| Operator Training System (OTS)                              | Spanish Engineering Company - Chile office                        | Delivery of an Early-OTS for a New Catalytic Reformer Unit                           | Aspen HYSYS       | 2015 | Bolivia   | EPC          | Refining  | In order to be able to accommodate the schedule changes in the main OTS project, it was proposed to final client the option to develop and deliver an "early-OTS" (OTS with simplified screens and control system still inside the process simulator), that was accepted as a change in scope. A number of additional days was considered for this project and for the original one.   |

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## Inprocess References List: 2008-2023

| Project Type  | Customer  | Project Title   | Process Simulator | Year | Country              | Company Type | Industry  | Short Description   |
|---|---|---|-------------------|------|----------------------|--------------|-----------|---|
| Dynamic Simulation Modelling Study                          | USA Engineering Company                                       | Dynamic Simulation Studies for VRU and IAC compressor systems   | Aspen HYSYS       | 2015 | United Arab Emirates | EPC          | Oil & Gas | Inprocess used the existing dynamic model of Vapor Recovery Unit (VRU) already developed by Inprocess in a previous project and developed a model of the Instrument Air Compressor (IAC) system as, by identifying and collecting the process data required to perform the dynamic simulation of the system. In addition, Inprocess performed a series of operating scenarios for both systems located in Umm Lulu Field.   |
| Flow Assurance Analysis                                     | Spanish Engineering Company for an Algerian Operating Company | Flow Assurance Study for Algerian Oil Field                     | OLGA              | 2015 | Algeria              | EPC          | Oil & Gas | Flow Assurance Study based on the dynamic simulation to evaluate and identify the various problems that was able to be faced during start-up, shutdown, pigging operations for selected gathering system trunk lines and transfer lines of the Algerian Oil Field using OLGA Software .   |
| Dynamic Simulation Modelling Study; Flow Assurance Analysis | Abu Dhabi-based EPC for Abu Dhabi Oil Company                 | Depressurization, MMDT and Hydrate Study for Offshore Oil Field | OLGA              | 2015 | United Arab Emirates | EPC          | Oil & Gas | <p>The project's main objective was to develop pipeline simulation models with OLGA in order to:</p> <ul style="list-style-type: none"> <li>- Perform WHT topside depressurization and report minimum metal temperature and confirm it is within MMDT, fluid temperature at restriction orifice (RO) inlet &amp; outlet, depressurization rate and depressurization time for WHTs topside well fluid and gas lift facilities.</li> <li>- Identifying all possible cases for hydrate formation and provide recommendation for mitigation measures to prevent the hydrate formation for all the cases.</li> <li>- Identifying the depressurization and hydrate formation cases of well fluid, gas lift and excess gas.</li> </ul> |

## Inprocess References List: 2008-2023

| Project Type  | Customer                                | Project Title  | Process Simulator | Year | Country   | Company Type | Industry       | Short Description  |
|---|---|--|-------------------|------|-----------|--------------|----------------|--|
| Dynamic Simulation Modelling Study                    | Italian Major Oil Company               | Dynamic Simulation Study for a Floating Production Unit              | Aspen HYSYS       | 2015 | Indonesia | Operator     | Oil & Gas      | Through a series of dynamic simulation studies carried out by Inprocess our client verified the equipment suitability for defined design cases of the floating production unit, including compressors, drivers, pumps, heat exchangers and columns performances. It evaluated the control valve sizing, the primary and secondary protection systems and the instrument ranges and alarms. In addition, the engineering model was used for control system design studies including Compressor surge protection, Control strategies, Controllers tuning, Shutdown philosophy and sequences (including PSD- and ESD) and Complex control sequences and procedures. Finally, the engineering studies cover operability studies in addition to verification of operational procedures. |
| Dynamic Simulation Study for Process Control Analysis | French Major Oil Company                | Dynamic Model of a Refinery Reformer Fractionator for APC studies    | Aspen HYSYS       | 2015 | France    | Operator     | Refining       | A dynamic simulation model of the fractionator column of the catalytic reformer of a refinery in France has been developed and handed over to the client. The main purpose of such a high-fidelity dynamic model is to test new Advanced Process Control alternatives before implementing them in the real plant   |
| Operator Training System (OTS)                        | German EPC and Process Licensor         | Operator Training System for a new Ammonia and Hydrogen plant in USA | UniSim Design     | 2015 | USA       | EPC          | Bulk Chemicals | An Operator Training System, direct connect with Siemens DCS, UniSim Design Dynamic Simulation, and Inprocess Instructor Station, was developed and implemented in a new Ammonia plant (and its associated Hydrogen plant)   |
| Training Program                                      | Spanish Oil Company (Chemical Division) | Process Trainer Courses for PTA column operators (I) & (II)          | Aspen HYSYS       | 2015 | Spain     | Operator     | Petrochemicals | After the successful development of a Process Trainer (dynamic model with a user-friendly interface), the client requested Inprocess to deliver a series of training course for the operators that would be in charge of running the PTA column in the plant. These courses took place twice, during which around 20 operators were trained on the behaviour of the new unit.  |

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| Project Type   | Customer  | Project Title  | Process Simulator | Year | Country      | Company Type           | Industry       | Short Description  |
|--|---|--|-------------------|------|--------------|------------------------|----------------|--|
| Dynamic Simulation Study for Compression Systems         | Swiss compressor manufacturer for a Middle East NOC           | Dynamic Simulation Studies for the Booster Compressors and Recompessors in an Oman Gas Plant | Aspen HYSYS       | 2015 | Oman         | Equipment Manufacturer | Natural Gas    | Dynamic Simulation Study was carried out for the Booster Compressor and Recompessors in Turbo Expanders for an Oman Gas Plant to confirm the operation of the compressor systems under a number of defined procedural and upset conditions. The model will allow evaluating the design and identifying potential problems.   |
| Flow Assurance Analysis; HIPPS or other Depressurization | Milan-based EPC for an Arabian Oil Major                      | Third Phase of HIPPS Study for Gas Fields Development  | Aspen HYSYS; OLGA | 2015 | Saudi Arabia | EPC                    | Oil & Gas      | Third phase of a dynamic Simulation Study to evaluate HIPPS system of an upstream process plant for new operating conditions, using OLGA. Inprocess was requested to verify the results of the previous study with the model developed by the Customer and perform a sensitivity analysis to determine the minimum HIPS set point to protect the Trunk line.   |
| Dynamic Simulation Modelling Study                       | Spanish Energy Company - R&D Division                         | Simulation studies for a series of potential distillation sequences                          | Aspen HYSYS       | 2015 | Spain        | Operator               | Bulk Chemicals | A mixture coming out from a biotechnology reactor needed separation and purification in order to reach purities above 99% for some of the alcohols that were in the fermentation broth. Inprocess was requested to prepare the process simulations that would support the conceptual design study in order to select the most promising separation and purification sequence of unit operations  |
| Flow Assurance Analysis                                  | Spanish Engineering Company for an Algerian Operating Company | Flow Assurance Study for a new field development in Algeria                                  | OLGA              | 2015 | Algeria      | EPC                    | Oil & Gas      | The project main deliverable was the "Transient Flow Assurance" report that detailed the results obtained during the execution of the selected transient simulation scenarios. Steady State reports and OLGA native files were also handed over to the EPC company as part of the project deliverables   |
| Dynamic Simulation Study for Compression Systems         | Swiss compressor manufacturer for a Middle East NOC           | Dynamic Simulation Study for Compression System in Oman (Phase I)                            | Aspen HYSYS       | 2014 | Oman         | Equipment Manufacturer | Oil & Gas      | Dynamic simulation study was performed in order to confirm the operation of the gas injection compression system under a number of defined procedurals and upset conditions. The model allowed evaluating the design and identifying potential problems. The objectives for the study were to check the proposed emergency shut-down procedures and recommend changes, if deemed necessary; to verify the suitability of the anti-surge control system and recycle valve sizing; to identify the requirement for hot or cold gas by-pass compressor cycle. |

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| Project Type                            | Customer                                | Project Title  | Process Simulator   | Year | Country      | Company Type | Industry       | Short Description  |
|---|---|--|---------------------|------|--------------|--------------|----------------|--|
| Operator Training System (OTS)          | USA E&P Company                         | OTS for an Alaska Oil & Gas Field in Alpine  | Aspen HYSYS         | 2014 | USA          | Operator     | Oil & Gas      | The exploration and production company wanted an OTS to train its team of operators in charge of the control system in a remote facility in Alaska. The control system in place was not a common DCS but a combination of a data acquisition system (InfoPlus.21) and an APACS/Quadlogs controller. The proposed OTS would model the plant facilities with HYSYS, it also simulated the control system with a softcontroller and would use Inprocess Instructor Station software for connectivity, instructor console and emulation of operators consoles. |
| Operator Training System (OTS)          | Swedish Chemical Company                | Additional Reactor model for the OTS of a Chemicals Plant  | Aspen HYSYS         | 2014 | Sweden       | Operator     | Bulk Chemicals | The dynamic model of an OTS developed by Inprocess for a chemical plant in Sweden was extended in order to incorporate an additional reactor. The DCS emulation and the instructor and operator consoles were as well modified.  |
| Documentation                           | Arabian Oil Company                     | On-site engineer consultancy services to develop step-by-step documentation                                    | Aspen HYSYS; RefSYS | 2014 | Saudi Arabia | Operator     | Refining       | One refining simulation consultant from Inprocess stayed for four consecutive weeks at the client headquarters in Saudi Arabia to help and advise on the development of case studies for several refinery units.   |
| Steady State Simulation Modelling Study | Arabian-Chinese Joint Venture           | Development of Steady State Simulation models for a series of Refinery Process Units in a new Arabian Refinery | Aspen HYSYS; RefSYS | 2014 | Saudi Arabia | Operator     | Refining       | Individual Steady State simulation models were developed for 15 refinery process units and its associated equipment for a greenfield refinery project in Saudi Arabia. Three additional models, combining some of the individual ones into a refinery-wide type, were also part of the project.  |
| Operator Training System (OTS)          | Spanish Oil Company (Chemical Division) | Process Trainer for Purified Terephthalic Acid (PTA) Columns   | Aspen HYSYS         | 2014 | Spain        | Operator     | Refining       | Inprocess delivered a training tool that enabled operators to modify process variables in the PTA columns dynamic model through a user-friendly HMI in order to study the dynamic behaviour of the system. Inprocess' Process Trainer solution combined the Operator Console, the user-friendly interface and the core dynamic model engine (Aspen HYSYS).   |



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| Project Type  | Customer   | Project Title   | Process Simulator | Year | Country              | Company Type | Industry       | Short Description   |
|---|--|---|-------------------|------|----------------------|--------------|----------------|---|
| Dynamic Simulation Study for Compression Systems            | French Engineering Company (UK office) for a Carbon Capture Plant in UK    | Dynamic Simulation Study of a Booster Fan system for a Carbon Capture Plant                       | Aspen HYSYS       | 2014 | United Kingdom       | EPC          | Power Plants   | A dynamic simulation model of the booster fan system in a Power Station was developed in order to quantify the impact of booster fans operations (start-up, shut-down, etc.) on the pressure profile of the flue gas from the outlet of the Heat Recovery Steam Generator (HRSG) through the flue gas ducting from the duct interface to the Carbon Capture plant (CCP).  |
| Dynamic Simulation Modelling Study                          | French Operator Company  | Dynamic Simulation Study for the fuel gas network of a chemical plant                             | Aspen HYSYS       | 2014 | France               | Operator     | Petrochemicals | Inprocess developed two dynamic simulation models (the current and the future one) for the Fuel-Gas Network in order to evaluate pressure changes at boilers burners against fuels flow disturbances for both plant configurations.   |
| Dynamic Simulation Modelling Study                          | Spanish Engineering Company  | Dynamic Simulation Study for a Dew Pointing Unit  | Aspen HYSYS       | 2014 | Algeria              | EPC          | Oil & Gas      | A dynamic simulation model for a Dew Pointing Unit was developed and a set of operating scenarios was carefully selected in order to analyse the dynamic response of the system, verifying pressure and temperature limits, at different situations.  |
| Dynamic Simulation Modelling Study                          | Spanish Oil Company (Refining Division)                                    | Simulation Models for Maleic Anhydride Production Column  | Aspen HYSYS       | 2014 | Spain                | Operator     | Refining       | Inprocess developed simulation models for the dehydration column in a Maleic Anhydride production plant in order the client could evaluate the column behaviour, specifically around reboiler fouling, with regards to operational variables (such as temperature, pressure or load).   |
| ITOP; Training Courses for Operators                        | Spanish Refinery Site  | Development of an Operational Efficiency Module for ITOP  | Aspen HYSYS       | 2014 | Spain                | Operator     | Refining       | The client (the training department of an oil refining company) was interested in owning a generic training tool that could teach operators on how to operate "right" a refinery unit but also how to operate if optimally in terms of operational efficiency. To achieve so, Inprocess Training for Operators (ITOP) tool was modified in order to include Key Performance Indicators related to Operational Efficiency, together with a dashboard showing the evolution of such parameters. |
| Dynamic Simulation Modelling Study; Flow Assurance Analysis | French Engineering Company (Abu Dhabi office) for an Abu Dhabi Oil Company | Dynamic Simulation Study for pipelines and processing plant in a Field Development Project in UAE | OLGA              | 2014 | United Arab Emirates | EPC          | Oil & Gas      | A dynamic simulation model for a field development project was developed in order to verify and validate the system behaviour and responses to operating upsets and varying process and wells conditions. Two process simulators were required: OLGA for pipelines and Aspen HYSYS for onshore facilities.  |



## Inprocess References List: 2008-2023

| Project Type   | Customer                                   | Project Title   | Process Simulator | Year | Country      | Company Type           | Industry    | Short Description  |
|--|--|---|-------------------|------|--------------|------------------------|-------------|--|
| Flow Assurance Analysis; HIPPS or other Depressurization | Milan-based EPC for an Arabian Oil Major   | Second Phase of HIPPS Study for Gas Fields Development  | OLGA              | 2014 | Saudi Arabia | EPC                    | Oil & Gas   | Second phase of a dynamic Simulation Study to evaluate HIPPS system of an upstream process plant for new operating conditions, using OLGA. Inprocess was requested to verify the results of the previous study with the model developed by the Customer and perform a sensitivity analysis to determine the minimum HIPPS set point to protect the Trunk line. |
| Operator Training System (OTS)                           | Spanish Engineering Company (Chile office) | Operator Training System for a New Catalytic Reformer Unit in a South American Refinery                                       | Aspen HYSYS       | 2014 | Bolivia      | EPC                    | Refining    | An Operator Training System for the New Catalytic Reformer Unit of a refinery in Bolivia was developed and implemented by Inprocess. The dynamic model was built in Aspen HYSYS, the emulation of the DCS and the operators consoles were developed with DeltaV software from Emerson and the instructor station with Inprocess' proprietary software.         |
| Dynamic Simulation Study for Process Control Analysis    | French Exploration & Production Company    | Dynamic Simulation Study to analyse the Controllability and Flow Assurance Study for Slugging Prediction in a Gabon O&G Plant | Aspen HYSYS       | 2014 | Gabon        | EPC                    | Oil & Gas   | The objective of the project was to tune the dynamic model, once real plant data was made available to Inprocess, in order to match the values obtained by plant instrumentation. Also, a Flow Assurance Study for Slugging Prediction was developed in an onshore Oil & Gas Separation Plant in Gabon.  |
| Operator Training System (OTS)                           | German E&P Operating Company               | Operator Training System for a Gas Oil Separation Plant (GOSP) and the associated Gas Utilization Plant (GUP)                 | Aspen HYSYS       | 2014 | Libya        | Operator               | Oil & Gas   | Operator Training System for the GOSP and GUP at a North-African Field. The dynamic model was built in Aspen HYSYS, the emulation of the DCS and the operators consoles were carried out with SIMIT software from Siemens and the instructor station with Inprocess proprietary software.  |
| Dynamic Simulation Study for Compression Systems         | German Compressors Manufacturer            | Dynamic Simulation Study for Excess BOG Compressor system in a LNG Plant  | Aspen HYSYS       | 2014 | Russia       | Equipment Manufacturer | Natural Gas | The Project's main objective was to deliver a dynamic simulation study (DSS) for the BOG compression system and to confirm the operation of the compressor system under a number of defined procedural and upset conditions. The model allowed evaluating the design and identifying potential problems.   |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer   | Project Title   | Process Simulator | Year | Country | Company Type           | Industry       | Short Description   |
|--|--|---|-------------------|------|---------|------------------------|----------------|---|
| Operator Training System (OTS)                   | Dutch Exploration and Production Company                   | Process Trainer and Training Program for operators in a Brazilian FPSO              | Aspen HYSYS       | 2014 | Brazil  | Operator               | Oil & Gas      | The HYSYS models developed for the previous Dynamic Simulation Study (“DSS”) was further developed to an emulated Process and Operator Trainer. In order to transform the already existing engineering simulation models into a Process Trainer, an emulation of the DCS was incorporated into the dynamic model and several training exercises were developed.   |
| Steady State Simulation Modelling Study          | French Exploration & Production Company (Norwegian Branch) | Version Upgrading of an Existing Allocation Simulation Case                         | Aspen HYSYS       | 2014 | Norway  | Operator               | Oil & Gas      | The allocation model being used to calculate CORF (Component Oil Recovery Factor) by Client was not compatible with the latest HYSYS version. Therefore, Inprocess was requested to upgrade the simulation model and the calculator utility in order to use the latest (and future) HYSYS version.  |
| Operator Training System (OTS)                   | Spanish Oil Company (Chemical Division)                    | Replica of the Operator Training System already built for two large chemical plants | Aspen HYSYS       | 2014 | Spain   | Operator               | Petrochemicals | Inprocess developed an Operator Training System replica for two existing chemical plants in Spain. The modelling was based on the original OTS developed for the two new chemical plants in China. Both plants are owned and operated by the same company.  |
| Dynamic Simulation Study for Compression Systems | Swiss compressor manufacturer                              | Dynamic Simulation Study for multiple compressors systems in a FPSO topside         | Aspen HYSYS       | 2014 | Ghana   | Equipment Manufacturer | Oil & Gas      | Dynamic simulation to confirm the operation of the three individual compressor system under a number of defined procedurals and upset conditions.   |
| Operator Training System (OTS)                   | Swiss compressor manufacturer                              | Operator Training System for multiple compressors systems in a FPSO topside         | Aspen HYSYS       | 2014 | Ghana   | Equipment Manufacturer | Oil & Gas      | The existing models of the 3 individual compressor systems were merged in one single model and the compressor systems duplicated and assembled as they will be in the real plant. The resulting model was connected to Rockwell’s FactoryTalk to replicate very similar functionality as in the control room. The functionality for the instructor was also implemented by using Inprocess’ instructor station software |
| Steady State Simulation Modelling Study          | German EPC Company (Romanian Office)                       | Steady State Simulation Support for an Amines System                                | Aspen HYSYS       | 2014 | Romania | EPC                    | Bulk Chemicals | Inprocess was requested to validate the existing steady state process simulation for an Amines gas treatment and to evaluate possible alternative configurations.   |

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| Project Type                            | Customer                                   | Project Title  | Process Simulator | Year | Country | Company Type           | Industry       | Short Description   |
|---|--|--|-------------------|------|---------|------------------------|----------------|---|
| Steady State Simulation Modelling Study | Spanish Oil Company (Chemical Division)    | Dynamic Simulation models for purified terephthalic acid (PTA) Dehydration Columns | Aspen HYSYS       | 2014 | Spain   | Operator               | Bulk Chemicals | Inprocess developed steady state and dynamic simulation models of the three new columns and associated equipment. These models were used to study the behaviour of the system and the results did help the client to enhance their operating decisions. With the dynamic simulation model, the client did analyse different operating conditions for the start-up, shutdown and normal operation of the new purified terephthalic acid (PTA) columns. |
| Operator Training System (OTS)          | Compressor Manufacturer                    | Operator Training System for a Methane Compressor in a LNG Plant                   | Aspen HYSYS       | 2014 | Angola  | Equipment Manufacturer | Natural Gas    | In a process licensed by Conoco Philips, Inprocess focused on the model on the Gas Turbine, auxiliary equipment (with Mark VI GE property control) and the compressor trains linked to CCC controllers to size the compressor protection system.  |
| Operator Training System (OTS)          | Swedish Chemical Company                   | Operator Training System for a Chemicals Plant                                     | Aspen HYSYS       | 2014 | Sweden  | Operator               | Bulk Chemicals | An Operator Training Simulator (OTS) was developed as a training tool for the operators of a chemical plant in Sweden was developed. An interesting technical challenge was solved by integrating the rigorous dynamic model in Aspen HYSYS with an emulation software of the Experion PKS from Proconex and an instructor station from Inprocess   |
| Dynamic Simulation Modelling Study      | Italian Engineering Company                | Dynamic Simulation Modelling for a GTL Plant                                       | Aspen HYSYS       | 2014 | USA     | EPC                    | Refining       | The EPC in charge of the project requested Inprocess to develop a dynamic model of several of the processing units in a Gas To Liquids plant. The interactions among the different process units, the utilities and the combined heat and power plant will be tested.   |
| Dynamic Simulation Modelling Study      | Italian Engineering Company                | Dynamic Simulation Studies for a LNG plant   | Aspen HYSYS       | 2014 | Canada  | EPC                    | Natural Gas    | The aim of the Dynamic Simulation Study was to demonstrate that the LNG Storage Tanks could act as buffering capacity that stored all the energy released during the loading mode by means of an increase in pressure without reaching the design pressure.   |
| Operator Training System (OTS)          | Spanish Engineering Company (Chile office) | Operator Training System for a Crude Distillation Unit                             | Aspen HYSYS       | 2014 | Bolivia | EPC                    | Refining       | Operator Training System for the Atmospheric Distillation Unit of a refinery in Bolivia. The dynamic model was built in Aspen HYSYS, the emulation of the DCS and the operators consoles was carried out with software DeltaV from Emerson and the instructor station with Inprocess software   |

## Inprocess References List: 2008-2023

| Project Type                                     | Customer                                       | Project Title  | Process Simulator | Year | Country      | Company Type | Industry       | Short Description  |
|--|--|--|-------------------|------|--------------|--------------|----------------|--|
| Dynamic Simulation Modelling Study               | Spanish Engineering Company (Oman site)        | Dynamic Simulation Studies for a Gas Plant Facility                        | UniSim Design     | 2014 | Oman         | EPC          | Oil & Gas      | The EPC company required Inprocess to design, build and install a high fidelity dynamic process model for a gas plant facilities in Oman. Using the dynamic simulation model, it was checked the operation and stability of the entire facility in the various operating modes. The detailed dynamic simulation helped to confirm process control performance, the adequacy of equipment protection, the adequacy of safety systems, control - safeguarding set points and the adequacy of start-up and shutdown procedures. |
| Operator Training System (OTS)                   | French Consultancy Company                     | Operator Training System for Polyols and PG unit in a Petrochemicals Plant | IndissPlus        | 2014 | Saudi Arabia | Operator     | Petrochemicals | An Operator Training System, with INDISS dynamic simulation model connected to ABB's DCS emulation, was developed for the operator of a petrochemicals plant in Saudi Arabia   |
| PSA Studies                                      | Spanish Petroleum Refinery                     | Refinery PSA Unit Dynamic Simulation Study                                 | Aspen HYSYS       | 2014 | Spain        | Operator     | Refining       | Dynamic simulation of a PSA unit in a refinery to purify hydrogen streams. Each step of the cyclic unit operation was simulated and the behaviour of the existing unit reproduced by the model.<br>The model run dynamically and once the steady state was reached, the following results was recorded: <ul style="list-style-type: none"> <li>• Hydrogen recovery</li> <li>• Hydrogen productivity</li> <li>• Hydrogen composition purified product</li> <li>• Composition rejected product</li> </ul>                      |
| Dynamic Simulation Study for Compression Systems | Dutch Exploration and Production Company       | Dynamic Simulation Study for a Topside Compressor Closed Loop              | Aspen HYSYS       | 2014 | Brazil       | Operator     | Oil & Gas      | To verify the initial condition, control strategy and operability of the process system during closed-loop test as well as verification of the utility conditions, since the utility conditions was constrained in the test. The closed loop test of gas compressors intends to use inert gas. Nitrogen was used as the basic test gas, while helium could be added for cooling constraints.   |
| Dynamic Simulation Modelling Study               | Swedish Petrochemicals Company (Belgian Brand) | Dynamic Simulation of the start-up of a LTRS Refrigeration Unit            | Aspen HYSYS       | 2014 | Belgium      | Operator     | Petrochemicals | An existing dynamic model of the unit from a previous project with Inprocess was enhanced to allow for the dynamic simulation of the start-up procedures for the LTRS unit   |

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| Project Type                                     | Customer  | Project Title   | Process Simulator | Year | Country              | Company Type           | Industry     | Short Description  |
|--|---|---|-------------------|------|----------------------|------------------------|--------------|--|
| Flare Systems Analysis                           | Spanish Engineering Company                           | Dynamic Simulation Flare Load Analysis for Canadian Oil Sands Field               | Aspen HYSYS       | 2014 | Canada               | EPC                    | Refining     | Dynamic simulation studies were carried out to assess the EPC company in charge of the design of the plant flare network, evaluating the flare loads from different units and for different possible contingencies.  |
| Flare Systems Analysis                           | Petroleum Refinery in Spain                           | Revalidation of Pressure Safety Valves for a Refinery                             | Aspen HYSYS       | 2014 | Spain                | Operator               | Refining     | Revalidation of a selection of the safety valves that are currently in operation in this Spanish refinery.   |
| Flare Systems Analysis                           | Spanish Petroleum Refinery                            | Determination of the Flare Load for a Refinery CDU by Dynamic Simulation Analysis | Aspen HYSYS       | 2013 | Spain                | Operator               | Refining     | A Spanish Refinery expressed to Inprocess the interest in applying dynamic process simulation to realistically estimate the flare load resulting from a General Power Failure (GPF) for two units of the Refinery: Light-Ends Unit (without de-isohehexanizer) in a second project phase   |
| Operator Training System (OTS)                   | Automation Systems Provider (Spanish Office)          | Operator Training System for a Combined Cycle Power Plant                         | UniSim Design     | 2013 | Poland               | Equipment Manufacturer | Power Plants | Development of a simulation tool, with training capabilities that was been used to train the operators of the control room of a Combined Cycle Power Plant facility. This kind of applications requires creating a dynamic model of the plant units and connecting it to software capable of reproducing the behaviour of the DCS being used to control the plant  |
| Dynamic Simulation Study for Compression Systems | Dutch Exploration and Production Company              | Dynamic Simulation Study Extension to expand the original project scope           | Aspen HYSYS       | 2013 | Brazil               | Operator               | Oil & Gas    | Implementation of the dynamically developed control logic for the injection compressor and rerun critical scenarios to check the behaviour of the system.<br>Implementation of the compressor manufacturer control logic for the CO2 compressor and rerun critical scenarios to check the behaviour of the system.<br>These actions are a consequence of the results obtained by dynamic simulation in the parent project. |
| Dynamic Simulation Study for Compression Systems | German Compressors Manufacturer for a Middle East NOC | Dynamic Simulation Study for a LP Compression System at an offshore Platform      | Aspen HYSYS       | 2013 | United Arab Emirates | Equipment Manufacturer | Oil & Gas    | To revamp project from Abu Dhabi company to improve volume flow rate capacity of 4 LP compressors which located offshore.  |





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|---|---|--|-------------------|------|----------------------|------------------------|----------------|---|
| Dynamic Simulation Study for Process Control Analysis       | Swedish Petrochemicals Company (Belgian Brand)        | Dynamic Model for LTRS Refrigeration Unit  | Aspen HYSYS       | 2013 | Belgium              | Operator               | Petrochemicals | Our customer was interested in improving the control and operability of the LTRS refrigeration unit in the DeHy plant they operated in Belgium.<br>At present, too much C3 is lost to the fuel gas system so that a solution must be found in order to improve the plant economics.<br>A dynamic simulation process model was developed and handed over to our client in order it could try several new control narratives, either conventional or multivariable. |
| HIPPS or other Depressurization                             | Italian Engineering Company                           | Dynamic Simulation Studies to confirm HIPPS  | Aspen HYSYS       | 2013 | Italy                | EPC                    | Oil & Gas      | A dynamic process simulation study to confirm if the PS was able to protect the existing HP Production Drums.   |
| Operator Training System (OTS)                              | German DCS and Automation supplier (Norwegian Office) | Life Cycle Simulator for a North Sea Field Development Project   | UniSim Design     | 2013 | Norway               | Equipment Manufacturer | Oil & Gas      | As part of the Safety Automation System, the operator of the North Sea field and the Engineering company developing the project have specified a Life Cycle Simulation system to be used during the Engineering Phase, the SAS FAT and the Operators Training.  |
| Operator Training System (OTS)                              | French Consultancy Company                            | Operator Training System for a Gas Treatment Train   | IndissPlus        | 2013 | United Arab Emirates | Operator               | Natural Gas    | A Direct-Connect Operator Training System was being developed for the UAE operator of a Natural Gas Treatment plant   |
| Dynamic Simulation Modelling Study; Flow Assurance Analysis | Korean EPC Company for an Abu Dhabi Oil Company       | Dynamic Simulation Study for a Field Development Project in the Persian Gulf   | OLGA              | 2013 | United Arab Emirates | EPC                    | Oil & Gas      | To carry out Dynamic simulation of the integrated process system including artificial islands and Zirku islands process facilities. Prepare all calculations required to ensure smooth start-up, adequate safety response to anticipated emergencies, and orderly shutdown of the systems   |
| Dynamic Simulation Modelling Study                          | Major Oil&Gas Company                                 | Dynamic Model version upgrade  | Aspen HYSYS       | 2013 | Azerbaijan           | Operator               | Oil & Gas      | The dynamic model previously developed by Inprocess was requested to be upgraded to a newer version   |
| Dynamic Simulation Study for Process Control Analysis       | French Exploration & Production Company               | Dynamic Simulation Study to analyse the Controllability of the Slug Catcher and the first Separator in a Gabon O&G Plant | Aspen HYSYS       | 2013 | Gabon                | EPC                    | Oil & Gas      | A Dynamic Simulation Study was carried out to analyse the controllability in order to optimize it, for the new Slug Catcher and Separator in an onshore Oil & Gas Separation Plant in Gabon.  |





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|---|---|--|-------------------|------|--------------|--------------|----------------|--|
| Operator Training System (OTS)                        | Turkish Petroleum Refinery                  | Operator Training System for a Delayed Coker (Emulated Solution) + Knowledge Improvement Program (KIP) | Aspen HYSYS       | 2013 | Turkey       | Operator     | Refining       | The operator of the Turkish refinery requested Inprocess to develop a dynamic model of their delayed Coker, including an emulation of the DCS system in operation. This emulated OTS will be used to train the refinery operators on the normal and abnormal operation of the Coker.   |
| Steady State Simulation Modelling Study               | Major Chemical Company (Spanish brand)      | Steady State Study for a Depropanizer Column   | Aspen HYSYS       | 2013 | Spain        | Operator     | Bulk Chemicals | A Steady State model of the depropanizer column of a propylene plant was developed by Inprocess. The model was used to simulate the column behaviour for two new operating points candidates   |
| Steady State Simulation Modelling Study               | Saudi Refining Company                      | Steady State Simulation Study for a CDU/VDU system processing 100% of KH Crude Oil                     | Aspen HYSYS       | 2013 | Saudi Arabia | Operator     | Refining       | Our client will expand developed simulation model for 50:50 AL: KH under a Clean fuel project to create a new process simulation model to reflect 100% KH crude oil. The new process simulation shall be developed for Crude and Vacuum Distillation units including CDU Naphtha Stabilizer columns.   |
| Steady State Simulation Modelling Study               | German Petroleum Refinery                   | Steady State Simulation of a refinery Mild Hydrocracker (HMC)  | Aspen HYSYS       | 2013 | Germany      | Operator     | Refining       | One of Inprocess existing refinery customers requested to update their existing steady state model for the Mild Hydrocracker (MHC) unit with all encon measures and some additional equipment like amines system, to have a complete simulation for the MHC unit.  |
| Hydrogen Network Study                                | Spanish Petroleum Refinery                  | Refinery Hydrogen Network Flowrates Optimization   | Aspen HYSYS       | 2013 | Spain        | Operator     | Refining       | The Inprocess optimization application was focused on the H2 Network, with all suppliers and consumers units of the Refinery and external suppliers/consumers. Inprocess analysed the way the hydrogen network was being managed in the Refinery and it determined how it could be optimally operated by an online application, Inprocess' H2 Network Optimizer.   |
| Dynamic Simulation Study for Process Control Analysis | London-based Oil & Gas Major - E&P Division | Control strategy and parameters determination for a flow recycle controller                            | Aspen HYSYS       | 2013 | Azerbaijan   | Operator     | Oil & Gas      | Customer found that the MOL pump minimum flow controller showed a very slow response. Since the recycle valve was fully closed most of the time, it is difficult to get any actual plant data to improve the controller response. Based on the existing dynamic model, customer is interested to analyse the control strategy and calculate the pre-settings of the flow recycle controller of the MOL pumps |

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|--|---|--|-------------------|------|----------|------------------------|-------------|---|
| Dynamic Model linked to DCS                      | Norwegian FPSO Operator                               | Verification of a previous dynamic model for OTS and tuning of PID controllers | Aspen HYSYS       | 2013 | Norway   | Operator               | Oil & Gas   | Project Engineering company requested to Inprocess to review, update and improve an existing dynamic model of the FPSO that was developed by a third company in order to build an Operator Training System. Additionally, once the model is closer to plant reality, customer wants Inprocess to tune the control loops of controllers in the DCS   |
| Dynamic Simulation Study for Compression Systems | Swiss compressor manufacturer for an FPSO constructor | Dynamic Simulation Study for a Reinjection Compressor                          | Aspen HYSYS       | 2013 | Malaysia | Equipment Manufacturer | Oil & Gas   | Dynamic simulation to prove the Anti surge valve sizing and to analyse if any further safety device i.e. Cold gas bypass Valve or Hot gas bypass valve is required to protect the compressor from surge excursions that would harm the compressor   |
| Dynamic Simulation Modelling Study               | Dutch Exploration and Production Company              | Dynamic Simulation Study for a FPSO in Brazil                                  | Aspen HYSYS       | 2013 | Brazil   | Operator               | Oil & Gas   | Inprocess client was interested in obtaining the results from several case studies run for different operating conditions and for different emergency scenarios of the FPSO. The main objective of the whole study was to proof the selected control strategies were fit for purpose. Additionally, the study should verify the operability and robustness of the process control system and to check whether controllers that are to be implemented work as intended |
| Software Extension and Programming               | Compressor Manufacturer                               | Tailoring an existing HYSYS extension (controller) as per customer request     | Aspen HYSYS       | 2013 | Italy    | Equipment Manufacturer | Natural Gas | After using the release candidate version of the HYSYS extension, a number of modifications to the Graphical User Interface and workflow had been identified. These changes were intended to streamline the usage of the extension along with providing additional options to improve its features.   |
| Dynamic Simulation Modelling Study               | Norwegian FPSO Operator                               | Dynamic Model Development of a FPSO  | Aspen HYSYS       | 2013 | Norway   | Operator               | Oil & Gas   | Client wanted to see, in a proof of concept way, the benefits of developing a dynamic model of the FPSO   |

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|--|--------------------------------|--|-------------------|------|------------|------------------------|----------------|---|
| Dynamic Simulation Modelling Study               | Italian Engineering Company    | Dynamic Simulation Study for a Gas Utilization Plant                     | Aspen HYSYS       | 2013 | Italy      | EPC                    | Oil & Gas      | <p>The Project's objective was to deliver dynamic simulation of the provided process scheme, including additional details from PFD to be supplied. Possible uses of the dynamic model were:</p> <ul style="list-style-type: none"> <li>• Evaluate operational procedures</li> <li>• Determine the effects of unit trips (compressors, pumps, heating medium, etc.).</li> <li>• Ensure compressors' protective and safety systems operate effectively under all require conditions</li> <li>• Evaluate the operation of the existing columns</li> <li>• Verify that the control system operates effectively under the required conditions</li> </ul> |
| Dynamic Simulation Study for Compression Systems | German Compressor Manufacturer | Dynamic Simulation Study for the compressors in a Floating LNG           | Aspen HYSYS       | 2013 | Brazil     | Equipment Manufacturer | Natural Gas    | <p>The project main objective was to deliver a dynamic simulation study to check and confirm the operation of the Excess bog compressor for the Floating LNG project under a number of defined procedural and upset conditions. The model allowed evaluating the design and identifying potential problems</p>  |
| Hydrogen Network Study                           | Spanish Petroleum Refinery     | Hydrogen Network Optimizer installation and execution                    | Aspen HYSYS       | 2013 | Spain      | Operator               | Refining       | <p>The proposed optimization application was focused on the H2 Network, with all suppliers and consumers units of the Refinery and external suppliers/consumers. Inprocess had analysed the way the hydrogen network was being managed in the Refinery and how it was able to be optimally operated by an online application, here referred as H2 Network Optimizer.</p>  |
| Dynamic Simulation Modelling Study               | Spanish Engineering Company    | DSS for the compression system of a Combined Cycle Power Plant           | Aspen HYSYS       | 2013 | Bangladesh | EPC                    | Petrochemicals | <p>Steady State check and Dynamic Simulation Study to verify the fuel supply to the gas turbine in the combined cycle was always ensured in front of several equipment malfunctions and unexpected disturbances</p>   |
| Knowledge Improvement Program (KIP)              | Norwegian FPSO Operator        | Technical Support in developing a simulation model during pre-FEED phase | Aspen HYSYS       | 2013 | Norway     | Operator               | Oil & Gas      | <p>Optimization of a simulation model developed in Aspen HYSYS. The model was enhanced and a process control report was issued.</p>   |

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|--|--|--|-------------------|------|---------|--------------|----------------|---|
| Dynamic Simulation Study for Compression Systems | Petroleum Refinery in Spain                            | Dynamic Simulation Study for the propylene storage and refrigeration system  | Aspen HYSYS       | 2013 | Spain   | Operator     | Refining       | A dynamic process simulation study of the storage system was delivered in order to evaluate the required compressor capacity. The capacity evaluation was based on the dynamic analysis of the produced gas during selected operating modes of the plant  |
| Flare Systems Analysis                           | Spanish Petroleum Refinery                             | Flare Network Revalidation Study   | Aspen HYSYS       | 2013 | Spain   | Operator     | Refining       | In this study, Inprocess executed the revalidation of the existing refinery PSVs by means of process simulation. All possible contingencies was simulated, flare loads was recalculated and PSVs, resized (API 520). With these newly determined PSVs and flare loads, the entire flare network was been as well revalidated (API 521)                              |
| Operator Training System (OTS)                   | Spanish Oil Company (Chemical Division) - China branch | Operator Training System for two large chemical plants   | Aspen HYSYS       | 2012 | China   | Operator     | Petrochemicals | Operator Training System for two new chemical plants with a total of 3000 I/O points, based on dynamic simulation model, DeltaV control system & SIS emulation, and using Inprocess' proprietary Instructor Station (IIS)   |
| Operator Training System (OTS)                   | Spanish Petroleum Refinery                             | Process Trainer tool for a series of distillation columns  | Aspen HYSYS       | 2012 | Spain   | Operator     | Petrochemicals | The client was interested in providing a hands-on training environment for the control room operators of their two deethanizer columns in the refinery cracker. This process trainer should improve the understanding of the process and the coordination of the operational shifts   |
| Dynamic Simulation Modelling Study               | Italian Engineering Company                            | DSS applied to analyse operational scenarios in project design phase   | Aspen HYSYS       | 2012 | Italy   | EPC          | Oil & Gas      | Dynamic Simulation Studies were conducted on behalf of the final operator of the oil & gas plant to analyse operational scenarios (what-if studies) in order to predict potentially critical operational conditions before they actually happen: effect of incorporating additional equipment; effect of equipment trips; operational bottlenecks (column capacity) |
| Dynamic Simulation Modelling Study               | Solvent Recovery Company in Germany                    | DSS to evaluate the performance of the hot oil system servicing the reboiler of a distillation column under a number of emergency situations | Aspen HYSYS       | 2012 | Germany | Operator     | Petrochemicals | The client was interested in evaluating the dynamic behaviour of the heating oil system in the distillation column reboiler during emergencies. In particular, the control system performance and the maximum temperature increase rate.  |

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| Project Type   | Customer   | Project Title   | Process Simulator | Year | Country      | Company Type           | Industry  | Short Description  |
|--|--|---|-------------------|------|--------------|------------------------|-----------|--|
| Dynamic Simulation Modelling Study; Flare Systems Analysis | German E&P Operating Company                               | DSS to evaluate the performance of current flare system after a plant expansion                                 | Aspen HYSYS       | 2012 | Libya        | Operator               | Oil & Gas | The goal of the study was to investigate if the existing HP emergency flare system was sufficient for the safe blow-down of the gas lift plant as result of the gas lift facilities extension and the new depressurization devices installed, following the API guideline. |
| Operator Training System (OTS)                             | Exploration and Production Company in Bolivia              | Operator Training System for Gas Field  | Aspen HYSYS       | 2012 | Bolivia      | EPC                    | Oil & Gas | The second phase of this OTS project considers the expansion of the dynamic model with the addition of the new units of the second Central Processing Facilities, so that the entire plant was included in a single OTS  |
| Dynamic Simulation Study for Compression Systems           | German Compressor Manufacturer for a LNG Operator          | Dynamic Simulation Study to check and confirm the protection and correct operation of a maintenance compressor  | Aspen HYSYS       | 2012 | Germany      | Equipment Manufacturer | Oil & Gas | Dynamic Simulation Study to verify that the anti-surge system provides adequate protection; that the isolation valve response time was adequate; that the control valves' actuator rates was right; and that the system responds properly to load changes                  |
| Dynamic Simulation Study for Compression Systems           | Norwegian FPSO Operator                                    | Dynamic Simulation Study of the Dry Gas Export System (DGES) of an FPSO   | Aspen HYSYS       | 2012 | Norway       | Operator               | Oil & Gas | Dynamic Simulation Study to evaluate different emergency and normal operation scenarios for the compression system exporting the dry gas from a FPSO platform  |
| Dynamic Simulation Modelling Study                         | Spanish Engineering Company                                | Dynamic Simulation Study for a Gas Turbine System   | Aspen HYSYS       | 2012 | Saudi Arabia | EPC                    | Oil & Gas | Dynamic Simulation Studies for the gas system in order to identify if this system was able to maintain the gas feed according to the gas turbine manufacturer requirement  |
| Dynamic Simulation Study for Compression Systems           | German Compressor Manufacturer for a floating LNG Operator | Dynamic Simulation Study to check and confirm the protection and correct operation of a regeneration compressor | Aspen HYSYS       | 2012 | Germany      | Equipment Manufacturer | Oil & Gas | Dynamic Simulation Study to verify that the anti-surge system provided adequate protection; that the isolation valve response time was adequate; that the control valves' actuator rates was right; and that the system responds properly to load changes                  |
| Flare Systems Analysis; HIPPS or other Depressurization    | Dutch Exploration and Production Company                   | CO2 Compression Blow down Study for FPSO  | VMGSim            | 2012 | Brazil       | Operator               | Oil & Gas | Blow down studies of the CO2 compression system of a FPSO to determine the temperature profile and phase behaviour during depressurization of the "at risk" sections in order to determine if there was a real possibility of forming dry ice during compressor blow down  |



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| Project Type                            | Customer                                       | Project Title  | Process Simulator | Year | Country      | Company Type           | Industry  | Short Description  |
|---|--|--|-------------------|------|--------------|------------------------|-----------|--|
| Software Extension and Programming      | Compressor Manufacturer                        | HYSYS Dynamic Extension for Voith Vorecon Simulation Tool  | Aspen HYSYS       | 2012 | Italy        | Equipment Manufacturer | Oil & Gas | Development of a dynamic extension module to incorporate a variable speed planetary gear type RWE model by integrating the Voith Vorecon Simulation Tool.  |
| Software Extension and Programming      | Arabian National Oil Major - Refining Division | CDU/VDU Pre-heat Train Performance Monitoring and Cleaning Schedule Evaluation Tool                              | Aspen HYSYS       | 2012 | Saudi Arabia | Operator               | Refining  | Inprocess developed a complete application to perform heat exchanger fouling monitoring for a 124000 BPD refinery CDU/VDU and, based on the predicted trends, it developed an automated tool to run different heat exchanger cleaning scenarios over one year of operation.  |
| Operator Training System (OTS)          | Compressor Manufacturer                        | OTS for a two-train compression system   | Aspen HYSYS       | 2012 | Algeria      | Equipment Manufacturer | Oil & Gas | Operator Training System for an Oil & Gas processing plant, using Inprocess proprietary Instructor Station (IIS) and Mark VI emulator (including operator HMI) for anti-surge control including the connectivity to GE proprietary turbine dynamic model (Easy5)   |
| Dynamic Model linked to DCS             | London-based Oil Major - (E&P Division)        | Controllability Study using Dynamic Simulation. Phase 2  | Aspen HYSYS       | 2012 | Azerbaijan   | Operator               | Oil & Gas | Inprocess developed a dynamic process simulation model of an existing oil production platform. The model was connected to the existing ABB DCS using OPC - in order to test new control strategies before implementing these into the real plant. Inprocess also developed a graphical user-friendly interface for the model.                                  |
| Steady State Simulation Modelling Study | German Petroleum Refinery                      | Reformer Model Calibration and Training  | Aspen HYSYS       | 2012 | Germany      | Operator               | Refining  | For model calibration, a Reformer model of one refinery Unit that represents the actual plant was developed. The model was calibrated using one set of plant test runs. The model delivery was combined with a model delivery workshop at refinery site, where the main model characteristics were explained and the possible use of the model were described. |
| HIPPS or other Depressurization         | Spanish EPC for an E&P Company in Bolivia      | Depressurization Study for the Central Processing Facilities and Exporting System of a Field Development Project | Aspen HYSYS       | 2012 | Bolivia      | EPC                    | Oil & Gas | Dynamic Simulation of the depressurization scenarios of the Central Process Facility of a Bolivian O&G field following the calculation normative of the operating company  |



## Inprocess References List: 2008-2023

| Project Type  | Customer  | Project Title  | Process Simulator | Year | Country      | Company Type           | Industry       | Short Description   |
|---|---|--|-------------------|------|--------------|------------------------|----------------|---|
| Dynamic Simulation Study for Compression Systems            | Swiss compressor manufacturer for a Middle East NOC   | DSS for a new single train, four stage, gas lift compression system              | Aspen HYSYS       | 2012 | Oman         | Equipment Manufacturer | Oil & Gas      | Development of a dynamic simulation model for the Zauliyah new Gas Lift Compressor Package consisting of a single train four stage compression system with 4 gas coolers and 5 scrubbers. The existing plant was not modelled as part of project scope  |
| ITOP; Training Courses for Operators                        | Japanese Chemicals Company - Spanish Site             | Multi-year Training Program for Plant Operators based on Inprocess' program ITOP | Aspen HYSYS       | 2012 | Spain        | Operator               | Bulk Chemicals | Inprocess was carrying out 20 days of operator education per year using ITOP. ITOP is Inprocess' approach for training operator in subjects like Process Engineering, and Unit Operation  |
| HIPPS or other Depressurization                             | Dutch Exploration and Production Company              | Production HIPPS and Test HIPP studies on a FPSO plant                           | Aspen HYSYS       | 2012 | Brazil       | Operator               | Oil & Gas      | Dynamic Simulation Study using process simulation to evaluate the pressure protection systems for the facilities  |
| Flare Systems Analysis; Knowledge Improvement Program (KIP) | Petroleum Refinery in Spain                           | Knowledge Transfer for the dynamic modelling of an atmospheric crude unit        | Aspen HYSYS       | 2012 | Spain        | Operator               | Refining       | Client was interested in enhancing their dynamic simulation skills through the joint development of the dynamic model of the refinery crude fractionator. Event scheduler was configured for the study of the column under 17 different scenarios for the assessment of the PSV and the vent header size.   |
| Flow Assurance Analysis; HIPPS or other Depressurization    | Milan-based EPC for an Arabian Oil Major              | HIPS Study for Gas Fields Development  | Aspen HYSYS; OLGA | 2012 | Saudi Arabia | EPC                    | Oil & Gas      | Dynamic Simulation Study to evaluate HIPPS system of an upstream process plant for new operating conditions, using OLGA.  |
| Dynamic Simulation Study for Compression Systems            | Swiss compressor manufacturer for an FPSO constructor | Dynamic Simulation Study of a flash gas compressor                               | Aspen HYSYS       | 2012 | Malaysia     | Equipment Manufacturer | Oil & Gas      | Inprocess carried out a dynamic compressor simulation study to analyse the following design and operational aspects: <ul style="list-style-type: none"> <li>• Cold-Gas-Bypass requirement &amp; sizing</li> <li>• Analysis of Settle-Out Conditions</li> <li>• Verification of PSV and pressure Alarm Settings</li> <li>• Blow-Down Conditions (blow down valve open delays, etc.)</li> </ul> |
| Hydrogen Network Study                                      | Spanish Petroleum Refinery                            | Feasibility Study for Control and Optimization of Hydrogen Network               | Aspen HYSYS       | 2012 | Spain        | Operator               | Refining       | A feasibility study for an online application (H2 Network Optimizer) was carried out, focusing on the site H2 network (with all consumers and suppliers from the refinery, the petrochemical plant and externals), to consider ways to improve network management.  |



## Inprocess References List: 2008-2023

| Project Type                                     | Customer                                      | Project Title  | Process Simulator | Year | Country           | Company Type           | Industry       | Short Description  |
|--|---|--|-------------------|------|-------------------|------------------------|----------------|--|
| Dynamic Model linked to DCS                      | Norwegian FPSO Operator                       | Dynamic Simulation to Support FPSO design  | Aspen HYSYS       | 2011 | Norway            | EPC                    | Oil & Gas      | Client already developed the bulk of the dynamic model and requests Inprocess to further support these modelling activities, i.e. with regards to further updating & validating the model and to connect the model to an emulation of the DCS. |
| Software Extension and Programming               | London-based Oil Major - Refining Division    | Refsys Extension Development   | Aspen HYSYS       | 2011 | USA               | Operator               | Refining       | Inprocess developed a software extension that links process and refining simulator to an existing in-house calculation routine (DLL) developed by our client.  |
| Equipment Monitoring                             | Multinational Chemical Company - Spanish site | Simulation-based Online monitoring of a twin Heat Exchanger                                | Aspen HYSYS       | 2011 | Spain             | Operator               | Petrochemicals | Simulation-based online monitoring of twin Heat Exchangers. The application was tracking fouling factors of the exchangers and offers prediction functionalities to support operational decisions, e.g. when to clean the exchanger.           |
| Dynamic Simulation Study for Compression Systems | Milan-based EPC                               | DSS for a Compressor refrigeration loop and export gas compressor                          | Aspen HYSYS       | 2011 | Italy             | EPC                    | Oil & Gas      | Dynamic Simulation Study of the refrigeration loop and export gas compressors  |
| Operator Training System (OTS)                   | Spanish Engineering Company                   | Operator Training System for a lube oil plant  | Aspen HYSYS       | 2011 | Spain             | EPC                    | Refining       | Integration of an existing dynamic process model into a new Operator Training System for a Lube Oil Plant. The OTS is based on generic DCS operator views and uses Inprocess' Instructor Station.  |
| Dynamic Simulation Study for Compression Systems | Norwegian FPSO Operator                       | Support for the dynamic analysis of a wide variety of operating scenarios for the new FPSO | Aspen HYSYS       | 2011 | Norway            | EPC                    | Oil & Gas      | Inprocess supported the dynamic analysis of a wide variety of operating scenarios for the new FPSO.  |
| Operator Training System (OTS)                   | Compressor Manufacturer                       | OTS for an LNG plant compressor using Inprocess proprietary Instructor Station (IIS)       | Aspen HYSYS       | 2011 | Malaysia          | Equipment Manufacturer | Oil & Gas      | In a process licensed by Air Products, Inprocess focused the efforts in modelling the Mixed Refrigerant (MR) and the C3 Train sections with special attention to the compressor areas, coolers and vaporizers zones.                           |
| Flare Systems Analysis                           | Major Oil&Gas Company                         | Dynamic Flare Load Study for a Platform in Trinidad & Tobago                               | Aspen HYSYS       | 2011 | Trinidad & Tobago | Operator               | Oil & Gas      | Model the blowdown of several holdups of a platform in order to study the cold temperature penetration along the vent header.  |
| Dynamic Simulation Modelling Study               | London-based Oil Major - Refining Division    | DSS to analyse the warm-up behaviour of a Coker Drum                                       | Aspen HYSYS       | 2011 | USA               | Operator               | Refining       | Inprocess developed a dynamic simulation model to study the transient warm-up behaviour of an existing coke drum - when charged with the off-gases from the online drum. This model was then used to evaluate planned process changes.         |

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## Inprocess References List: 2008-2023

| Project Type                                     | Customer                                      | Project Title   | Process Simulator | Year | Country  | Company Type           | Industry  | Short Description  |
|--|---|---|-------------------|------|----------|------------------------|-----------|--|
| Operator Training System (OTS)                   | Spanish EPC for an E&P Company in Bolivia     | Operator Training System for Gas Field  | Aspen HYSYS       | 2011 | Bolivia  | EPC                    | Oil & Gas | Operator Training System based on a dynamic model linked to DeltaV DCS and SIS. Total I/O point was 1600.  |
| Dynamic Simulation Modelling Study               | Italian Oil & Gas Major (E&P Division)        | Dynamic process model development of separation train   | Aspen HYSYS       | 2011 | Italy    | Operator               | Oil & Gas | Dynamic process model development of separation processes of one train of a production asset. The model was to be integrated into the DOFF infrastructure, which was being developed to support the operations team in taking control of primary separators during slug generation --> thus, avoiding unexpected plant shutdowns.  |
| Dynamic Simulation Study for Compression Systems | Swiss compressor manufacturer                 | Dynamic compressor station simulation study to analyse several design and operational aspects | Aspen HYSYS       | 2011 | Malaysia | Equipment Manufacturer | Oil & Gas | Inprocess carried out a dynamic compressor simulation study to analyse the following design and operational aspects: <ul style="list-style-type: none"> <li>• Cold-Gas-Bypass requirement &amp; sizing</li> <li>• Analysis of Settle-Out Conditions</li> <li>• Verification of PSV and pressure Alarm Settings</li> <li>• Blow-Down Conditions (blow down valve open delays, etc.)</li> <li>• Analysis of Hydrate Formation or Liquid Formation in piping during depressurization</li> </ul> |
| Flare Systems Analysis                           | Italian EPC for a Polish Natural Gas Operator | Dynamic flare system wall temperature calculations during the blow-down of a compressor unit  | Aspen HYSYS       | 2011 | Italy    | EPC                    | Oil & Gas | Dynamic flare system wall temperature calculations during the blow-down of a compressor unit   |
| Knowledge Improvement Program (KIP)              | Italian Oil & Gas Major (E&P Division)        | KIP for Dynamic Simulation of a gas conditioning plant  | Aspen HYSYS       | 2011 | Italy    | Operator               | Oil & Gas | Following the success of the initial KIP for dynamic simulation, the client deploys Inprocess' KIP concept to a larger gas conditioning plant: In a first step, Inprocess developed the dynamic model. In a subsequent phase the client was trained in developing and using the model.   |
| Dynamic Simulation Modelling Study               | London-based Oil Major - Refining Division    | DSS to analyse the hydraulics behaviour during dumping of HF to dump drum                     | Aspen HYSYS       | 2011 | USA      | Operator               | Refining  | Inprocess developed a dynamic process model of the HF reactor and the dump drum in order to support our client in assessing the safe design of a new HF Reactor. For this study, Inprocess applied dynamic process modelling for investigating the behaviour of the reactor loop during an Emergency Shut-Down (ESD).  |



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|---|---|---|-------------------|------|----------------------|------------------------|----------------|---|
| Dynamic Simulation Study for Compression Systems      | Italian Compressor Manufacturer for a Middle East NOC | DSS to check and confirm the operation of compressor trains of a compressor station             | Aspen HYSYS       | 2010 | United Arab Emirates | Equipment Manufacturer | Oil & Gas      | Dynamic simulation studies to check and confirm the operation of compressor trains of a compressor station under a number of defined procedural and upset conditions  |
| Dynamic Simulation Study for Compression Systems      | Compressor Manufacturer                               | Dynamic Simulation Study for a Compression System (two trains, 2 stages each)                   | Aspen HYSYS       | 2010 | Thailand             | Equipment Manufacturer | Oil & Gas      | Dynamic simulation studies to check and confirm the operation of compressor trains of a compressor station under a number of defined procedural and upset conditions  |
| Dynamic Simulation Study for Process Control Analysis | Spanish Ethylene Cracker Operator                     | SS and Dynamic models development of a double column C3 splitter unit to be used for APC revamp | Aspen HYSYS       | 2010 | Spain                | Operator               | Petrochemicals | Development and calibration of Steady-State and Dynamic model of a double C3 splitter with reboiler/Condenser heat integration, including the associated DMCplus controller. Obtain the non-linearity gain curves for each pair independent-dependent variable of the associated DMCplus controller. Validate the Dynamic model against plant historic data feed to the Dynamic model. Perform virtual Step-test over HYSYS Dynamic model to obtain the HYSYS-based DMCplus model and review design. Educate customer on the project details. |
| Dynamic Simulation Study for Compression Systems      | Milan-based EPC for a Middle East NOC                 | DSS for Gas Processing and Sulphur Plants Compressors   | Aspen HYSYS       | 2010 | Italy                | EPC                    | Oil & Gas      | Dynamic Compressor Study of 6 compressor trains.  |
| Dynamic Model linked to DCS                           | London-based Oil Major - (E&P Division)               | Controllability Study of an LP Separation Train using Dynamic Simulation. Phase 1               | Aspen HYSYS       | 2010 | Azerbaijan           | Operator               | Oil & Gas      | Development of a dynamic process simulation model of an existing oil production platform. The model was connected to the existing ABB DCS using OPC, in order to test new control strategies before implementing these into the real plant. Inprocess also developed a graphical user-friendly interface for the model.   |
| Software Extension and Programming                    | London-based Oil Major - Refining Division            | Refsys Extension Development  | Aspen HYSYS       | 2010 | USA                  | Operator               | Refining       | Inprocess improved the functionality, usability and robustness of an existing refinery software extension that our client previously developed.   |

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| Project Type                                     | Customer                              | Project Title   | Process Simulator | Year | Country              | Company Type | Industry  | Short Description  |
|--|---------------------------------------|---|-------------------|------|----------------------|--------------|-----------|--|
| Dynamic Simulation Study for Compression Systems | Global EPC (UK office) for Libyan O&G | Dynamic Simulation Study for a Gas Recovery Module  | Aspen HYSYS       | 2010 | Libya                | EPC          | Oil & Gas | Dynamic Process Simulation Compressor Study for a new off-shore platform. The study focuses on the operability and controllability issues of the complex four stage compression train as well as on safety issues.   |
| Knowledge Improvement Program (KIP)              | Madrid-based EPC                      | Dynamic Simulation know-how transfer based on a Dynamic Simulation Study project                    | Aspen HYSYS       | 2010 | Spain                | EPC          | Oil & Gas | Training Programme based on a number of training sessions to be executed in parallel to the execution of a dynamic simulation study project in order to effectively deploy dynamic simulation know-how.  |
| Dynamic Simulation Modelling Study               | Madrid-based EPC                      | Dynamic Simulation Studies to test the controllability of the revamped production separators        | Aspen HYSYS       | 2010 | United Arab Emirates | EPC          | Oil & Gas | Dynamic simulation studies for a production separator system in order to check and confirm its operability under a number of defined procedural and upset conditions of the producing facilities.  |
| Dynamic Simulation Study for Compression Systems | Spanish EPC for a Middle East NOC     | Dynamic Simulation Study (DSS) for an Abu Dhabi Field development project                           | Aspen HYSYS       | 2010 | United Arab Emirates | EPC          | Oil & Gas | Dynamic simulation compressor study for a new centrifugal compressor line integrated into an existing reciprocating compressor train. The study focuses on the design of the new equipment as well as on the operability and controllability of the complete compression system. |
| Steady State Simulation Modelling Study          | German Petroleum Refinery             | Steady State Model of a Hydrocracker Unit   | Aspen HYSYS       | 2010 | Germany              | Operator     | Refining  | Inprocess developed a steady state model of an existing hydrotreating process unit including the detailed representation of the heat exchangers. This model was used by the client for energy studies.   |
| Flow Assurance Analysis                          | Madrid-based EPC for an Emirates NOC  | Flow Assurance in Transfer Lines for an Abu Dhabi Field development, using OLGA software            | OLGA              | 2010 | United Arab Emirates | EPC          | Oil & Gas | Flow assurance study using OLGA for a transfer line to evaluate slugging, surge, hydrates, etc. during different initial and operation conditions (ramp-up, ramp-down, pigging, etc.).   |
| Flow Assurance Analysis                          | Madrid-based EPC for an Emirates NOC  | Flow Assurance in Transfer Lines for an Abu Dhabi Field development, using OLGA software            | OLGA              | 2010 | United Arab Emirates | EPC          | Oil & Gas | Flow assurance study using OLGA for two transfer lines to evaluate slugging, surge, hydrates, etc. during different initial and operation conditions (ramp-up, ramp-down, pigging, etc.).  |
| Flow Assurance Analysis                          | Madrid-based EPC for an Emirates NOC  | Simulation of Gas Dissolution in a MOL line for an Abu Dhabi Field development, using OLGA software | OLGA              | 2010 | United Arab Emirates | EPC          | Oil & Gas | Transient analysis using OLGA to study gas dissolution and flow assurance after gas injection into a transportation oil pipeline.  |

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| Project Type   | Customer                                      | Project Title  | Process Simulator | Year | Country      | Company Type           | Industry       | Short Description   |
|--|---|--|-------------------|------|--------------|------------------------|----------------|---|
| Dynamic Simulation Modelling Study; Flare Systems Analysis | German E&P Operating Company                  | Dynamic Blow Down Study for GUP and GOSP   | Aspen HYSYS       | 2010 | Germany      | Operator               | Oil & Gas      | Dynamic Blow Down Study to investigate the adequacy of an existing flare system and to analyse different blow-down options. The scope of the integrated dynamic process simulation model includes a number of process unit sections as well as the flare header.  |
| Knowledge Improvement Program (KIP)                        | Compressor Manufacturer                       | Knowledge Improvement Programme for Dynamic Compressor Modelling   | Aspen HYSYS       | 2010 | Germany      | Equipment Manufacturer | Oil & Gas      | Dynamic Process Simulation Study for a new compressor system combined with a number of training modules to train the client in the use and development of dynamic simulation models.  |
| Flare Systems Analysis                                     | German E&P Operating Company                  | Dynamic Flare Load Study to test the adequacy of current flare network   | Aspen HYSYS       | 2010 | Germany      | Operator               | Oil & Gas      | Dynamic Flare Load Study to investigate the adequacy of an existing flare system for new emergency conditions (fire) for a single vessel.   |
| HIPPS or other Depressurization                            | Milan-based EPC                               | Evaluation of the HIPPS system of an upstream process plant  | Aspen HYSYS       | 2009 | Italy        | EPC                    | Oil & Gas      | Dynamic Simulation Study to evaluate HIPPS system of an upstream process plant for new operating conditions.  |
| Knowledge Improvement Program (KIP)                        | German Petroleum Refinery                     | Knowledge Improvement Program (KIP) for Steady State Simulation of a Crude Unit with pre-flash and associated pre-heat train | Aspen HYSYS       | 2009 | Germany      | Operator               | Refining       | Inprocess developed a steady state crude unit model with pre-heat train for this refinery. The pre-heat train model can be manually updated from plant data and pre-heat train monitoring is supported. As part of the KIP, refinery process engineering team was trained in maintaining the model and using the complex model for different case studies - like predicting the pre-heat train performance after cleaning a specific heat exchanger |
| ITOP; Training Courses for Operators                       | Multinational Chemical Company - Spanish site | Multi-year Training Program for Plant Operators based on Inprocess' program ITOP   | Aspen HYSYS       | 2009 | Spain        | Operator               | Bulk Chemicals | Inprocess carried out >50days of operator education per year using ITOP = Inprocess Training for Operators tool (Unit Operations). The training content and schedule was adjusted to specific customer needs.   |
| Dynamic Simulation Study for Compression Systems           | Compressor Manufacturer                       | Dynamic Compressor Study including the anti-surge control as software extension  | Aspen HYSYS       | 2009 | Saudi Arabia | Equipment Manufacturer | Oil & Gas      | Dynamic Process Simulation Compressor Study including the development of the client's project specific anti-surge controller (implemented as a process simulator extension).  |

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|--|---------------------------------|--|-------------------|------|---------|------------------------|-----------|---|
| Dynamic Simulation Study for Compression Systems           | Compressor Manufacturer         | Dynamic Simulation Study for a Compression System (two trains, 2 stages each)  | Aspen HYSYS       | 2009 | Algeria | Equipment Manufacturer | Oil & Gas | Dynamic simulation studies to check and confirm the operation of compressor trains of a compressor station under a number of defined procedural and upset conditions  |
| Flow Assurance Analysis                                    | Italian EPC                     | Consultancy on integrating Pipeline and Facilities Models  | OLGA              | 2009 | Italy   | EPC                    | Oil & Gas | Our Simulation Experts were involved in Consultancy on integrating Pipeline and facilities to analyse flow assurance performance (applying HYSYS-OLGA link)   |
| Dynamic Simulation Study for Compression Systems           | Italian Compressor Manufacturer | Dynamic Process Simulation Compressor Study and external anti-surge, load sharing and performance controller integration | Aspen HYSYS       | 2009 | Italy   | Equipment Manufacturer | Oil & Gas | Dynamic Process Simulation Compressor Study and external anti-surge, load sharing and performance controller integration into commercial process simulators. This allowed a more accurate/realistic representation of the complete compressor system.   |
| Software Extension and Programming                         | Compressor Manufacturer         | New Unit Operation Development (Turboexpander) for dynamic process simulation  | Aspen HYSYS       | 2009 | Italy   | Equipment Manufacturer | Oil & Gas | Inprocess developed a new dynamic unit operation model for commercial process simulators. The complete model was consecutively connected to a PLC through OPC and used to develop a more efficient control design (instead of real equipment). In additional, some project equipment delivery phases were shortened by using the model to analyse extreme unit conditions and abnormal behaviour which could not be tested on real equipment. |
| Software Extension and Programming                         | Compressor Manufacturer         | Development of a connection between the PLC and the process simulation software  | Aspen HYSYS       | 2009 | Italy   | Equipment Manufacturer | Oil & Gas | In order to gain flexibility during the control design phase for compressors, Inprocess developed a connection between the PLC and the process simulation software. This connection allows exchanging analogue and digital signals between the compressor equipment simulation and the PLC control system, thus allowing Inprocess' customer to setup, modify and improve the logic control before start-up of the plant.                     |
| Dynamic Simulation Modelling Study; Flare Systems Analysis | German Petroleum Refinery       | DSS to determine the flare load of a crude unit and a Coker during a GPF   | Aspen HYSYS       | 2009 | Germany | Operator               | Refining  | Dynamic Simulation Study to determine the flare load of a crude unit and a Coker during a general power failure. The approach applied in this study has been described in an article that can be obtained from the download section of the Inprocess Webpage.   |



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| Project Type   | Customer                               | Project Title   | Process Simulator | Year | Country | Company Type | Industry  | Short Description   |
|--|--|---|-------------------|------|---------|--------------|-----------|---|
| Dynamic Simulation Modelling Study; Flare Systems Analysis | Global EPC for German Refinery         | Conceptual (non-detailed) Dynamic Flare Load Study for a Refinery Crude unit during a GPF | Aspen HYSYS       | 2009 | Germany | Operator     | Refining  | Conceptual dynamic simulation study to determine the flare load of a crude unit during a general power failure and a water breakthrough. The conceptual dynamic study allows for reduced detail and, therefore, reduced cost.   |
| Knowledge Improvement Program (KIP)                        | German Petroleum Refinery              | Knowledge Improvement Programme (KIP) for Steady State Simulation of Distillation         | Aspen HYSYS       | 2008 | Germany | Operator     | Refining  | Process Simulation Knowledge Improvement Programme (KIP) for Downstream Unit. Inprocess updated the existing model and trained the client's engineers in using the model to improve operations. The model has been used by the client to improve operations.  |
| Documentation  | Italian Oil & Gas Major (E&P Division) | Best Practices Documentation for Dynamic Simulation                                       | Aspen HYSYS       | 2008 | Italy   | Operator     | Oil & Gas | Development of client-specific "Best Practice Manual for Dynamic Process Simulation". This project helped to promote Dynamic Process Simulation to be used more often - whenever suitable.  |
| Knowledge Improvement Program (KIP)                        | Italian Petroleum Refinery             | KIP for Refinery SS Simulation: Topping & Vacuum Model Update and Maintenance             | Aspen HYSYS       | 2008 | Italy   | Operator     | Refining  | Inprocess Knowledge Improvement Programme (KIP) for Process Simulation of Crude and Vacuum Unit. Inprocess developed a steady state model for the client and trained the client's engineers in using and maintaining the model. One example of the case studies developed was related to the operation of the column with reduced condenser duty. |
| Training Program   | Milan-based EPC                        | Multi-year Process Simulation Training Program  | Aspen HYSYS       | 2008 | Italy   | EPC          | Oil & Gas | Multi-Year Training Programme on Process Simulation Packages (Upstream, Steady State, Dynamics, Advanced)<br>Total: > 30 courses  |
| Software Extension and Programming                         | Italian Oil & Gas Major (E&P Division) | HYSYS Integration with In-house simulator   | Aspen HYSYS       | 2008 | Italy   | Operator     | Oil & Gas | Development of IT infrastructure to integrate in-house simulator into Standard Process Simulation Software, while keeping the customer's Intellectual Property invisible to the users (Black Box approach).   |
| Dynamic Simulation Modelling Study; Flare Systems Analysis | German Petroleum Refinery              | Dynamic Flare Load Study for a Refinery Crude unit during a GPF                           | Aspen HYSYS       | 2008 | Germany | Operator     | Refining  | Dynamic Simulation Study to determine the flare load of a crude unit during a general power failure. This study has been described in a PTQ article that can be obtained from the download section of the Inprocess Webpage.  |





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|-------------------------------------|--|--|-------------------|------|---------|--------------|-----------|---|
| Flare Systems Analysis              | Multinational EPC - Italian site       | Dynamic Flare Load Study for Refinery Columns  | Aspen HYSYS       | 2008 | Italy   | EPC          | Refining  | Dynamic Simulation Project for the Italian office of a multinational EPC. Inprocess developed a number of dynamic models for different distillation columns to study the flare behavior for general power failure. The intention was to study the simultaneity of the flare load peaks. This study was presented at the 2008 Aspentech UGM.   |
| Knowledge Improvement Program (KIP) | Italian Oil & Gas Major (E&P Division) | KIP for the Dynamic Modelling & Technology Transfer for a Natural Gas Conditioning Plant | Aspen HYSYS       | 2007 | Italy   | Operator     | Oil & Gas | Inprocess applied its Knowledge Improvement Program (KIP) approach for dynamic process simulation by developing a dynamic model of an LTS gas plant and subsequently training the client in developing such a model. The model allows the users to evaluate current and future performance of the unit. The dynamic process simulation technology transfer sessions were held based on customized training material developed by Inprocess. This material remains with the customer for future usage. After completion of the model development and the training sessions, Inprocess provided consultancy to the client's process engineering team from our offices in Barcelona in order to motivate the customer's process engineers to develop their own models. As a result of this KIP, dynamic process simulation has seen much wider use with this client in the last few years. |