# Transpetro's InfoSCADA Project

## Application of the Proficy solution in the terminals and pipelines operated by Transpetro

By **Jediael Pinto Júnior**, Specialist Systems Coordinator at the National Center for Operational Control, Petrobras Transporte S.A. – Transpetro

The original article in Portuguese appeared in Petro & Química.

# Summary

Given the scope of Transpetro's geographic area, the need to centralize process data and provide this data to corporate users was identified. For this, it was necessary to implement a tool that would bring the data from the field supervisory systems, spread over the 49 terminals of Transpetro, to a single location, together with the data from the gas and oil pipelines, which are in Rio de Janeiro, and also allow access for corporate network users.

In this way, Transpetro created InfoSCADA, which is its PIMS (Process Information Management System). Today, InfoSCADA supports 150,000 tags and has 2,750 screens developed on the Proficy dashboard/portal, which allows simultaneous access by 100 users.

One of the areas that has benefited greatly from the implementation of InfoSCADA is maintenance. It is easier to access data and monitor variables — such as pressure, flow and temperature of notable points. In this way, the team started to have better conditions to act preventively in maintaining the operational bases.

InfoSCADA is today one of the best tools for monitoring maintenance, as well as for optimizing maintenance planning. Transpetro's operational bases precede the problems using the information provided by the system.

## Introduction

Petrobras Transporte SA - Transpetro is a wholly owned subsidiary of Petrobras, uniting the company's production, refining and distribution areas, with national operations and facilities in 19 of the 27 Brazilian states, also operating in the import and export operations of oil and oil products, gas and ethanol.

With more than 14 thousand kilometers of oil and gas pipelines, Transpetro stores and transports oil and oil products, biofuels and natural gas to the most remote points in Brazil. Billions of liters of fuel pass through a network of 7,517 kilometers of oil pipelines, 7,107 kilometers of gas pipelines (Figure 1), 21 onshore terminals, 28 waterway terminals and a fleet of approximately 53 oil tankers.
The Company is considered the largest natural gas processor in the country, with a processing capacity of 19.7 million m³ of the product and 4.5 thousand m³ of natural gas condensate per day. In 543 tanks, its storage capacity reaches 10 million m³.

*Figure 1 - Coverage of the geographical area of Transpetro gas pipelines*

Transpetro's corporate strategy has the mission of “meeting the needs of customers in a safe, profitable and integrated manner, with socioenvironmental responsibility, in the transport and storage of oil, oil products, gas, petrochemicals and biofuels, contributing to the development of the country.” The vision – “Transpetro, a transporter for the Petrobras System, will be innovative and multimodal, ready to operate abroad, according to the needs of Petrobras” - is achieved based on the following values: entrepreneurial spirit and overcoming challenges; permanent search for business leadership; focus on obtaining excellent results; workforce with a key element for the company's sustainability; excellence and leadership in matters of safety, health and preservation of the environment; and valuing the main stakeholders: shareholders, customers, employees, society, government, partners, suppliers and the community where the company operates.

## Development: The National Center for Operational Control – CNCO

The analysis of this strategy implies that safe and aware operations are decisive and reflect on Transpetro's operating result. Investments in technology aiming at the maximum reliability of its facilities are constant in the company and reflect the prioritization of technology combined with safety.

This binomial is present at the National Operational Control Center - CNCO, which centrally monitors the company's pipeline transportation operations, using state-of-the-art equipment. Altogether, there are more than 14 thousand kilometers of pipelines (oil and gas pipelines) supervised 24 hours a day and seven days a week. Created years ago, CNCO is prepared to meet the increased movement of Brazilian production of oil and oil products, natural gas and biofuels.

This centralized operation at CNCO provides increased efficiency and operational safety, as well as reduced costs, placing Transpetro in technological equality with the major international pipeline operators and at the technological forefront of pipeline transportation.

With an area of 1,200 m², the National Center for Operational Control occupies three floors of the headquarters building, located in Rio de Janeiro. From there, the operation technicians interact with the installations of the ducts and terminals, turning pumps on and off, opening and closing valves and changing points of operation of the loops, in addition to detecting leaks and simulating future operating conditions.

In the operating room of the National Operational Control Center (figure 2), remotely, 15 operating consoles control 100 pipelines and 37 pipelines spread over more than seven thousand kilometers. 11 compression stations are also operated by means of five operator consoles.

For terminals and compression stations, Transpetro's standard for supervision is iFIX HMI/ SCADA, part of the Proficy portfolio from GE Digital.

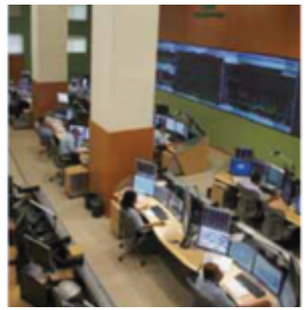


*Figure 2 - Videowall of the National Center for Operational Control*

## InfoSCADA Project

Given the scope of Transpetro's geographic area, there was a need to create a project to centralize all data and especially provide this data to corporate users. Thus, Transpetro created InfoSCADA, which is its PIMS (Process Information Management System), Level 4 of the automation pyramid.

PIMS (figure 3) allows the management of process information through the collection and storage in its temporal database and later visualization by management tools (spreadsheets, web reports, etc.), integrating with the business management system (Enterprise Resource Planning - ERP), production activities management system (Manufacturing Execution Systems - MES), laboratory information management system (LIMS) and others. This is because the shop floor information, acquired from the control systems, has a particular characteristic: it is time based. To identify a specific value, simply indicate a measurement point (tag) and a moment of time (timestamp). But, this process data requires collection and compression characteristics for storage, which are only available in temporal databases, and which result in better performance, both in the storage of information from control systems, which are sometimes collected with the speed of fractions of a second, as well as data recovery and optimization of disk space usage.

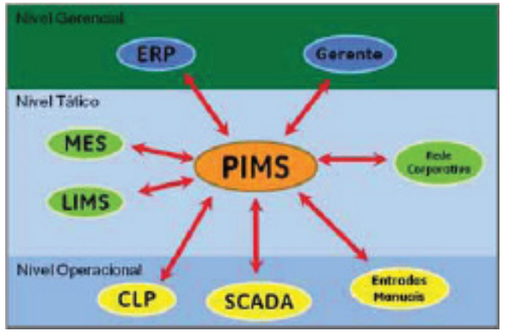
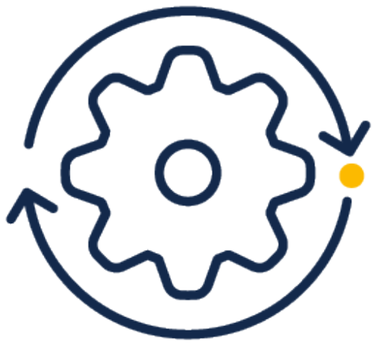



*Figure 3 - Process Information Management System (PIMS)*

The PIMS solution chosen by Transpetro was the implementation of the Proficy Historian and Proficy dashboard/portal software from GE Digital and marketed by its distributor in Brazil, Aquarius Software. It is an industrial database that offers a robust system for collecting, archiving and distributing large volumes of data from the factory floor. The software reads and stores process data through data collection via the OPC protocol, specific collection for iFIX HMI/ SCADA, CSV / XML files or customized interfaces. To ensure the availability of the information, it offers resources to collect data from redundant sources and store data locally in case of communication failure with the server, to transmit it when the connection is reactivated.

InfoSCADA came to solve some difficulties that Transpetro had been facing. For example, as SCADA systems are distributed geographically, there was no place to centralize data. If there was a need for data collection, it was necessary to ask the operation or automation technician to fill out a spreadsheet and send it to the headquarters in Rio de Janeiro. The company also needed corporate users to have access to SCADA data. In addition, there was a lack of a system for the general visualization of Transpetro's logistics, and there was also a difficulty for the maintenance team to access long-term historical data for failure analysis.

Therefore, it was necessary to implement a tool that would bring the data from the field supervisory systems, spread over the 49 terminals, to a single location, together with the data from the gas and oil pipelines, which are in Rio de Janeiro, and also allowing access for users of the corporate network, without jeopardizing the terminal automation network of the National Center for Operational Control.



## Architecture

The Transpetro architecture (figure 4) at each terminal and at the National Operational Control Center (figure 5) is composed of two SCADA systems (one hot and the other on standby), which are connected to the Petrobras intranet network - RIC (Rede Interna Corporativa = Internal Corporate Network). The project foresaw the installation of data collectors in these two SCADA systems, followed by the interconnection of this network through routers with firewall and security rules to the corporate network; and, finally, the installation of a data center with central historians, collecting this data and providing access via the web through servers. With this, any authenticated and authorized corporate user can access the web server system via the corporate network, from their computer, and check the process data, extract reports, and obtain all data from Transpetro terminals.

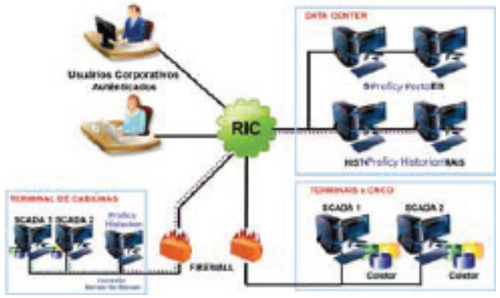



*Figure 4 - InfoSCADA Project Architecture for data collection and access for corporate users*

Analyzing the various proposals on the market, Transpetro opted for the Proficy dashboard/portal and Proficy Historian solutions, respectively the GE web portal and data collector. There were several reasons, but the main one was the ease


*Figure 5 - Screen with data from Pipelines of the portal of the National Center for Operational Control*

allowed by the integration with the supervisory system iFIX, which is standard in the company. It was not necessary to install any additional hardware on the terminals: the data collector was installed inside the machine where iFIX runs.

Interesting to note is the fact that collectors are installed in the two SCADA systems (as already said, one operating in hot and the other in stand-by), and the Proficy Historian could be programmed to recognize which is hot and which is standby, and that contributes to no data loss.

Another aspect to note is that the high availability mechanism of Proficy Historian, the Store & Forward feature, allows that, if communication is lost with the historian, the data that is archived locally during a certain period, sending it to the Proficy Historian when the communication is re-established, ensuring data availability for users.

Transpetro installed 114 collectors in 57 locations. Collectors are responsible for capturing the data of interest. They communicate directly with the information concentrator system and can communicate directly with SCADA. At the core of the architecture are servers, which have a historical database that can store Transpetro's current 80,000 historical tags in little space and in a very short search time. Transpetro is able to retrieve data recorded six months ago in a matter of seconds and generate graphs based on pre-established configuration parameters and sampling times. At the other end of the architecture are client applications, that is, users who will access this data. The current profile of users of the system includes a primary administrator and three more trained; 50 screen developers (duly trained local or head office employees) and more than a thousand users today, a number that should reach three thousand with the democratization of access.

Proficy Historian has a specific collector for iFIX and this was important during installation, since, in addition to a very simple configuration, information such as which tag should be recorded, description and engineering unit are automatically replicated. The historian reads the entire configuration from the iFIX database and identifies the configuration. In addition, Proficy Historian's own collectors (OPC, iFIX and others) manage redundancy natively: the server receives data from two providers and selects which data should be used, according to the provider that is active. These resources were fundamental for Transpetro because the company has two iFIX servers in each terminal as standard (a redundant pair).

The initial number of tag licenses was 100,000. This number was later increased to 150,000, to serve approximately 30,000 to 40,000 additional tags due to the entry of 11 new compression stations. The number of screens currently developed is 2,750 on the Proficy dashboard/portal, whose access has the capacity for 100 simultaneous users (with time-out programming to cancel inactive users and release licenses for new ones), and the connection to Proficy Historian also allows 100 concurrent connections.

## Data Visualization

It is important to note that the data can be accessed in reports and graphical screens of Proficy, through a computer using company-approved Internet browsers, or from Proficy Historian, which is the database, of two ways: via an OLE DB query - the user must be registered in the database with read access - or using the Microsoft Excel tool (Figure 6), through a plug-in.

It is an add-in offered by Proficy Historian, which is installed in Excel and allows you to connect to the database. It makes it possible, directly in Excel: to search for server tags; update values in real time; create reports; create historical or trend graphics; perform statistical analysis of the data, etc., in addition to allowing access to the data according to the user's profile.

In fact, not all users who have access to the Proficy dashboard/portal have access to Proficy Historian via Microsoft Excel, whose access is more restrictive and much more used by maintenance and process users in technical and engineering operations. The idea of accessing Proficy Historian through Microsoft Excel is the possibility for the user to do a dynamic search and create their own reports instantly.

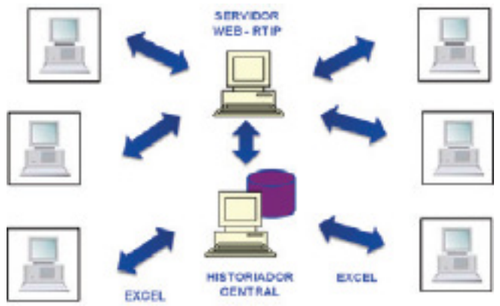



*Figure 6 - Access to Proficy Historian through Microsoft Excel*

## Cabiúnas Terminal

During the InfoSCADA implementation process, an extra need arose. For the Cabiúnas Terminal - which is the largest natural gas processing hub located in Macaé / RJ - it was necessary to expand servers and, therefore, adopt a local historian, exclusively for local data storage.

The Cabiúnas Terminal stores and transfers approximately 15% of the oil, processing part of the natural gas produced in the Campos Basin. Its processing capacity is 19.7 million m3 / day of gas and 4.5 thousand m3 / day of gas condensate. It consists of three URLs (Uindade de Recuperação de Líquidos - Liquid Recovery Unit), three UPCGNs (Unidade de Processamento de Condensado de Gás Natural - Natural Gas Condensate Processing Unit) and one URGN (Unidade de Resfriamento de Gás Natural - Natural Gas Cooling Unit).

Due to the large number of points, it was necessary to have a larger dedicated database to communicate. The architecture of iFIX at the Cabiúnas Terminal is made up of six pairs of SCADA servers, with 70 clients and three server terminals, with a license of 10 each for remote access, totaling today around 48,000 tags, adding all these six pairs.

The iFIX servers send their data to Proficy Historian, which acts as a local server, providing data to the Cabiúnas operating stations, and a server-to-server connection is made from the Historian of Cabiúnas to the Historian of PIMS of InfoSCADA.

The benefits of this solution in Cabiúnas have proved to be quite positive, especially since the amount of intelligent instrumentation data is now much greater than simply the process data itself. The equipment data is even more voluminous than the process data itself.

## Successful Application: Maintenance

One of the areas that has benefited greatly from the implementation of InfoSCADA is maintenance. Before the new system, the data could only be accessed by the CNCO operating system, that is, to obtain the data and perform some monitoring of the variables – such as pressure, flow and temperature of the notable points, it was necessary to ask the operators of the CNCO database or a trend to carry out the study and still call the CNCO to obtain the status of some variable. This did not even allow, in some cases, preventive action to maintain the operational bases.

As previously mentioned, the Mesh Management indicated technicians to be trained as developers, and the screens were developed in conjunction with the CNCO team. As the screens were being developed, users were informed and started using them as a reference.

The fact that the entire system already made available the data of the field variables in the CNCO database was an easiness for the developer, who only requested registration, “history the variables,” the data and then the variables were available to implement the screens.

InfoSCADA is today one of the best tools for monitoring maintenance, as well as for optimizing maintenance planning. Transpetro's operational bases precede the problems using the information provided by the system.

Daily, the operational bases scan all monitored points, checking the variables and programming technicians to act when abnormalities are identified. As a result, the risk of failure to deliver to customers was reduced, as well as the number of out-of-office visits, which often had an impact on the next day's schedule.

The gas pipelines are 100% operated by the National Center for Operational Control. There is no supervisory in the field. Thus, when maintenance technicians went to the delivery point (a station where the pressure of the duct is reduced and the gas is delivered to the local distributor), they were unaware of the data of the devices at that delivery point. To facilitate the work, the maintenance field team developed a screen (figure 7) identical to the one used at CNCO, including the data acquired from InfoSCADA. With this, in order to know the status of the signals at the delivery point, the maintenance technician, using a laptop with wireless communication and a token to access the Petrobras corporate network, access the InfoSCADA portal and visualize all data on field.

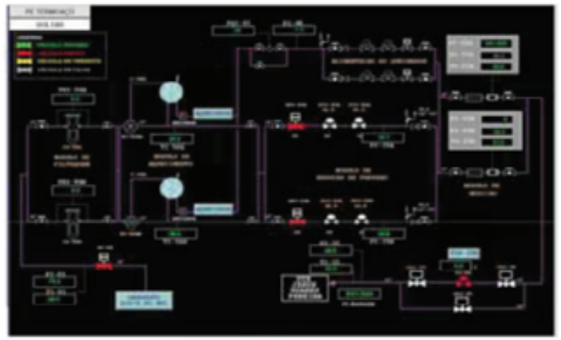


*Figure 7 - One of the screens developed by the maintenance team*

## Conclusions

To summarize, one of the main gains for Transpetro was being able to convert the data online into historical data, which can be used in the future. The potential for using historical data is enormous, especially regarding analysis of specific operations or products. InfoSCADA is a concrete example of the integration of the worlds of Information Technology and Automation Technology.

The benefits achieved by Transpetro with the development and implementation of InfoSCADA, using Proficy Historian and the Proficy dashboard/portal software, include:

- General view of all oil and gas pipelines and terminals on a single data server, allowing to see all Transpetro logistics in a single system
- Consolidation of information to optimize logistics (especially quantities in oil and gas pipelines)
- Access to field data in real time from Petrobras' corporate network
- Graphical analysis of data for long periods of time
- Calculation of process efficiency indexes for monitoring
- Security: data access profiles, password synchronization with the domain and access to screens and tags according to the user's access profile
- Low system acquisition and maintenance cost compared to other software
- Compatibility with iFIX HMI/SCADA systems used in Terminals and Compression Stations, with no need to purchase hardware in the field
- Ease of training screen developers (in eight-hour training only)

In the future, Transpetro intends to integrate, in addition to terminals, oil and gas pipelines, also data from oil tankers to InfoSCADA, where other types of collectors will be needed and are already being tested.

The company also foresees the expansion of Historian server hardware and the integration of other systems that make use of the data stored in InfoSCADA.

## Acknowledgment

Special record of recognition for the contributions of Rodrigo Henrique da Silva and Roberto Lima Santos for the important support in the preparation of this article, especially regarding the benefits obtained from the implementation of InfoSCADA in the maintenance area.

The original article in Portuguese appeared in Petro & Química.

## About GE

GE (NYSE: GE) is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology and scale, GE delivers better outcomes for customers by speaking the language of industry.

## Contact Information

**www.ge.com/digital**