ARC BRIEF
AUGUST 30, 2007

RTP Corporation in Turbine Automation: Seeking Service, Reliability, and Speed

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Executive Summary

Turbine automation remains a specialized segment within the automation business that is still not dominated by mainline DCS or PLC systems, but remains the domain of more specialized systems. This situation persists for both technical and business reasons. From the business standpoint, turbine OEMs prioritize new turbine business over automation system retrofits. Yet because turbines last longer than automation systems, older machines inevitably require replacement automation systems sometime during their operating life.

When the time comes to retrofit, turbine owners must decide if they will restrict their choice of supplier to just the turbine OEM or will accept systems and services from other providers. If they consider other suppliers, they must give priority to selecting high-performance, high-reliability equipment and a service organization with deep expertise and an excellent track record in this very specialized application. This ARC Brief discusses the experiences of one cogeneration plant and a major energy services provider working with RTP Corporation's automation equipment in demanding turbine control applications.

Turbine automation persists as a niche automation business that is not dominated by mainline DCS or PLC automation systems, but instead by specialized systems. This creates challenges for end users who eventually must upgrade their turbine automation systems.

Turbine automation retrofit – a persistent niche

Medium and large turbines have always been a "niche" application for automation – one that is not perfectly suited for either DCS or PLC-based automation systems. Instead of general-purpose DCS or PLC systems, most large turbines are still controlled by specialized automation systems designed specifically for turbo-machinery control. The power of DCS and PLC systems has mushroomed in the years since they were introduced. So why have they had trouble penetrating into turbo-machinery automation?

There are a number of good reasons. First of all, turbine control is a quite specialized application that requires special components. For example turbine speed sensors are often redundant, magnetic speed sensor inputs used for both

speed control and overspeed protection. In addition to more conventional sensors, turbine automation systems must interface with vibration sensors, flame scanners, and linear variable differential transformers (LVDTs), as well as magnetic speed pickups, all of which must be scanned rapidly.

The turbine control application involves high-speed positioning of large hydraulically actuated valves. Thus the application places a premium on speed of response and a very short controller period. It is an application that works best when it can take full advantage of today's high-performance hardware. For turbines expected to operate continuously, automation system redundancy is required to meet the high availability targets for the machine. Finally, in addition to speed and reliability, precise control is critical. Large turbines operate very close to the thermal and mechanical limits of their critical components. Even small control errors or sub-optimal dynamic response can move the turbine into operating points that will shorten the life of the equipment or even cause an immediate equipment failure.

Business factors

Besides the technical difficulties of turbine control there are business factors that contribute to making turbine automation a niche business. The most important factor is that turbine OEMs are not in business to sell retrofit automation systems. The turbine-generator sets in power plants are major and strategic capital expenditures. In large or multi-unit plants, their total value can be in the hundreds of millions of dollars, and winning such business creates huge opportunities for after-market services.

In order to capture this huge business opportunity, the OEM typically agrees to a large scope of responsibility. This includes equipment design, installation, startup, and commissioning. The OEM is not a systems integrator, however, and much prefers to work with familiar equipment, preferably their own equipment. Doing so gives the OEM control over the full set of customer deliverables and allows the OEM to guarantee performance. Tight sourcing of the whole package provides the OEM with the confidence required to extend such guarantees.

Turbine OEMs are more motivated to sell new equipment than to perform automation system updates.

Compared to the business opportunities represented by new turbines, pursuing business for automation system retrofits is small potatoes for a turbine OEM. Automation retrofit business thus definitely takes a back seat in the OEM's

business plans, and end user customers sense this second class status (though they do not appreciate it).

Process automation companies also find the turbine control market sub-optimal from a business standpoint because of the high degree of application expertise required, the demands of the application, and the less-than-perfect fit of most of their primary products. As a result, smaller businesses that are focused on turbine automation products and services have sprung up and seized this situation as a business opportunity. But these firms are focused on services and project execution, not on supplying reliable automation hardware and systems.

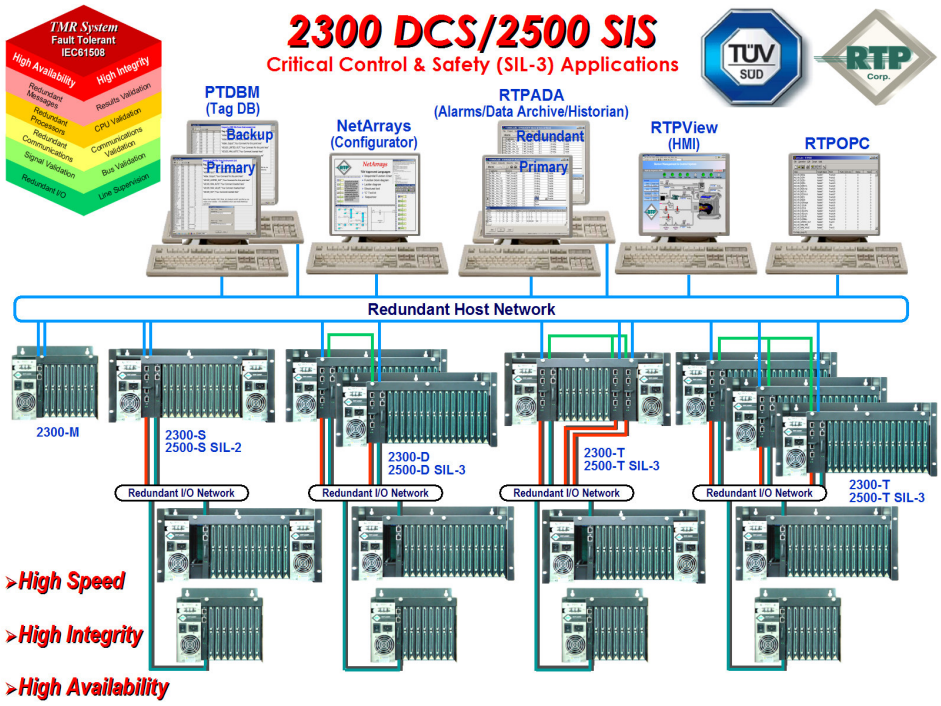
Sooner or later, every owner of a large steam or gas turbine must make plans to upgrade their turbine automation system.

With the long service lives of turbines, however, automation system retrofit becomes a necessity at some point during the capital equipment lifecycle. Thus every turbine owner is sooner or later confronted with a decision about how and where to procure a new automation system for an older turbine.

End user options

End users have several options when they choose a plan for turbine automation retrofit. Many end users simply prefer to deal with their turbine OEM. This represents a low risk but expensive upgrade path. The end user usually has only a small window for performing the retrofit, and has very little flexibility or leverage in negotiations with the turbine supplier. Nevertheless, most end users continue to engage their turbine OEMs for retrofit projects.

The alternative is to engage either a DCS supplier or a specialist organization to provide these services. In this case the initial investment may be much lower, but reliable project execution and obtaining solid equipment for future reliability are critical end user needs. End users must choose between DCS and safety shutdown automation equipment, often supplemented by specialized sensors or actuators. The end user must also find a services organization that has application expertise and a superb track record in delivering successful turbine automation projects.



RTP Automation Systems Offer Many Options for Redundancy

RTP Corporation

RTP Corporation is now making a play for turbine end users willing to consider suppliers other than their turbine OEM. RTP markets the 2300 DCS and 2500 SIS systems for process automation and critical control. Besides being a pure high-performance platform, these systems have three other characteristics that suit them for turbine automation:

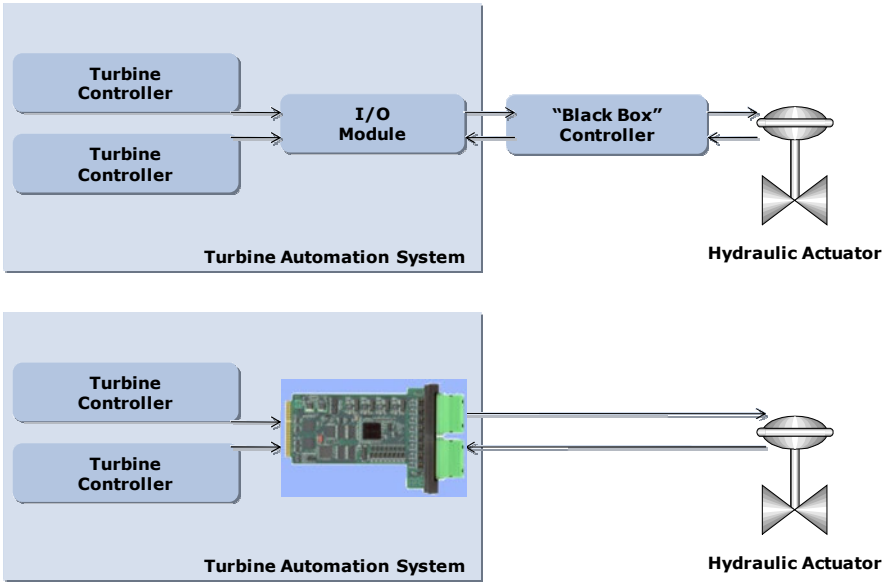
- The systems provide simplex, dual-redundant, or triple-modular redundancy automatically as redundant hardware is added. This type of feature allows the end user a wide range of price vs. reliability configurations, some of which are TÜV approved for SIL 3 applications. This capability is very similar to what premium priced systems from major turbine OEMs now provide.

- The 2300/2500 supports a large number of intelligent I/O modules including a high speed intelligent servo card with LVDT input and a high speed counter card for speed control applications. These modules use digital outputs for actuation. Both of these modules have an on-board processor that allows them to support control loops that have cycle times of 1 mSec or less.

- A typical application of these intelligent I/O modules is for turbine overspeed protection. When turbine overspeed protections is implemented using the module's fully independent processor, the module complies with American Petroleum Institute requirements for overspeed protection. This reduces the need for design and installation of multiple speed sensors the machine.

- The components of the 2300/2500 system come from family of modules whose high reliability has made them common in critical high performance applications. These modules are found on 95 of the 103 operating US nuclear power plants reactors.

The Intelligent RTP modules can be downloaded with a user application from Their IEC 61131-3 compatible configuration tool. The advantage to the end user is that 1 mSec control loops can run on a module that is a full-fledged member of the DCS and also provides full diagnostics and status monitoring. In other designs, engineers have implemented an external high speed servo controller as a "black box". This was done to obtain the high speed available with such a controller. But by implementing a black box external to their automation system, such a controller represents a blind spot to diagnostics and a source of unreliability compared with the dual or triple redundant automation system.



High Speed Controllers on I/O Eliminates External "Black Boxes"

San Gabriel Cogeneration Experience

San Gabriel Cogeneration in Pomona, California needed an automation upgrade for their gas turbine, which is a relatively low-volume model. The company has a very lean staff, so they needed a turnkey project and a system that would not draw from their very limited human resources down the road. They installed an RTP system on this unit in 2003 and are very happy with the results. Most important to them is reliability. They report that the system has "Never taken us offline. Never". Besides that, the quick installation and startup (36 hours) were also good experiences.

The non-obsolescence policy that a smaller supplier like RTP can support is also invaluable to San Gabriel. They can keep more spare parts on hand than they could justify with their old system. Finally, San Gabriel was able to fully integrate the new turbine system with its existing DCS immediately because of the OPC connectivity of the RTP system.

A less tangible but still satisfying point for San Gabriel is that they are running their turbine with I/O and equipment they consider near-indestructible. As part of their vendor selection they interviewed other users of RTP I/O and have found that the excellent reliability reported has been their experience as well during the 4 years they have owned the turbine control system.

Wood Group

Wood Group is a $3.5B an energy services company operating in 44 countries. Wood Group has a turbine control service business that is probably the largest in the world outside of turbine OEMs. Wood Group also has outstanding depth of knowledge in turbine control. Most of their turbine professionals have decades of experience with OEMs or other major suppliers.

In the words of one turbine automation expert, "a 100 mSec system is the definition of a dog in this application".

This turbine group operates as a system integrator within Wood Group serving turbine control retrofit projects. Their policy is to pre-qualify automation platforms for turbine control service. Their qualification includes running the control systems against a closed loop reference turbine simulator.

Wood Group identifies speed of execution as a critical advantage for the RTP 2300 system that they have qualified for turbine control. The advantage of a faster system is that control action does not have to be based on a single measurement sample. This makes the control action more stable without being

unresponsive. Wood Group's characterization of the RTP modules as "the fastest on the market" was given before RTP introduced its high speed servo and counter modules. Wood is happy with the 10mSec performance of the RTP equipment they qualified, and eager to use the newer 1 mSec modules. In general, Wood Group shies away from slower equipment. Said one Wood expert, "a 100 mSec system is the definition of a dog in this application".

While recognizing the reticence of some customers to deal with smaller automation suppliers, Wood feels that RTP is a nimble and customer-focused organization, especially compared with major OEMs. Noting that major OEMs have reduced their set of supported modules to a small number, Wood points to the fact that RTP still supports many different I/O modules for its DCS and SIS products.

Wood believes that as soon as a turbine control system becomes about 15 years old, the support issue comes into the picture. When end users have trouble sourcing spare parts, they are forced to either perform a retrofit or run the risk of longer unplanned shutdowns and less reliable operation. Wood insiders give RTP credit for keeping its larger I/O family updated to avoid situations where whole systems become unreliable due to part availability.

Recommendations

- At some point during a turbine's operating life, automation retrofit becomes a necessity. Owner-operators must decide by policy to restrict their supplier of turbine automation to the turbine OEM or to open it to others.

- The turbine control application requires automation systems that can execute very high speed control loops, provide modular redundancy, and interface to the turbine without external "black box" controllers.

- In choosing equipment and service suppliers, a successful track record in turbine applications is indicative of application expertise and suitability for service in such a specialized area.

This paper was written by ARC Advisory Group on behalf of RTP Corporation. The opinions stated are those of ARC Advisory Group. For further information or to provide feedback on this paper, please contact the author at HForbes@ARCweb.com.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