

VCS based e-Diagnostics

- VCS is a Comprehensive Control System with a key feature of network based “Total Recall.” Ultimate audit capability.
- Machine intelligence is constantly improving, based on evaluating subsets of all the data in a real-time manner. Monitoring and notification is automatic and built-in.
- Information transfer is file-based for robust and reliable dissemination, archive and reuse. It is also designed to be used to evaluate multiple tools.
- Improvements are geared toward maximizing uptime with minimal operator/technician involvement (demonstrated near order of magnitude improvement in MTBA).



Data Needed by Supplier for e-Diagnostics

- To effectively improve tool performance, 100% of all available data are needed. With VCS we record all signals, states and events, all the time.
- These data are most valuable, when there is a difficult diagnosis to be made. Typical time to diagnose and resolve the root cause of a problem, with VCS, is less than 5 minutes. This is local or remote.
- The general philosophy is for the tool to perform self-diagnosis, which it does. An expert is “called-in,” only for difficult problems. Hence, the design limiting case for “e-diagnosis” is “hard” problems.

How are these data used?

- Internally, we use the VCS archive data to improve tool performance by constantly improving designs, from both a hardware and software perspective.
- Customer site data is in the identical format. All that changes are the operational scenarios. Adding customer site data into our data acquisition matrix assures that performance improvements meet customer needs.
- The goal is to have no unforeseeable failures. Presently, we are logging much longer mean time to assists and failures. Warnings are issued regularly, in order to prevent failures. At some customer sites, new tool uptime exceeds tools with 10 years history.

Comments on Proposal for e-Diagnostics

- **Diagnostics are not selective or intermittent, except under primitive control system cases. Diagnostics are continuous and self-recovery is the norm. With VCS, they occur every 50ms.**
- **The primary reason to review tool data is to confirm that self-checking mechanisms are working as planned. Typically, these mechanisms are not perfect and they are subject to ongoing improvements, which require a continuous source of information.**
- **Our biggest problem is making a network connection to the tool.**
- **With VCS, we simplify the definition of e-Diagnostics; replay whatever happened in the field at any time and any place. If it did not take care of itself, then all the necessary data are available for expert review or else to be utilized in order to improve the design so that it does take care of itself (avoid failures) in the future.**

Steps to Problem Avoidance

Elements of Self-Diagnosis and Recovery	Status with VCS
1. Develop Default Warning and Error Limits for Parameters (all of them).	100% complete with 50ms periodic monitoring
2. Allow Network Access to All Information	100% Complete (improvements in user convenience are ongoing)
3. Intelligently Adjust Warning (and Error Limits) based on New information.	<ul style="list-style-type: none"> a. SPC can be adjusted for every parameter by customer. b. Ongoing efforts to improve default limits. c. Limits can also be adjusted by the customer, based on new information.
4. Develop State Estimator to perform cross-correlation and interrelationships between variables.	<ul style="list-style-type: none"> a. VCS Archive allows this to be done easily with human interaction – not possible on other systems. b. Ongoing developments to make this automatic.