



Spacecraft Emergency Response System (SERS)[™]

...Providing Automated Monitoring, Reporting, and Emergency Management for Distributed Teams

Both government and private organizations are faced with the demands to provide better, faster, and less expensive products and services. The Virtual Mission Operations Center (VMOC) is a NASA-sponsored program that achieves these goals by applying new forms of automation to team-based process management and supervisory control tasks. Under the VMOC paradigm, advanced automation is used to enable highly flexible process management by dynamically forming and supporting distributed teams of on-call personnel.

The Spacecraft Emergency Response System (SERS) is the first product deployed under the VMOC effort. With SERS, there is no longer the need for continuous human monitoring of spacecraft during routine operations. Instead, SERS enables "lights-out operations," in which standard process monitoring and management tasks are performed autonomously, using advanced automation, expert systems, and software agents. When SERS identifies a potential fault or an emergency requiring human attention, a suite of workgroup computing tools dynamically creates a response team by contacting the most appropriate personnel and facilitating their interactions. With SERS, missions can better utilize their expensive human and computer resources.

A typical NASA mission using SERS generally needs only one operator working a single shift 8 hours/day, 5 days/week. Prior to SERS, typical small operations employed 2 - 3 operators per 8-hour shift, 3 shifts/day, 7 days/week. For every mission, a SERS-enabled ground system reduces the time operators are required to spend in the control center by 15,000-25,000 hours/year; saving up to \$1 million/year. Because SERS frees the operators from performing mundane monitoring tasks, highly skilled personnel can now perform more rewarding and beneficial tasks. Currently, SERS is being, or will be, used by the Small Explorer (SMEX) and the Middle Explorer (MIDEX) missions, the Hubble Space Telescope, and the New Millennium Program missions.

More specifically, SERS is a Web-based collaborative environment that enables secure distributed fault and resource management. SERS incorporates the use of intelligent agents, threaded discussions, workflow, database connectivity, and links to a variety of communications devices (e.g., 2-way paging, PDA's, smart phones, and telephony) via gateways. When SERS detects a problem, it automatically:

- Contacts appropriate on-call personnel
- Synthesizes and presents the status and history of events and actions for rapid resolution
- Automatically generates all necessary reports and documentation
- Enables cooperative work by on-call personnel at distributed locations

Because NASA uses SERS for spacecraft operations, it is secure and reliable. SERS authenticates users via passwords and, if desired, encrypts data. To ensure reliability, a typical SERS setup consists of dual Windows NT[™] servers (one prime and one hot spare) that continuously replicate their data. In addition, SERS agents continuously monitor the status of all the SERS software, gateways, computers, and networks. If an agent detects a problem, SERS automatically reconfigures itself to work around the problem (e.g., if a network goes down, SERS switches from network-based paging to dialup analog paging), and alerts administrators of the problem.

Though currently optimized for spacecraft operations, SERS is designed to be easily adapted to other domains that require automated reporting and distributed team management, such as rapid response teams, disaster management, network monitoring, industrial automation and facility operations, sales force support, and medical equipment and emergency management.



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