

## Automation of Design Engineering Processes

**A method facilitates ISO 9001 compliance and eliminates voluminous, difficult-to-manage paper files.**

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A method, and a computer program that helps to implement the method, have been developed to automate and systematize the retention and retrieval of all the written records generated during the process of designing a complex engineering system. It cannot be emphasized strongly enough that “all the written records” as used here is meant to be taken literally: it signifies not only final drawings and final engineering calculations but also such ancillary documents as minutes of meetings, memoranda, requests for design changes, approval and review documents, and reports of tests.

One important purpose served by the method is to make the records readily available to all involved users via their computer workstations from one computer archive while eliminating the need for voluminous paper files stored in different places. Another important purpose served by the method is to facilitate the work of engineers who are charged with sustaining the system and were not involved in the original design decisions. The method helps the sustaining engineers to retrieve information that enables them to retrace the reasoning that led to the original design decisions, thereby helping them to understand the system better and to make informed engineering choices pertaining to maintenance and/or modifications of the system.

The software used to implement the method is written in Microsoft Access. All of the documents pertaining to the design of a given system are stored in one relational database in such a manner that they can be related to each other via a single tracking number. In addition to improving the management of records of the design process, the method can be utilized to improve the design process itself in a number of ways that include the following:

- Any component of the total collection of design data can be retrieved immediately.
- Through careful construction of the portion of the software that governs the inputs to the database, one can tailor the design process so that the software prompts for all required inputs, thereby ensuring that required components of the system are not overlooked.
- The software provides that a given data element can be entered once and is then automatically reused as needed, eliminating the need for repetitive typing and eliminating the confusion caused by differences among different textual entries of essentially the same information.
- Inputs can be constructed easily. For system designs requiring similar inputs, relatively simple cut-and-paste operations can be performed.
- Fewer than the customary administra-

tive procedures are needed. Most of the instructions on how to supply the requested information can be provided by the software in the form of help screens.

- The design process can be quickly and efficiently integrated in the sense that different engineering and administrative disciplines and design subprocesses can be tied together and the relevant information made available to all persons monitoring the database.
- The aforementioned integration is enforced by requiring feedback from design subprocesses in different disciplines.
- It facilitates ISO 9001 compliance through a structured design process, which includes objective evidence of meeting requirements.
- Metrics for the entire design process can be built into each process step and displayed.
- The quality of the final product is improved through reduction of the probability of missing design-process steps.
- Scheduling is included in the integration and is thereby enhanced.

*This work was done by Glenn Torrey, Gerald Sawasky, and Karim Courey of United Space Alliance for Kennedy Space Center. Further information is contained in a TSP (see page 1).  
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