INEL/CON--97-01062
CONF-9709185--

INTEGRATION OF PROJECT MANAGEMENT AND SYSTEMS ENGINEERING: TOOLS FOR A TOTAL-CYCLE ENVIRONMENTAL MANAGEMENT SYSTEM

by

PAUL B. BLACKER, and REBECCA WINSTON
Lockheed Martin Idaho Technologies Company

An expedited environmental management process has been developed at the Idaho National Engineering and Environmental Laboratory (INEEL). This process is one result of the Lockheed Martin commitment to the US Department of Energy to incorporate proven systems engineering practices with project management and program controls practices at the INEEL.

Lockheed Martin uses a graded approach of its management, operations, and systems activities to tailor the level of control to the needs of the individual projects. The Lockheed Martin definition of systems engineering is:

> "Systems Engineering is a proven discipline that defines and manages program requirements, controls risk, ensures program efficiency, supports informed decision making, and verifies that products and services meet customer needs."

THE NEED FOR AN EXPEDITED ENVIRONMENTAL MANAGEMENT PROCESS:

Environmental cleanups cost too much, take too long, and the project information usually is not properly integrated. Project costs and times are often under-estimated because of a failure to define requirements and to complete rigorous planning actions. An EPA official recently succinctly described the problem by saying that many cleanup projects are initially underestimated by a factor of three to five times.

Additionally, another major cause of cost over-runs is the lack of rigorous management controls during cleanup work. With several hundred activities starting and ending at various times during a multi-year project, managers lose control and make mistakes. Our process reduces cost by controlling the planning and execution.

The protection of human health and the environment is one of the important activities of our time. To achieve that objective, society has dedicated billions of dollars a year for environmental cleanups. The development of new and innovative cleanup technologies is a major part of our national environmental effort.

We are convinced, however, that as important as new technologies are, the most important developments that will reduce the cost and time and improve the quality of cleanups are management tools - used in conjunction with new technologies.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible electronic image products. Images are produced from the best available original document.

HOW THE SYSTEM WAS DEVELOPED:

The development of this unique process was accomplished as a result of the following.

- Lessons learned from successes and failures on one of the Nation's largest Superfund cleanup project,
- Project management tools implemented, such as those promulgated by the Project Management Institute,
- Program Controls adopted by the DOE and contractors,
- The Systems Engineering tools developed by

The U.S. Department of Energy's (DOE) Idaho National Engineering Lab is one of the Nation's largest Superfund sites. It is composed of hundreds of different contaminated sites contaminated with hazardous and toxic, radioactive, and mixed wastes. The extent of contamination, the need to protect public health and the environment, and the high visibility of the Department of Energy waste problem has provided fertile ground for the development of better, faster, and cheaper ways to clean up contaminated sites. The large size of the contamination problem and the large number of environmental professionals and concerned agencies generated new insights into how environmental cleanup projects can be managed better and more effectively.

Secondly, the Department of Energy, as have other Federal agencies, has been strong proponents of Project Management concepts, such as earned value information. These project management tools have been an integral part of the management of projects and has been an integral element of management activities required by DOE and its contractors.

Third, Program Controls, such as DOE Orders and other requirements are specifically designed for operation within the unique requirements of the Department of Energy complex.

Lockheed Martin has strongly promoted the benefits of systems engineering and, in compliance with it's management contract at the INEEL, has instituted systems engineering program at the INEEL. Subsequently, the DOE has decided that the systems engineering process will be extended throughout the entire DOE Complex. The INEEL, as a result, has been designated as the DOE's lead laboratory for systems engineering.

We have witnessed the problem of the slavish incorporation of the above disciplines without tailoring the tools to the unique needs of environmental cleanup projects. To overcome such problems, we adopted an approach of a streamlined incorporation of the required tools in a fashion that best met the unusual needs of the project team members. Instead of overlaying either project management and/or systems engineering systems we intentionally asked the question "What does the environmental project management team need to successfully manage a cleanup." Based upon the answers to those requirements, we developed this expedited system to meet the unique needs of environmental managers.

WHAT THE SYSTEM IS:

This process is a total-cycle environmental management system. An extensive series of analyses of twenty environmental cleanup projects was conducted to identify the needs and requirements for successful cleanups. The expedited cleanup process was then developed to provide the project management team with a product that has the following features:

- Complete incorporation of the EPA cleanup requirements into a repeatable, measurable process,
- Combination of project management and systems engineering processes for total control of planning, execution, and closure of projects,
- Integration of requirements with computer software and hardware to accelerate performance and improve accuracy, and
- Placement of this system into the hands of the highly trained environmental professional.

WHAT THE SYSTEM DOES:

The system is designed to provide the management team with those tools that reduce error and enhance efficient project planning and execution. Analysis of many environmental projects identified outputs that we refer to as products that provide the team with needed information for informed management decisions. The process provides managers the following products:

- A template ensuring inclusion of all the essential regulatory components of the cleanup process,
- A roadmap showing the relationships, precedent and successor activities of the entire cleanup process,
- A planning tool for initial baseline, intensive top-down and bottom up strategy, resource and schedule,
- A regulatory negotiation tool for acquiring cooperation of regulatory personnel by showing mastery of the entire project,
- A management control process seamlessly operating from initial planning through execution, closure, and delisting,
- A value-added analysis tool determining the value received from each activity,
- A strategic, tactical planning and "what-if" analysis tool for fine-tuning each project,
- A business negotiation tool to be used with contractors to ensure compliance to good business practices,
- An auditable, verifiable record of the decision making process used during the project,
- A metric system that applies measures of performance and quality to all elements of the process and yields accurately measured and quantified information,
- A quality assurance, audit, and independent evaluation tool,
- An education, training, and testing tool,
- A change control tool,
- A cost-benefit analysis tool,

- A risk analysis tool,
- A quality control mechanism for acquiring information, lessons-learned, and measurements,
- An electronic communication platform for rapid, accurate and "real-time" project communication.

AN OVERVIEW OF KEY COMPONENTS OF THE PROCESS:

The remainder of the presentation illustrates examples of our process. The first graphic is an overview of the entire process. It gives an integrated view of how the project management and systems engineering components work together. Following a review of the overview, the following graphic examples of each of the following constituents of the process will be presented.

- Identification of project requirements,
- Validation of requirements,
- Definition of products that meet those requirements
- Definition of scope and quality of each product,
- Determination of the activities necessary to complete each product,
- Verification that requirements have been satisfied and products are complete,
- Integration of management controls (such as earned value, etc.).

This overview and brief description of each of the components has shown how the components, when used together, provide the project team with integrated set of tools for improving the efficiency and reliability of environmental cleanup operations.