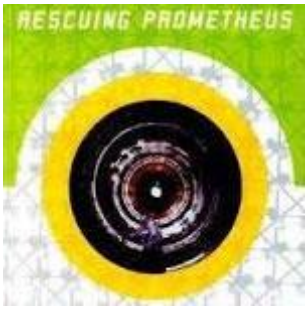

Rescuing Prometheus: Four Monumental Projects That Changed the Modern World

Author: Thomas P. Hughes

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Clearly this book is of much interest not only to acquisition professionals but to all DoD personnel because the stories in Hughes' book explain a lot the how and why we are where we are now. The people described in the book and the technological developments that resulted from their efforts have defined the "connected world" we are experiencing now.

The second half of the 20th century saw the development of several technologies that have come to define the beginnings of the 21st century. As Prometheus gave fire to mankind and changed the way humans lived, these technologies have ushered the connected world. What is particularly significant is that three of the four technological developments and the systems engineering methodology that evolved from them were the result of basic and applied research by the Department of Defense.

Hughes presents the history of four projects and includes a chapter on the evolution of systems engineering. The first project he describes is the SAGE air defense system. The need to track incoming missiles led to the interconnection of radar sites by telephone lines; the need to store the radar data led to the development of the magnetic core memory and the transformation of IBM from a typewriter company to a computer company; the need to generate the tracks led to the first computer languages and programs. It also changed the technologies for Command and Control forever. The second project described is the development of Atlas, the first ICBM. A particular challenge here was the concurrent design of the many parts of the system while simultaneously conducting basic and applied research on parts of it. This had two major impacts: the development of systems engineering management to handle the complexity of the endeavor and the development of key technologies that enabled the US space program. The third project is the development of the ARPANET, the precursor to and technology basis of the Internet. The original ARPA (now DARPA) program connected computers in a few universities

forming the first computer network. While the first two projects, SAGE and Atlas, were focused on the development of specific systems and had many contractors and subcontractors, this did not have a very direct military application and involved primarily academic efforts. Computers connected through telephone networks (the Bell system) and exchanging data through packet switching were expected to enhance Command and Control capabilities. No one really foresaw how email and the development of the web browser would connect the world. The fourth project is a different one; it is the complex story of the Central Artery/Tunnel development in Boston. The complexity of this project did not derive from the engineering challenges (engineers have learned long ago how to dig holes) but from the social, economic, environmental, and political complexities of carrying out a large project in an urban environment. Note that the purpose of the project was also connectivity – to facilitate North-South traffic through Boston and improve access to Logan Airport. The ensuing turmoil from the responses to the project of very many public interest groups, state organizations and federal entities (from EPA to the Federal Highway Administration that funded part of the project).

What was common to all four projects was that they were large scale, they involved multiple technologies, they were executed by a large number of contractors and subcontractors, and they affected diverse sets of people by changing the way they were functioning. Such projects posed a new challenge both at the technical and managerial perspectives. This gave rise to systems engineering and systems engineering management methodologies and tools that are still evolving even though they are deeply embedded in the way we work. One cannot help but wonder how the chief systems engineers of the Pharaohs managed the construction of the Pyramids without the technologies and tools available today.