

## Systems From the Top

Thomas P. Hughes, *Rescuing Prometheus*, 1998

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In terms of handling complexity, I possess point of view that is both fairly unique and useful. Much of my studies this past academic year have involved the examination of the impact and quantification of complexity while my previous occupation was applying systems engineering techniques in the development of defense systems at Raytheon. Because I understand complex systems both as an academic and a “grunt” engineer, I find the subject matter of Thomas Hughes’s *Rescuing Prometheus* extremely interesting – besides that I have been stuck in rush hour traffic through the Boston central artery more times than I want to remember. Unlike some other texts, *Rescuing Prometheus* does not focus on the “nuts and bolts” of large systems but instead focuses upon the people, funding, and management of these projects. In general, I praise Hughes’s work – especially in regards to his depth of research, but I do have complaints about the text.

My strongest complaint is that Hughes focuses on the highest levels of systems management and development with out describing the points of view of individual developers and office managers. Hughes goes into great depth about the actions and personalities of high level system builders like Professor George E. Valley, Jr., General Bernard Schriever, and Fredrick Salvucci but failed to describe what these mammoth projects looked like from the inside. To Hughes’s credit, his work did somewhat detail outer perspectives, especially when discussing the Central Artery Project and efforts to apply systems engineering to civil contracts. From experience, I know that high level managers often do not possess adequate understanding of day-to-day technical work environments, and while the technical challenges of large projects are daunting, it is often the challenge of getting the legions of engineers, contractors, finance people, and technicians to work in a complementary fashion that determines a system’s success. When Hughes makes note of the flat hierarchy present in the development of SAGE, I can not help but wonder what that means because even though a large group maybe composes of equals on an organizational chart, there are almost always individuals who are the greater of equals. Despite these failings, Hughes did not completely ignore lower level personnel as illustrated by his description of how techniques spread from the SAGE development program into future projects by the various engineers who gained experience and education as a result of the project.

My next complaint is that Hughes could have done more to compare and contrast the characteristics of his selected systems. Hughes examines extremely dissimilar military systems (SAGE, Atlas, and ARPANET) and civil systems (CA/T and civil systems engineering) but does not attempt to make many general statements generalizable to each system. Upon thinking about this omission, it may be possible that these systems were so different that Hughes was unable to make conclusive statements aside from the fact that they illustrated the evolution of systems engineering and possessed strong systems builders that spearheaded development. Perhaps, more would be gleamed through

evaluation of a systems engineering failure; after all, one often learns more from a failure than a success.

A question that *Rescuing Prometheus* led me to ask is whether complex development projects can be created, much less sustained, without government participation. Lately, I have tried to think of a modern technical system that did not use public funds or favors in its development. Whether it's a complex highway network, a new power plant, or sports stadium, I have failed to identify a large complex system that has not received some form of government backing. Perhaps this is because such expenditures entail large risks that few are willing to undertake without government safety nets, or maybe it is simply that corporations know that they can persuade local, state, or federal government to offset costs. Most likely, the answer involves these ideas and many others. In fact, as illustrated by both in the Atlas and Central Artery & Tunnel projects, a large part of building the system is organizing government and corporate stakeholders. Perhaps the question that I should ask is whether there has ever been a complex system developed without some form of government sponsorship.

While *Rescuing Prometheus* is an interesting and well researched work, it is a text with its share of flaws. In closing, a final general criticism of this work is that Hughes overly delves into the minutia systems development distracting readers from his main focus of showing the impact of systems engineering in the development of these systems. From a historical perspective, the extra information is of great interest, but there may have been a better way to arrange the book to leave the reader with a better sense of system engineering's role. Despite all of my complaints, this was an interesting and education book.