

Federal Aviation Administration (FAA) Advanced Automation System (AAS)

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This example was created as a SE example directly for the SEBoK. It describes the Advanced Automation System (AAS), part of the Federal Aviation Administration (FAA) Advanced Automation Program. It describes some of the problems which can occur in a complex, software intensive system program if SE is not applied.



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Description

In 1981, the Federal Aviation Administration (FAA) announced the Advanced Automation Program, which was established to modernize air traffic control (ATC) computer systems. A centerpiece of the project was the

Advanced Automation System (AAS). AAS was the largest project in FAA's history to modernize the nation's ATC system. AAS would replace computer hardware and software as well as controller workstations at tower, terminal, and en-route facilities and allow the ATC system to accommodate forecasted large increases in traffic through the use of modern equipment and advanced software functions. (GAO 1992)

The FAA originally proposed AAS in 1982 as a project that would cost \$2.5 billion and be completed in 1996. However, substantial cost increases and schedule delays beset the AAS project over its history, caused by numerous problems in AAS development:

- The project began with a design competition between Hughes and IBM. The competition involved numerous extensions and took four years to complete. Analysis by the FAA and others pointed to inadequate consideration of user expectations and improper assessment of the technology risks. (Barlas 1996)
- The FAA pushed for 99.99999% reliability, which was considered by some "more stringent than on any system that has ever been implemented" and extremely costly. (DOT 1998)
- The program created unworkable software testing schedules - "Testing milestones were skipped or shortcutted and new software was developed assuming that the previously developed software had been tested and performed." (Barlas 1996)
- There were an extraordinary number of requirements changes. For example, for the Initial Sector Suite System (ISSS), a key component of AAS, there were over 500 requirements changes in 1990. Because of these changes, 150,000 lines of software code had to be rewritten at a cost of \$242 million. (Boppana et al. 2006)
- IBM's cost estimation and development process tracking used inappropriate data, were performed inconsistently, and were routinely ignored by project managers. The FAA conservatively expected to pay about \$500 per line of computer code - five times the industry average. The FAA ended up paying \$700 to \$900 per line for the AAS software. (Gibbs 1994)
- In 1988, FAA estimated that the AAS program - both contract and supporting efforts - would cost \$4.8 billion. By late 1993, the FAA estimated that it would

cost \$5.9 billion. Before the program was dramatically restructured in 1994, estimates had risen to as much as \$7 billion, with key segments expected to be behind schedule by as much 8 years. In 1994, with significant cost and schedule overruns, as well as concerns about adequate quality, usability, and reliability, the AAS program ceased to exist as originally conceived, leaving its various elements terminated, restructured, or as parts of smaller programs. (DOT 1998)

The AAS problems could be associated with the non-use or misuse of a number of systems engineering (SE) concepts and practices: system requirements, system architecture complexity, project planning, risk management, change management, system analysis and design, system reliability, system integration, system verification and system validation/testing, and management oversight.

Summary

The AAS program was the centerpiece of an ambitious effort begun in the 1980s to replace the computer hardware and software throughout the ATC system - including controller workstations, and en-route, terminal, and tower air traffic control facilities. AAS was intended to provide new automated capabilities to accommodate increases in air traffic. After sustaining serious cost and schedule problems, the FAA dramatically restructured the program into more manageable pieces. This action included terminating major segments of the contract. (DOT 1998.)

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