

ABSTRACT AND BIOGRAPHY

Software Architecture Review Board for Flight Systems

The operational behavior of modern space systems is largely controlled by software, and the trend in some parts of NASA is toward exponential growth in the size of flight software. That growth is fueled by increasingly ambitious requirements, increasingly capable flight processors, and the relative ease by which software accommodates evolving understanding. Flight software has become perhaps the most complex artifact in space missions, and not surprisingly, the number of problems attributed to flight software has grown accordingly. Some complexity is unavoidable because it is inherent in mission requirements, but some is self-inflicted due to weak software architecture. Architecture can be “weak” to the extent that it fails to provide suitable abstractions to shape the designs. Architecture that fails to adequately address complexity at the outset spawns a cascade of extra engineering effort in the downstream efforts of design, verification, and operations. As a well-known computer scientist put it, “Point of view is worth 80 IQ points”, and that’s what good architecture provides: a point of view that makes problems easier to solve.

This talk describes the formation of a NASA Software Architecture Review Board whose mission is to help flight projects improve their software architectures during their formative period. The review model is based in part on AT&T’s successful model from the 1990s, but tailored for NASA’s project lifecycle. The talk will also summarize several areas of review focus based on the complexities of real-time embedded flight systems.

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Dan Dvorak is a principal engineer in the Systems and Software Division at JPL working in software architecture for flight systems, model-based systems engineering, fault management design, and human-robotic operations. Dan led the NASA study on flight software complexity that led to a recommendation to establish a NASA software architecture review board. Dan is PI for a R&D task to develop human-rated automation and control technology to ensure that robotic systems can work safely with astronauts. Prior to joining JPL in 1996, Dan worked at AT&T Bell Laboratories on several projects including a system for monitoring the nation’s 4ESS electronic switching systems for long-distance telephone traffic, and a rule-based extension to the C++ language. Dan holds a Ph.D. in computer science from The University of Texas at Austin, an MS in computer engineering from Stanford University, and a BS in electrical engineering from Rose-Hulman Institute of Technology.