

Title:

Challenges and Opportunities for Information Technology on Future Space Missions

Abstract:

Space exploration missions have always been about the creation of a certain kind of information: new scientific knowledge. And the future is as exciting as ever – planned and proposed Earth-observing satellites, planetary explorers, and deep-space observatories offer the promise of continuing discoveries. But the challenges of the future mission set differ from those of the past. The frontiers of both exploration and technology are being consciously pushed. Space platforms will interact in new ways with each other and with uncertain environments, leading to software of increasing complexity that nonetheless must be highly reliable. More capable sensors and instruments lead to raw data volumes of unprecedented size that nonetheless must be rendered to reveal their prizes.

Modern information, software engineering, and computing technologies have numerous critical contributions to make towards the success of future space missions. Among them: the creation of sophisticated predictive models to define scientific investigations; the systematic exploration and detailed understanding of mission and space platform designs; new approaches to the validation of complex software; capabilities for mission planning and execution in remote planetary environments; architectures for the coordination of multiple space platforms; greatly scaled bandwidth and networking to bring much more information from deep space back to Earth; and new ways to assist scientists searching for the nuggets in the data, even at collection time.

This talk will sample ongoing technology investigations in these areas, along with examples of the future space missions that will rely on and exploit their results.

Bio:

Richard J. Doyle is the Leader of the Center for Space Mission Information and Software Systems, and Manager of the Information Technologies Program Office at the Jet Propulsion Laboratory, California Institute of Technology in Pasadena, California. He serves as an editorial board member at *IEEE Intelligent Systems*, where he contributes the department "AI in Space." He is currently serving as a member of the Executive Council of the American Association for Artificial Intelligence. He is a recipient of the NASA Exceptional Service Medal. He received his B.A. in mathematics with a minor in astronomy from Boston University, his S.M. in electrical engineering and computer science from the Massachusetts Institute of Technology, and his Ph.D. in computer science at the MIT Artificial Intelligence Lab. He gave the invited talk entitled "The Emergence of Spacecraft Autonomy" at the National Conference on Artificial Intelligence in Providence, RI in 1997. He was the US Program Chair for the International Symposium on Artificial Intelligence, Robotics and Automation for Space (*i*-SAIRAS), held at Tokyo in 1997, at Noordwijk, The Netherlands in 1999, and at Nara, Japan in 2003.