



# Probabilistic Risk Assessment Procedures Guide for NASA Managers and Practitioners

National Aeronautics and Space Administration

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Probabilistic Risk Assessment (PRA) is a comprehensive, structured, and logical analysis method aimed at identifying and assessing risks in complex technological systems for the purpose of cost-effectively improving their safety and performance. NASA's objective is to better understand and effectively manage risk, and thus more effectively ensure mission and programmatic success, and to achieve and maintain high safety standards at NASA. NASA intends to use risk assessment in its programs and projects to support optimal management decision making for the improvement of safety and program performance. In addition to using quantitative/probabilistic risk assessment to improve safety and enhance the safety decision process, NASA has incorporated quantitative risk assessment into its system safety assessment process, which until now has relied primarily on a qualitative representation of risk. Also, NASA has recently adopted the Risk-Informed Decision Making (RIDM) process. Over the years, NASA has been a leader in most of the technologies it has employed in its programs. One would think that PRA should be no exception. In fact, it would be natural for NASA to be a leader in PRA because, as a technology pioneer, NASA uses risk assessment and management implicitly or explicitly on a daily basis. NASA has probabilistic safety requirements (thresholds and goals) for crew transportation system missions to the International Space Station (ISS). NASA intends to have probabilistic requirements for any new human spaceflight transportation system acquisition as a valuable addition to supplement existing deterministic and experiencebased engineering methods and tools. During the past several decades, much has been written on PRA methods and applications. Several university and practitioner textbooks and sourcebooks currently exist, but they focus on applications of PRA to industries other than aerospace. Although some of the techniques used in PRA originated in work for aerospace and military applications, no comprehensive reference currently exists for PRA applications to aerospace systems. This PRA Procedures Guide, in the present second edition, is neither a textbook nor an exhaustive sourcebook of PRA methods and techniques. It provides a set of recommended procedures, based on the experience of the authors, that are applicable to different levels and types of PRA that are performed for aerospace applications. It therefore serves two purposes, to: 1. Complement the training material taught in the NASA PRA course for practitioners, and together with the Fault Tree Handbook, the Risk-Informed Decision Making Handbook, the Bayesian Inference handbook, the Risk Management Handbook, and the System Safety Handbook to provide quantitative risk methodology documentation, and to provide aerospace PRA practitioners in selecting an analysis approach that is best suited for their applications.

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