

Special session:

The NASA and DNV Challenge on Optimization Under Uncertainty

This special session features the contributions to the following challenge problem: <https://github.com/dnv-opensource/UQ-Challenge-2025>.

Motivation

NASA missions often involve the development of new vehicles and systems that must be designed to operate in harsh domains with a wide array of operating conditions. Similarly, DNV works to safeguard life, property, and the environment across a range of industries by ensuring that complex engineered systems can be trusted to operate reliably, even during rare and extreme events. DNV collaborates across various sectors to address the challenges of designing and operating safety-critical systems. Both NASA and DNV deal with high-consequence and safety-critical systems for which quantitative data is either very sparse or prohibitively expensive to collect. Limited heritage data may exist, but is also usually sparse and may not be directly applicable to the system of interest, making UQ extremely challenging.

Recognizing the shared challenges in UQ across different sectors, NASA Langley Research Center and DNV Group Research and Development have developed a challenge problem to unite a community of researchers toward common goals. While the problem formulation is presented in a discipline-independent framework, the underlying application is consistent with the complexities of realistic systems. This collaborative effort aims to advance methodologies in UQ that are broadly applicable, enhancing safety and reliability across various domains.

This challenge aims to advance research within:

- Modeling and refinement of uncertainty given sparse data
- Propagation of mixed aleatory and epistemic uncertainties through system models
- Design optimization in the presence of uncertainty

Register for the 2025 UQ Challenge

Each participating group should first register by sending an email to uqchallenge@dnv.com including the name of all the participants, their email address and affiliations. Furthermore, let us know who will be the point of contact for the group.

Accepted responses to the challenge will have the opportunity to present their results at this special session. For further information about the challenge, see <https://github.com/dnv-opensource/UQ-Challenge-2025>

Organizers

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NASA Langley Research Center: Luis G. Crespo, Sean Kenny