# System of Systems Engineering Collaborators Information Exchange (SoSECIE)

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**Mission-Level Optimization: A New Method for Designing Successful Systems**

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#### Abstract

Mission engineering is a growing field with many practical opportunities and challenges. Research and practice in this field aims to increase system effectiveness, reduce life cycle costs, and aid in communicating system capabilities to key stakeholders. Optimizing system designs for their mission context is important to achieving these goals; however, system-level optimization is generally done using multiple key performance indicators (KPIs) as objectives, which are not always directly representative of, nor easily translatable to, mission success. This article introduces, motivates, proposes, and tests a new approach for performing mission-level optimization (MLO), where the objective is to design systems that maximize the probability of mission success, while accounting for many sources of operational and environmental uncertainty. This approach executes Monte Carlo simulations in the optimization loop to generate a probability of success metric, which is then used as the optimization objective. A physics-based mission model application case is developed, and it is used to test MLO under different scenarios to examine how it compares against the traditional multiobjective optimization approach. The results find that MLO converges on designs with higher mission success rates, without necessarily sacrificing KPI values or computational resources required.

#### Biography

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| Brian Chell is a Postdoctoral Research Associate with the Systems Engineering Research Center at Stevens Institute of Technology. His research interests are in distributed space systems and applying multidisciplinary design optimization techniques to mission-level analysis. Brian received a Ph.D. in Systems Engineering and an M.E. in Space Systems Engineering from Stevens, and a B.S. in Aerospace Engineering Sciences from the University of Colorado Boulder. |  | A picture containing person, person, smiling, posing  Description automatically generated |