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Title: Uncertainty Quantification and Fusion Model Calibration to increase accuracy and efficiency of T&E Resources

Modeling & Simulation (M&S) can be used to increase the efficiency of test & evaluation (T&E) resources by providing insights into expected mission performance. In this presentation, an Infrared Search and Track (IRST) pod is used as an exemplar for how M&S can be applied to digital engineering. First, a Multiphysics simulation model of the pod performance is constructed, including degrading mission conditions such as aero-optical effects. Model calibration and fusion modeling techniques are then used, which leverage real world test data to improve the accuracy of the simulation model and compensate for any missing physical phenomena. Reduced Order Modeling (ROM) techniques are deployed to accelerate the computation time, enabling integration of deep physics into mission environment. Lastly, uncertainty quantification techniques are used to characterize the systemic/process-based uncertainties. Quantified process-based uncertainties are used together with ROMs to determine operational variations in mission performance and identify most probable failure scenarios.