# ENGINEERING VALUE OF SIMULATION PROCESS AND DATA MANAGEMENT APPLIED TO AERO-ENGINE DESIGN

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## SUMMARY

The design of a gas turbine aero-engine calls on a large number of engineering skills, intellect and knowledge and involves the coordination, processing, verification and management of information from numerous sources and in a variety of forms. An increasingly vital contribution to the design process is the use of numerical simulation of aero-engine behaviour.

One such class of simulation is the prediction of engine transient thermo-mechanical behaviour. This needs to be assessed at the component, module and whole engine level, and makes use of finite element models with varying levels of fidelity, complexity, physics and model size. This brings with it aspects of technical information management particular to the discretisation and solution of simulation models in areas such as structural mechanics and fluid dynamics. Furthermore the multi-disciplinary basis of engineering design, the geographic distribution of engineers and the variety of information exchanges involving the analysts provides a particularly complex environment for simulation information management.

This paper looks at a recent assessment of the potential business value of simulation process and data management (SPDM) to an aero-engine design enterprise. Perspectives from the mechanical analysis community are examined, at various levels of complexity – organisational and technical. These show the types of information sources and their lifecycles, the levels of fidelity that these need to support and their adaptive nature in design iteration. The links into and out of individual engineering analysis steps and the overall analysis process are used to develop the requirements for an SPDM solution. Key human aspects in a competitive business environment are illustrated. For example the needs of the analyst to do more assessment, to increase model complexity, to more easily manage and re-use the simulation information, to effectively communicate and, not least, their needs to retain flexibility.

The diversity of the computational environment is examined, for example the data management differences brought about by analyses on high-end desktop computers versus remote clusters, and the merits of distributed storage and network speed.

The aspects are illustrated by two use cases that bring out key requirements for SPDM. Some of these are known to be available in existing commercial SPDM solutions, others provide some basis for SPDM vendors to develop and demonstrate their future capabilities.