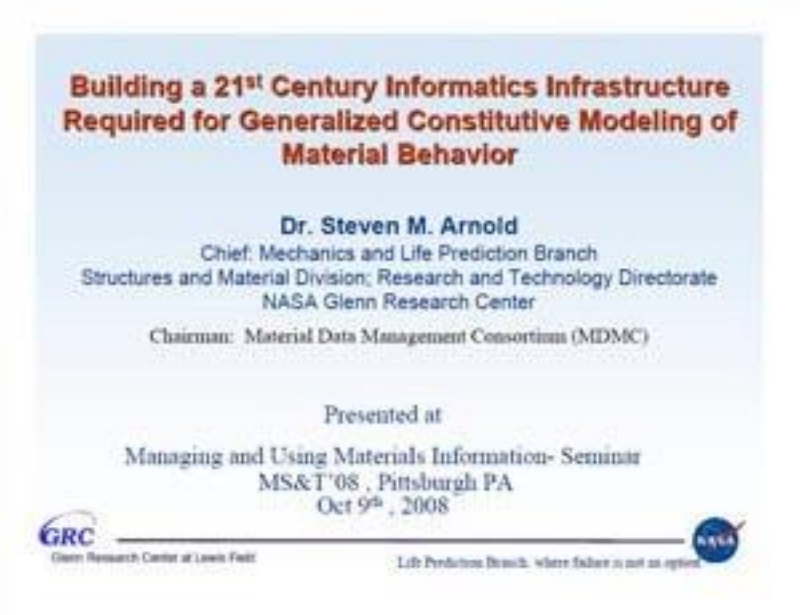
## NASA case study




Dr Steven Arnold is Chief of the Mechanics and Life Prediction Branch in the Structures and Material Division at NASA Glenn Research Center. He also chairs the Material Data Management Consortium, a collaboration of leading aerospace, energy, and defense enterprises that has developed a best practice approach to materials data management, including guiding the development of the GRANTA MI software system.

He began by outlining the work of the Mechanics and Life Prediction Branch, and the intense materials information requirements that result. This work includes a broad range of material characterization and experimental mechanics. Results then need to be analyzed to generate mathematical characterizations of material behavior. These are used as input to in-house modeling tools and to commercial software such as Abaqus—for example, for FEA analysis of a component.

A key point in Dr Arnold's talk was a paradigm shift in modeling approaches that is dramatically increasing materials data management challenges. Historically, the need was to gather, store, and use the 'point-wise' materials property data required for conventional design and analysis methods. Now, the focus is on capturing the complete fundamental response spectrum of a material—for example, not simply a property such as Young's Modulus, but the full stress-strain curve for a material at a range of different temperatures. Not only is there more (and more complex) data to store—but the level of effort required to generate this data (particularly when testing at high temperatures) means that it is a much more valuable commodity. However, if such complete data *can* be captured, not only does it enable more sophisticated constitutive modeling, it also creates an information resource that can support new or refined models in the future, without the need to repeat expensive tests because the correct data was not captured first time around.

NASA Glenn has focused on the likely use—and the likely users—of materials data, now and in the future, in developing an informatics infrastructure for this data. This

focus drove the organization to take a lead in the foundation, in 2002, of the Material Data Management Consortium (MDMC), along with ASM International and Granta. The MDMC's philosophy, now supported by 17 leading engineering enterprises, is to analyze the full 'lifecycle' of materials data—its capture, analysis, deployment, and maintenance—and to provide tools within the GRANTA MI system that support each stage.


*Sample NASA homepage within the GRANTA MI system. Materials data can be navigated in the left panel. The right panel provides quick access to specific data and tools in language tailored to the user community.*

NASA Glenn has implemented GRANTA MI to capture, analyze, and share both test data and external reference data. The database contains thousands of records and continues to grow. GRANTA MI's flexible web browser user interface has enabled development of a variety of 'homepages' *(above)* through which different users access and apply the data and tools that are relevant to them. These homepages use pictures and text tailored to the specific user community, and also provide links enabling access and export to third-party software and NASA in-house systems. NASA has also been instrumental in specifying underlying database features such as Access Control, which is now in use to ensure that users only see data appropriate to their role and authorization status. Current effort is focused on developing a model table within the system, and on meeting the particular needs of composite data.

NASA Glenn provides an excellent example of the need for effective materials data management—and how that need can be met through a comprehensive, integrated approach. It also shows the benefits of the MDMC collaboration in allowing one member to influence the development of the GRANTA MI system and benefit from that development, while sharing the costs with other partners.