The numerical implementation of established materials science principles in the form of purposeful engineering tools has brought a new level of integration of the science and engineering of materials. Building on a system of fundamental databases known as the Materials Genome, parametric materials design has integrated materials science, applied mechanics and quantum physics within a systems engineering framework to create a first generation of designer “cyberalloys” that have entered successful commercial applications, and a new enterprise of commercial materials design services has steadily grown over the past decade. The DARPA-AIM initiative broadened computational materials engineering to address acceleration of the full materials development and qualification cycle, and a new level of science-based AIM modeling accuracy has been achieved under the ONR/DARPA “D3D” Digital Structure consortium. A surface thermodynamic genome database predicted directly from validated DFT quantum mechanical calculations generated novel “Quantum Steels” completely eliminating intergranular stress corrosion cracking at the highest strength levels. Integration with fundamental databases and models has demonstrated the historic milestone of accelerated flight qualification for aircraft landing gear through application of the fully integrated computational design + AIM methodology. Past success defines a clear path forward for major enhancement of materials genomics technology.