High-Throughput (HT) Mechanical Property Characterization of Additive Manufactured (AM) metal alloys
• To further accelerate investigating PSP relationships of AM materials there is a need to use HT property characterization techniques.
• Model developed based on nondimensional analysis, using FEA simulations to extract uniaxial from indentation stress-strain curves.
• HT high cycle fatigue fixture capable of testing 4 samples in bending fatigue simultaneously has been developed.
• Future work: fixture design for automated miniature tensile testing.

Surface Crack Modeling in IN-718
• Better prediction of life to mitigate catastrophic failure.
• Develop computer based model to describe transition of surface to through cracks.
• Comparison of model predictions to experimental data.

Microstructure-sensitive Crystal Viscoplasticity for Ni-base Superalloys
• Consider influence of microstructure evolution over long-term exposure in gas turbine systems on the mechanical behavior.
• Explore influence of microstructure on creep-fatigue interactions.

Creep and Creep-Fatigue Crack Growth Behavior in Ni-base Superalloys
• Develop a unifying approach to extend time-dependent fracture mechanics concepts to creep-brittle materials (i.e. Ni-base superalloys).
• Understand the nature of crack tip stress fields for growing cracks in the presence of small-scale creep and transient conditions.
• Data-driven modeling provides verification and validation between experiment and FEA.

Microstructure-sensitive Modeling of Rolling Contact Fatigue
• Improve computational and experimental tools to support accelerated design of bearing steels beyond traditional empirical techniques.
• Develop computational model that predicts the role of retained austenite and strain-induced phase transformations during RCF.
• Develop Fatigue Indicating Parameters (FIPs) to predict crack nucleation and propagation.

Creep and Creep-Fatigue Crack Growth Behavior in Ni-base Superalloys
• Develop a unifying approach to extend time-dependent fracture mechanics concepts to creep-brittle materials (i.e. Ni-base superalloys).
• Understand the nature of crack tip stress fields for growing cracks in the presence of small-scale creep and transient conditions.
• Data-driven modeling provides verification and validation between experiment and FEA.