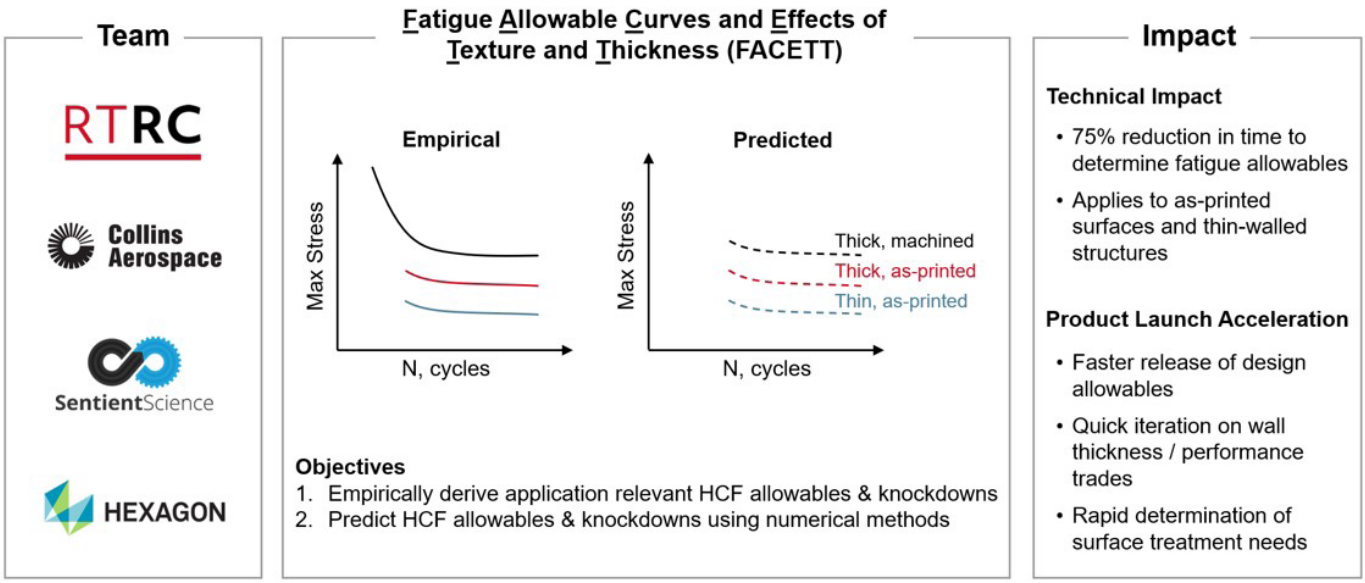
PROJECT SUMMARY 5541

Fatigue Allowable Curves and Effects of Texture and Thickness (FACETT)



This graphic illustrates the technical approach and impact of the RTRC FACETT project.

PROBLEM

Additive manufacturing (AM) machines and materials qualification are major barriers to broad AM adoption. Generating the requisite data and models requires substantial resources to produce statistically significant data. This qualification process requires generating test coupons under a controlled process and testing and analysis of the resulting data. These processes are then "frozen" with no changes to key process variables allowed. Standard-based guidance does not exist for requirements when a process change is needed. This greatly inhibits AM processes from responding to changes in the technology or supply base, allowing only one path to implement change to a qualified process - a total requalification, which may cost over $3M per machine/material combination and take several years.

OBJECTIVE

The project aims to empirically derive and numerically predict high cycle fatigue design allowables for textured thick-and-thin-walled Ti-6Al-4V additively built material. Using these datasets, the goal is to validate the use of an integrated computational materials engineering (ICME) tool that will reduce the time required to generate fatigue allowables by 75%.

AMERICA MAKES TECHNOLOGY DEVELOPMENT ROADMAP

This project aligns to: PROCESS

ASTM PROCESS CATEGORY
Powder Bed Fusion

EQUIPMENT
SLM 280

MATERIAL
Ti-6Al-4V

TECHNICAL APPROACH

RTX Technologies Research Center (RTRC) will develop a test plan for a set of up to 15-thick-and-15 thin-walled Ti-6Al-4V laser powder bed fusion (LPBF) fatigue specimens with as-printed surface texture built on a SLM 280. Based on the test plan, RTRC will perform the requisite high cycle fatigue testing on the specimens and curate the resulting data into the project's Material Data System (MDS). Lastly, high cycle fatigue predictions will be generated for textured thick-and thin-walled material based on empirically characterized microstructure and surface profile.

PROJECT START DATE

November 2023

EXPECTED END DATE

June 2025

EXPECTED DELIVERABLES

- Conventional test matrix and test plan
- Standards and material/process specifications used on project
- Powder reuse strategy
- Statistically based mechanical properties curve (B-Basis)
- Final report

FUNDING

$499,691 total project budget
($299,815 public funding/$199,876 private funding)

PROJECT PARTICIPANTS

Project Principal:
RTX Technologies Research Center (RTRC)

Project Participants:
Collins Aerospace Applied Research & Technology
Hexagon Manufacturing Intelligence
Sentient Science

Public Participants:
U.S. Department of Defense