H7.02-2933 - Feedback Sensors for Closed Loop Additive In-Space Manufacturing

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NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

This solicitation calls for an in-situ method for precision scanning of additive manufactured (AM) parts and feedback of that data back into AM layer by layer process control. The goal is to augment AM process controls with verifiable feedback to improve process stability and part quality to significantly reduce the risk associated with complex AM parts, especially those with critical hidden internal geometries or other features not readily measured with non-destructive tests/measurements.

The proposed approach employs IR/NIR optical measurement techniques (including inspection technology developed by Marshal Space Flight Center) to implement a small sensor onto the moving AM extrusion for integration in to In-Space Manufacturing AM processes. We will employ the 3D data scanned to inspect part by layer and modify machine control – likely requiring modification of the AM machine's X, Y, Z, and feed rate controlling mechanisms.

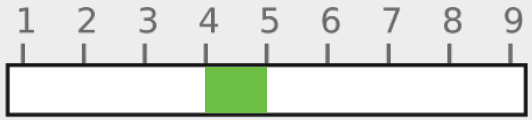
TECHNICAL OBJECTIVES AND WORK PLAN

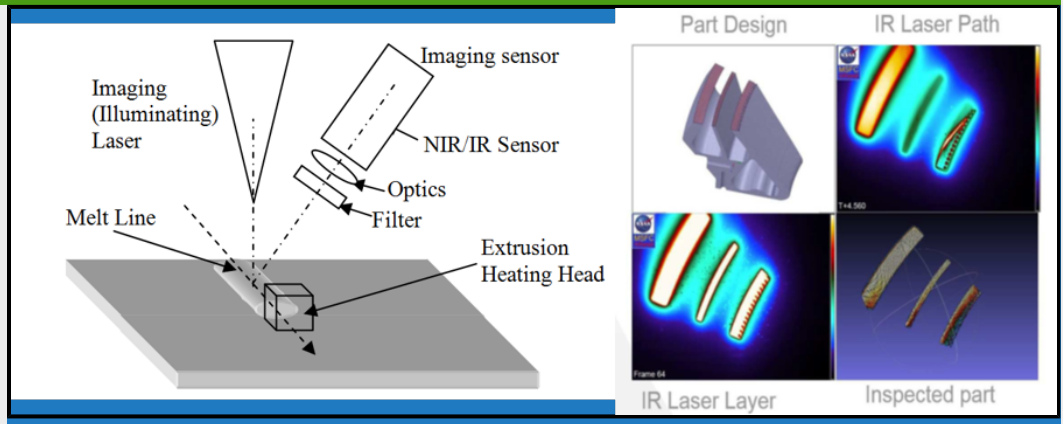
Objectives: Design, build, and utilize real-time metrology-based feedback control for additive manufacturing (AM) process improvement (MBCAM – Metrology Based Control of Additive Manufacturing).

Work plan over 6 months: Develop, build install, and test a 3D imaging feedback sensor - implementing the ability to acquire melt track data to better than 1/1000" inch (design goal is 1/10,000") and thus provide immediate capabilities for process characterization (i.e. to support out-of-process feedback and design for AM data). We will incorporate this sensor initially into an in-house FDM machine operated through an open source controller. This will allow us to integrate real-time feedback into the fabrication process (modulating scan speeds, feed speeds, layer thickness, scan spacing, bed and head temperatures, spot size, and plastic type). Create Phase II Development Plan to acquire an SLM machine for integration also allowing modulation of powder size, powder density, binders/metals mixtures, and laser power and scan speed).

TRL

Estimated





NASA APPLICATIONS

The goal is to develop a real-time system active feedback control and process characterization applied to multiple materials, specifically in Phase I to FDM parts, and in Phase II to support in-space manufacturing employing the ISS AMF. This will show how closed-loop AM manufacturing is feasible and changes the quality and consistency of AM manufactured parts for aerospace parts fabrication in support of rapid development and in-situ manufacturing for long-distance space missions.

NON-NASA APPLICATIONS

Key potential customers will be the military for out-of-production spares, industry for low quantity high quality parts manufacturing, and more specialized makers of other products like prostheses of 3D art. We will also partner with interested AM machine OEMs.

FIRM CONTACTS

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