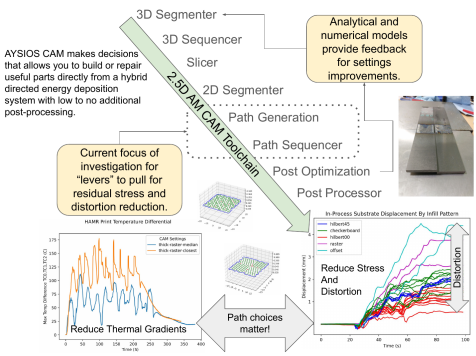


WHO

**SYSCOM:** NAVAIR  
**Sponsoring Program:** NAVAIR Chief Technology Office  
**Transition Target:** High value metallic components  
**TPOC:** (301) 342-9359  
**Other Transition Opportunities:** Repair of damaged components, replacement part manufacturing, coatings

**Notes:** Directed energy deposition (DED) paired with CNC machining promises a production path to large metal components from a relatively small footprint with positive implications for supply chain improvements. However, this class of additive processes has proven to be more difficult to master than their plastic counterparts. Since the "tool" is generally a laser, there is no guaranteed contact position with the workpiece. Heat transfer during the process is hopelessly non-steady state, which makes the consistency of the resultant material a constant object of concern. The rate at which events occur during processing tends towards conditions that are outside most available metallurgical data. The potential to produce or repair functional, high-value metal components on-demand via a digitally driven process is significant enough to make addressing these issues worthwhile.



PINE's AYSIOS CAM software makes manufacturing plan choices using a combination of empirical and analytical methods to satisfy the user's strategic objectives.

WHAT

**Operational Need and Improvement:** As additive manufacuting technology matures, the number of choices available for a machine operator is becoming increasingly daunting. Our philosophy is to put the human in control of the objectives and use automation to make the myriad of choices needed to fulfil this objective. The present work allows us to create objectives based around geometric and stress requirements.

**Specifications Required:** Create a build planning and simulation tool to optimize hybrid DED processes such that:

- \* Resulting geometry is within tolerances
- \* Stresses are within acceptable ranges
- \* Near surface stresses acceptable for fatigue life

**Technology Developed:** PINE has created a software solution for creating bespoke path plan solutions for building high quality metallic parts via hybrid DED systems. Our highly modular solution is scalable and configurable for bespoke applications. We have created a data exchange mechanism for partner physics models to be applied to PINE CAM paths to create measuremnts for our path plan optimization routines to satisfy user objectives.

**Warfighter Value:** The value proposition of our work is in a highly automatic toolchain for creating bespoke manufacturing plans for equipment organizations may already possess that allows them to make or repair parts with the best-scenario state for their internal stresses. This will result in parts that are dimenionally correct with the desired mechanical properties.

WHEN

Contract Number: N68335-24-C-0215		Ending on: Feb 02, 2026		
Milestone	Risk Level	Measure of Success	Ending TRL	Date
CAM System	Low	CAM system operational for external users with multiple target systems	7	4th QTR FY25
Heruistics Demonstration	Medium	Demonstrate categorical decision making for the CAM process for minimizing distortion derived from experimental results.	6	4th QTR FY25
Physics Model Ensemble	High	Three surrogate models derived via disparate methods predicting thermal and stress fields, targeting 1000:1 speedup over conventional FE methods	5	2nd QTR FY26

HOW

**Projected Business Model:** There are a few possible revenue streams here:  
For the SBIR project, we are building a UI for customers to interact with the CAM solution. I already have some beta users at some partner universities. I would like to build an income stream around this eventually.

The machining optimization partner for this project has also proposed using a subset of this project's output as an additive module for their machining simulation. i.e. Generate the stressed and distorted from the AM process as an input to their machining simulation to optimize output.

I would also include some or all of this at a system controller level for future DED systems developed at PINE.

**Company Objectives:** Steadier, non-SBIR income! We have been fairly succesfull in securing SBIR funds, but transition has been a challenge. This has effected our ability to retain talent.

**Potential Commercial Applications:** Service Parts  
Part Repair  
Data generation for machine learning applications (2 ongoing efforts here)  
OEM integration into DED Systems