Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-871

Topic # N181-028
Precision Machining of Composite Structures
Product Innovation and Engineering L.L.C.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 261, CH-53 Heavy Lift Helicopters

Transition Target: PMA-261, PMA-262

TPOC:
(301)342-9369

Other transition opportunities:
Primes – GKN Aerospace, Boeing, Spirit Aerosystems, Albany, Aurora

Notes: The illustration shows detail of a laser drilled hole demonstrating the feasibility of machining FRP material systems with a high power CW laser, a pulsed green laser, and a pulsed near-IR laser. This brings laser cutting capability to the growing use of FRP material by the Navy and throughout the military.

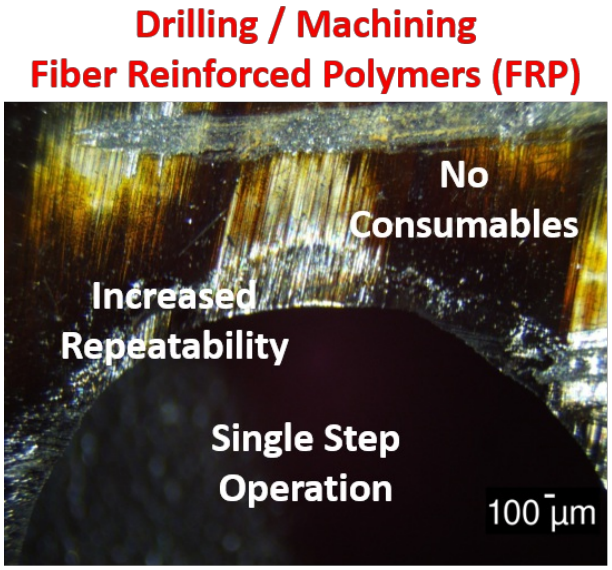

Photo courtesy of Product Innovation and Engineering This picture shows the back side of a hole drilled with pulsed laser with un-optimized processing parameters.

WHAT

Operational Need and Improvement:
- Reducing aircraft weight drives requirement to replace metallic components w/ FRP
- Reduce cost of machining Fiber Reinforced Polymer (FRP) materials
- Develop laser cutting system for FRP material, focus on glass and carbon
- Non-contact cutting reduces cost of replacing current tooling which is worn out machining FRP materials.

Specifications Required:
- Precision fastener hole and countersink machining process without inducing damage actual part
- Precision within the specified hole diameter +0.006" max,
- Surface roughness height rating of 250 or less w/ no breakout piles on exit side
- No delamination 0.010" deep from edge of hole or into the part from hole
- No splintering allowed beyond 0.010 in deep at entrance/exit of hole
- No damage to composite material from applied or induced heat
- Temperature limit should not exceed 50° F below the glass transition temperature

Technology Developed:
PINE is developing a laser cutting system for Fiber Reinforced Polymer material

Warfighter Value:
- Reduce operating cost by reducing frequency of expensive abrasion resistant drill bit
- Improve laser edge and shape cutting with single set-up in one process
- Reduce manufacturing time by eliminating need for guide hole
- Improves manufacturing process by utilizing dual lasers, rough cut with high power laser, finish cut with pulsed laser

WHEN

Contract Number: N68335-20-C-0128 **Ending on:** November 20, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete Phase I	Low	Develop innovative approach for a precision maching tool	TRL 4	September 2019
Initial Phase II Base (Yr 1)	Low	Develop prototype machine	TRL 4	November 2020
Initial Phase II Base (Yr 2)	Med	Develop necessary processing parameters and demonstration of precision fastener hole drilling capability on target material	TRL 5	June 2022
Initial Phase II Option (Yr 1)	Med	Refine processing parameters for target material and investigate new material systems.	TRL 6	November 2022

HOW

Projected Business Model: PINE is pursuing two paths:

1. Develop in-house machining capabilities, eliminating need to transition knowledge base
2. License technology to primes, allowing them to integrate this capability into their current workflow

Company Objectives:
Currently we are exploring both options and have not made a decision

Potential Commercial Applications:
Benchmark the precision machining system to machine and countersink fastener holes in composite structures for aircraft components. Transition the technology to provide an efficient and effective tool to produce countersunk fastener holes in carbon and glass fiber laminate composite materials used for military air platforms, as well as civilian air vehicle components and other industrial applications.

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