



# Fraunhofer USA

FRAUNHOFER USA CENTER FOR LASER APPLICATIONS CLA



**1 Laser Additive Manufacturing of an Aerospace Nozzle Demonstration Component.**

**2 Laser Additive Manufacturing of a Turbine Blade Demonstrator.**

**3 Screw Thread Build up using COAX™ Powder Deposition Technology.**

## Fraunhofer USA Center for Laser Applications CLA

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## MAKING LIGHT WORK

### Laser Additive Manufacturing

Fraunhofer is one of the pioneers in the growing field of additive manufacturing. Our process expertise includes the development of a range of state-of-the-art powder delivery nozzles which enable precise placement of the metallic powder material relative to the laser beam focus. Also, we have developed a coaxial wire system which enables multi-directional wire deposition for additive manufacturing.

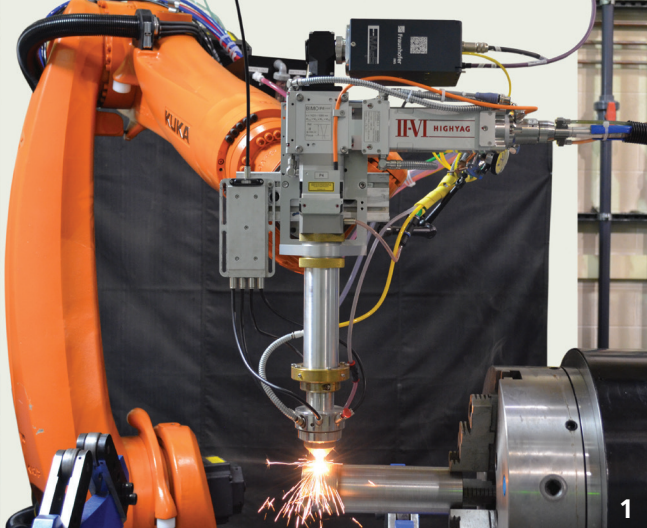
Our proprietary process monitoring and control technology and CAD to tool path generation software enable us to generate complex tool paths for build-up of high quality prototype components. Our CNC and robotic cells have up to 4 meters (13 feet) x 2.5 meters (8 feet) work envelope which enables large scale additive part construction which is not possible using powder bed technology.

### Advantages

- Low heat input / distortion
- Precise control of microstructure
- Minimal post machining requirements
- Functionally graded parts can be produced

### Applications

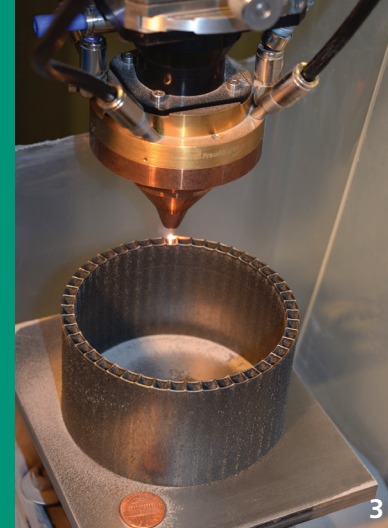
- Repair and rebuilding of turbine components
- Rebuilding of tooling and dies
- Creation of complex 3D components
- Rapid Prototyping
- Laser wire additive manufacturing



1



2



3

## MAKING LIGHT WORK

### Process Monitoring and Control – EMAQS

Process monitoring and control is becoming increasingly important for laser cladding and additive manufacturing applications.

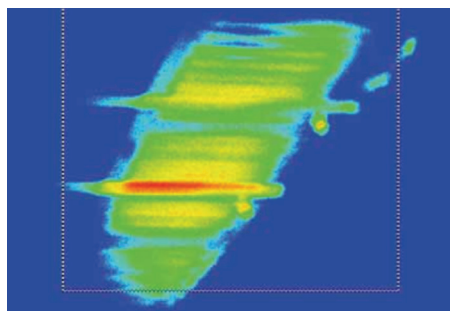
Fraunhofer CLA's EMAQS is a camera based process monitoring and control system which can view the process either coaxially through the laser processing optics or off axis from the side of the processing head.

For laser heat treatment applications the EMAQS camera is used to monitor part surface temperature and then the Lompoc

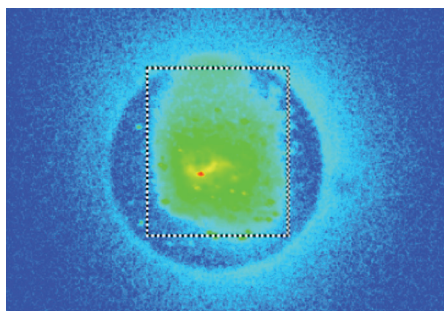
Pro software is able to closed loop control laser power in order to provide consistent heat input and heat treatment results.

For laser cladding and additive manufacturing the same system can be used to monitor and control the melt pool size so that the laser power can be continually adjusted to provide consistent results.

This is extremely beneficial for parts where there are issues caused by part heating over time or changing part geometries or materials which require the automatic adjustment of the laser power in order keep the melt pool size and heat input constant.

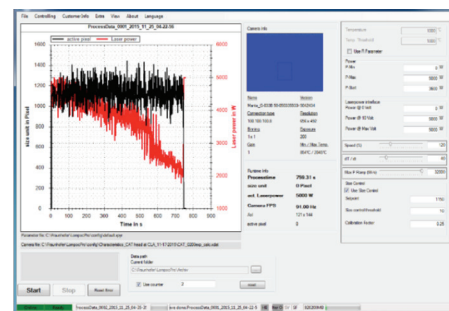


Thermal images from EMAQS Camera System

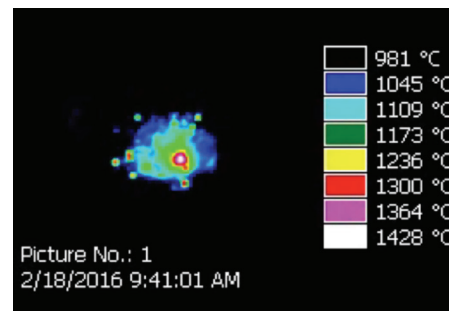


### Applications

- Powder Deposition for Laser Cladding
- Powder Deposition for Additive Manufacturing
- Wire based deposition including COAX™ Wire Processing



Lompoc Pro Software controls laser power to maintain constant melt pool size



1 Fraunhofer CLA COAX™ 8 Powder Head with EMAQS Camera mounted for coaxial process viewing and melt pool size control.

2 Fraunhofer IWS COAX™ Wire Head with EMAQS Camera mounted for coaxial process viewing and melt pool size control.

3 Fraunhofer IWS COAX™ 14 additive buildup of thin walled prototype part.