

Key Technologies (7)  
Structures Modeling, Designing, and Testing (1)

Author: Dr. Carlos Soriano  
IK4-TEKNIKER, Spain, carlos.soriano@tekniker.es

Dr. Borja Pozo  
IK4-TEKNIKER, Spain, borja.pozo@tekniker.es  
Mr. Mikel Madarieta  
IK4-TEKNIKER, Spain, mikel.madarieta@tekniker.es  
Mr. Andoni Delgado  
IK4-TEKNIKER, Spain, andoni.delgado@tekniker.es  
Mr. Arizaga Asier  
IK4-TEKNIKER, Spain, asier.arizaga@tekniker.es  
Mr. Iñigo Arizaga  
IK4-TEKNIKER, Spain, inigo.arizaga@tekniker.es

## ADDICTIVE MANUFACTURING OF SPACE STRUCTURES ON VACUUM USING THE LASER METAL DEPOSITION LMD TECHNIQUE BASED ON THE ADDITION OF METAL WIRE

### Abstract

Additive manufacturing (AM) is a promise technology for in-orbit/space manufacturing. Its potential use will reduce manufacturing cost and time. In this work we present the design and manufacture of an additive manufacturing machine based on the Direct Energy Deposition technique (DED): Laser Metal Deposition (LMD) by the addition of metal wire. The machine allows to manufacture structures of different alloys like Fe, Ni, Ti and Al and of maximum dimensions of 1900 x 900 x 750 mm in inert atmosphere (Ar and He) and in vacuum ( $< 5$  ppm of O<sub>2</sub>), with deposition rates up to 3 Kg/h. The machine also incorporates online control systems for geometry and temperature during the manufacturing process. The developed machine is of special interest to the aerospace sector given its capacity to manufacture large structures at high production rates in alloys that require an inert atmosphere or vacuum to generate components free of microstructural defects. The machine can manufacture and repair functional components, structures, tools, moulds, dies and gears. In addition, is capable to give protective coating against wear, corrosion and even as thermal barrier. So, this machine and the technology developed could help in the in-situ construction of future lunar and mars permanent settlement missions.