Technische
Universität
Braunschweig

Masterarbeit

Design, build and test of a 3D Printer for the Vacuum Environment

In Space Manufacturing (ISM), is an active area of research in the space industry, as it may lead to larger, more capable spacecraft at a lower cost. One of the most promising techniques is Additive Manufacturing, this is due to its inherent low waste, and flexibility. Indeed, multiple concepts have been proposed which would utilise AM to produce very large structures on-orbit, such as antenna reflectors, solar collectors, and space stations.
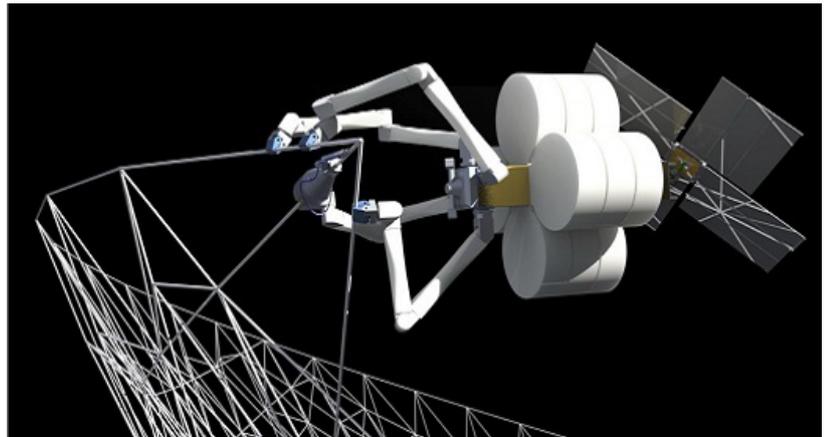
To realise these concepts, however, AM must be adapted to the harsh environment of outer space. Research has already proven that microgravity doesn't inhibit the use of traditional AM approaches, so long as Earth-like atmospheric conditions are maintained. The next step is to verify what impact the vacuum environment has on the AM process. Some initial experiments have been conducted, and imply that higher strength structures are possible due to reduced heat transfer from the part being printed. Up until now, however, these have been performed on commercial printers, with no adaption to the vacuum environment, which limits their lifetime, and the materials which can be used.

To enable long term testing in a vacuum environment, with a large variety of materials, it is therefore desirable to design and manufacture a 3D printer which is adapted to the vacuum environment. The design, build and test of this printer shall be the topic of this thesis.

In detail the following subtasks have to be performed:

1. Take the already completed concept design to a production ready design stage (PDR to CDR)
2. Model expected performance of the printer e.g. the cooling system
3. Build the designed printer
4. Test the designed printer and compare results with those of the model

If interested, please send Declan Jonckers your CV and grade transcript.

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