

Research theme	Design, Production and Management
Research title	Design of a modular micro pump assembly for space applications
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Background

Nowadays satellites contain more and more electronics. These electronics produce a lot of heat, which is cooled by a pumped cooling system. This cooling system is currently driven by a single large centrifugal pump. When one part fails of this pump, the whole cooling system stops working. This is of course not desired and therefore spare pumps are installed in satellites. These spare pumps provide extra weight, which is also not desired because launching one extra kilo into space requires about 100 kilograms of extra fuel and cost about 15.000,- euro.

Assignment

To overcome the high mass and single point of failure, the NLR introduced a new pump concept. By replacing the large pump by a modular micro pump assembly, this problem can be overcome. All micro pumps together should have the same capacity as the single large pump. Besides, no spare pumps are needed any more which is beneficial for total mass of the system.

Results

A modular micro pump is designed and tested on performance. A volume flow rate of 6,5ml/min is measured, where a requirement was set to 5ml/min for a single pump. In Figure 1, the stackable design is shown and consists of 8 disks with a top and bottom part. Every disks contains 2 micro pump principles, so a volume flow rate of about 100ml/min can be produced. The de individual parts are produced with Selective Laser Melting (SLM), which is a production technique within 3D-printing. Besides designing a stackable micro pump, research is done on the passive check valves and welding of SLM produced parts. Finally, there is a weight saving of 2kg with this design.



Figure 1: modular micro pump

Personal experience

Doing my master thesis at the NLR was a nice experience. Firstly, it was not only a theoretical assignment. The designs I made were actually produced and could be tested on performance. In addition, it is always nice to work on a project that eventually will be used. With some luck, in the near future a satellite will be launched with this micro pump design on board.