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### Title

## KARI's Additive Rocket Engine Initiative for Low-Cost and Sustainable Access to Space

### Authors

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### Abstract

Now is the new space era, all over the world's launcher developers are desperately trying to lower the price for transportation service because it is a very crucial point for survival and directly affects the sustainability. There may be several means for reducing the price such like simplifying system design, standardizing launcher components and using standardized and commercial grade parts, lowering manufacturing and testing cost, re-using partially or fully launch vehicle, shortening logistic steps and periods, and etc.

In this paper, we will describe the additively manufactured liquid rocket engine components for the KARI's initiative of an affordable and eco-friendly space transportation. And we also introduce the current development status of thrust chamber and other components. Several thrust chamber parts have been manufactured by the additive manufacturing technologies, which are laser powder bed fusion (L-PBF) and powder directed energy deposition (p-DED). Materials of pure copper, Inconel 718, and CuCrZr are used for L-PBF and Al-Bronze and Inconel 625 are used for p-DED. And some of the thrust chamber assemblies of 10 kN and 30 kN class thrust were conducted firing tests. Turbo pumps are designing now for 30 kN thrust liquid rocket engine which is basically planned to be made by the additive manufacturing. The liquid oxygen shutoff valve and engine thrust frame of Korea Space Launch Vehicle NURI's 3<sup>rd</sup> stage engine were designed, analyzed, and manufactured under the same requirements with those of the NURI. Also, some additively manufactured shutoff valves for upper stage engine of small satellite launch vehicle were imported and tested. Through these activities KARI expands the application of additive manufacturing technology to liquid rocket engines, advances the related technology, and innovates liquid rocket engine design.

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