

# DEEP BLUE AEROSPACE: LARGE COMBUSTION CHAMBER FOR ROCKET ENGINES WITH FARSOON METAL ADDITIVE MANUFACTURING



Figure 1: Rocket engine combustion chamber produced by FS621M (courtesy Deep Blue Aerospace)

## ↓ Project Overview

### CHALLENGES

- Build size
- Cost-control of product development
- Detail resolution
- Function integration

### SOLUTION

- Farsoon's large-format metal system FS621M

### KEY BENEFITS

- Rapidly manufacture large-sized engine parts featuring a light-weight design
- Improved performance and reliability; at a fraction of the cost

# Large scale production - at a fraction of the time and cost Through Additive Manufacturing.



## ↓ Customer Profile

Jiangsu Deep Blue Aerospace Technology Co., Ltd. (DBA), which was founded in November 2016, is a high-tech commercial aerospace enterprise focusing on the research and development of liquid reusable launch vehicles and providing commercial launch services, with integrating scientific research, production, test and launch services.

Learn more: [www.dbaspace.com/](http://www.dbaspace.com/)

*Figure 2: Deep Blue Aerospace exams as-printed combustion chamber from FS621M (courtesy Deep Blue Aerospace)*

In July 2021, commercial rocket launch company Deep Blue Aerospace completed China's first reusable launch test with its launch vehicle "DBA-M", known as the "Grass Hopper Jump". Following this first success Deep Blue Aerospace executed in October 2021 the VTVL (vertical take-off and vertical landing) test, successfully conducting a 100-meter jump. On May 7th, 2022, Deep Blue Aerospace achieved a second VTVL test launch to an altitude of 1000 meters, the distance between landing point and target was within 0.5m. By the end of June 2022, the ignition test of the 20-ton-thrust liquid oxygen kerosene rocket engine "Thunder-R1", which had been designed to deliver high performance while being economical for low volume production rockets, had been completed.

rockets, following US-based spacecraft manufacturer SpaceX. Being one of the first commercial rocket manufacturers in China to use industrial metal 3D printing for key components engineering, Deep Blue Aerospace invested in Farsoon's large-format metal system **FS621M** in 2022 to explore innovative manufacturing solutions for rocket engines.

*"At Deep Blue, we produce over 80% of the key components in rocket engine using metal 3D printing." said Dr. Tian Cailan, head of Additive Manufacturing of Deep Blue Aerospace, "Farsoon's FS621M offers us the ability to rapidly manufacture large-sized engine parts featuring light-weight design, structural integration, improved performance and reliability; with only a fraction of the cost, labor and lead time compared to the traditional technologies."*

## ↓ Growth and Success

This rapid pace of development, achieving in a short time-frame, the completion of these launch tests means the Deep Blue Aerospace has become the 2nd company in the world to succeed in all low-altitude engineering tests of reusable liquid oxygen kerosene



Figure 3: Farsoon FS621M system (courtesy Deep Blue Aerospace)

## ↓ Challenges Met

In 2022, Deep Blue Aerospace enhanced their batch production of single-piece, large-sized rocket engine combustion chambers using Farsoon's FS621M system. The additive manufactured Inconel combustion chamber measures **780mm (30.7 inches) in height and 550mm (21.7 inches) in diameter**. Major challenges include the size of the build, function integration, and detail resolution. The advanced additive manufacturing enabling many new innovations from Deep Blue engineers including consolidated design, light-weight lattice structures, and self-supported geometries. Other features such as complex geometries with many hundreds of internal cooling ribs and channels are designated to promote combustion efficiency of the rocket engine. The FS621M also allows for economical production of oversized aerospace parts with **an accelerated design-validation cycle by 80%** compared to the conventional manufacturing process.

*"Being a key component of the rocket engine, the combustion chamber has to achieve the required performance, efficiency and reliability under the extreme operating conditions of heat and pressure," says Dr. Tian, "We are fully convinced with the high quality, fast production speed, and operational stability delivered with Farsoon FS621M system. We are able to offer*

*products that are significantly lighter, more repeatable, yet demonstrates much better properties during the functional test, which is essential to meet the demanding standards of aerospace industry."*

*"For the next step, Deep Blue Aerospace will continue the VTVL launching test at a high-altitude, and start its very first orbital launch mission of the reusable full-scale carrier rocket." Says Dr. Tian, "We have full confidence combining our innovative designs with the expertise of Farsoon, and keep pushing the boundaries in metal powder bed fusion technology for large-scale engine parts production."*

## ↓ See for Yourself

Farsoon is proud to contribute to space science and to demonstrate 3D printing as an innovative manufacturing method for a wider range of end-use applications in the aerospace industry. **Farsoon Europe GmbH** will be showcasing a variety of metal additive manufacturing applications at Formnext 2022 in Frankfurt. Customers interested are welcome to visit us at up-coming Formnext event below, or email us: [globalinfo@farsoon.com](mailto:globalinfo@farsoon.com) for more details!

## ↓ Farsoon's Metal Laser PBF Systems

▼ FS621M



▼ FS721M



▼ FS421M



▼ FS301M



▼ FS273M



▼ FS121M



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