

A more efficient and competitive way to space, leading to new possibilities in the sky and on earth

ENLIGHTEN is a Horizon Europe project with the goal of developing key technologies for a new generation of cost-efficient, high-thrust, green, and reusable rocket engines powered by methane or hydrogen. Building on earlier developments in European propulsion, ENLIGHTEN targets a production cost reduction by a factor of 5 to 10. The project aims for the integration of these technologies into operational engines by 2027, supporting Europe's path towards competitive and sustainable space launch systems.



Laser Ignition System

Development of a multiplexed laser ignition system capable of distributing laser pulses to multiple ignition points through optical modules. The system is designed to ensure reliable, scalable, and cost-effective ignition suitable for reusable engines.



Electrical regulation valves

Design and qualification of electrically actuated regulation valves that operate immersed in propellants without requiring secondary sealing. These valves aim to improve precision, reduce mass and cost, and support multiple start cycles for reusable applications.



Single-element nozzle extension

Additive manufacturing of nozzle extensions from a single material, integrating optimized thermal and mechanical properties and internal cooling. This approach reduces manufacturing complexity and supports high-performance engine operation.



High-pressure multi-functional lines

Development of high-pressure lines that combine hydraulic, mechanical, and electrical functionalities. Designed for flexibility (e.g. engine gimbaling), high-pressure resilience, and integrated sensor capability, these lines aim for cost-efficient production, leveraging additive manufacturing.



Extended additive manufacturing

- Powder Bed Fusion – Laser Beam (PBF-LB) / Multi-Material (PBF-LB/MM) for complex components such as turbopumps and valves
- Direct Energy Deposition (DED) for large structures like nozzle extensions.

The goal is to ensure dimensional stability, reduce residual stresses, and enable efficient series production.



AI-powered Engine Health Monitoring System

Development of AI-powered health monitoring systems for real-time engine condition monitoring and predictive maintenance. This includes digital twin simulations for training data generation, real-time fault detection algorithms, and validation via engine-in-the-loop test environments.

All technologies will be integrated into a demonstration engine platform for validation. Testing is planned at a European high-thrust engine test facility. The roadmap foresees:

- Early integration of selected technologies into existing engine derivatives by 2025
- Maturation for next-generation reusable engines by 2027
- Readiness for deployment in reusable European launcher systems by 2030

ENLIGHTEN is shaping the future of European rocket propulsion – delivering breakthrough technologies for sustainable, reusable, and globally competitive launch vehicles.

