NASA's Space Launch System

RS-25 ENGINE

Operating Conditions

SPEED

MACH 23 - 17,000 MPH in 8.5 minutes

TURBOPUMP & PREBURNER SYSTEM

7,000 PSI (Automotive comparison = 20-30 PSI)
2 turbopump assemblies generate almost **100,000 HP**

FUEL CONSUMPTION

Consumes **1,500 Gallons Per Second**

196,000 gallons of liquid oxygen cooled to -297°F
537,000 gallons of liquid hydrogen cooled to -423°F

COMBUSTION TEMPERATURES

Main Combustion Chamber (MCC) = **6,000°F**
Combusts at **3,000 PSI** for over 8 minutes
Temperature ranges from **-423°F to 6,000°F**

FULL THROTTLE

First four SLS flights will operate at **109%** rated thrust

Imagine if your car had to work in this environment.

NASA designed the Space Launch System as the foundation for a generation of human exploration missions to deep space, including to the Moon and Mars.

SLS is the fastest vehicle carrying humans to space.

MACH 23
17,000 MPH
in just 8.5 minutes

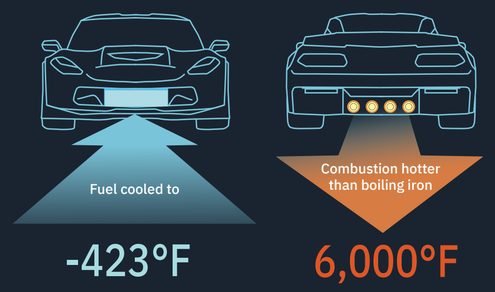
-423°F to 6,000°F

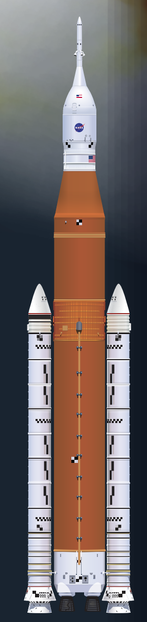
Max pressure **7,000 PSI**

L3Harris' RS-25: The Most Reliable, Flight-Proven Rocket Engine Ever Built

Exhaust velocity travels at 9,000 miles per hour, the same as traveling from NYC to LA in 15 minutes, and it's clean — it's superheated water vapor.

The RS-25 exhaust is clean, superheated water vapor, because the propellants are liquid hydrogen and liquid oxygen.





Taking Humans to the Moon and Beyond

Automotive Manufacturing vs. Rocket Manufacturing:

The automotive industry is made up of a wide range of companies and organizations involved in the design, development and manufacturing of cars. That is similar to the aerospace industry. In fact, the SLS program engages more than 1,100 large and small businesses in 44 states.

We even share automotive suppliers, like 3-Dimensional Services Group in Rochester Hills, MI. The supplier stamps car parts and Alloy 903 liners for the RS-25 powerhead.

Turbopump and Preburner System Comparison:

Energy (pressure and heat) from the RS-25 engine's preburner exhaust is needed to spin the turbopumps downstream, much like a turbo assembly on a car spins from hot gas generated by the engine's exhaust. Commercial automotive turbo assemblies operate at a pressure of 20-30 psi max, whereas the oxidizer preburner-turbopump assembly in the RS-25 engine operates over 200x that, at more than 7,000 psi! Each of the two turbopump assemblies combine to generate almost 100,000 hp. These aren't even producing thrust, they're merely propellant pumps! This output increases propellant pressure before final combustion in the main combustion chamber, where burning occurs for over 8 minutes at 3,000 psi and 6,000° degrees Fahrenheit.

Turbopump horsepower versus regular car horsepower: Each turbine blade powering the RS-25's high-pressure fuel turbopump produces more than any production car's horsepower and its airfoil is the size of a quarter.

Ability to Throttle:

In a car, the gas pedal is the means of controlling an engine's power. It does so by regulating the amount of fuel entering the engine. In the SLS rocket, the RS-25 engines are able to throttle as well. Each engine is equipped with a controller that not only communicates with the rocket, but also regulates engine thrust levels and monitors the health and performance of the engine.

Number of Moving Parts:

Cars expand exhaust gases against a piston. The piston pushes a crankshaft, the crankshaft runs the drive shaft, which turns the wheels that moves the car (mechanical motion measured in horsepower). Rockets exhaust gases directly out of the engine and produce thrust by conservation of momentum. The efficiency of car engines is limited in efficiency by the compression ratio of the piston, whereas rocket engines do not have such inefficiency.

Paint Jobs:

Cars have cool paint jobs, but you won't see extra paint on rockets because of the weight paint adds to the design. The rocket is all about maximizing its performance.

Oxidizer in Combustion:

For combustion powered cars and rockets, a chemical reaction releases energy to generate hot gases that accelerate the vehicles. For the chemical reaction to take place, you need a fuel and an oxidizer. Cars use oxygen from the atmosphere and rockets carry the oxidizer with it.

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NASA's Space Launch System (SLS): America's Exploration Rocket
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