NASA Seeks Clarity on New Rocket Fuel’s Explosive Properties

Description

For over six decades, large rockets primarily used a mix of liquid and solid propellants. Refined kerosene was preferred due to its easy handling and safety. Hydrazine was valued for its storage ease, while hydrogen offered efficiency, and solid fuels provided durability and quick launch readiness.

Around 15 years ago, the development of methane-fuelled engines gained momentum. SpaceX and Blue Origin now produce powerful engines, the Raptor and BE-4, each generating more than half a million pounds of thrust. SpaceX's Starship rocket employs 39 Raptors, whereas Blue Origin's New Glenn and the United Launch Alliance's Vulcan use fewer BE-4 engines in their boosters.

These "methalox" engines burn methane with liquid oxygen and have various benefits. Methane is ideal for reusable engines as it creates less soot than kerosene, which powers SpaceX's Falcon 9 rocket. It also handles better than liquid hydrogen, which can leak easily and requires very low storage temperatures of about minus 423 degrees Fahrenheit (minus 253 degrees Celsius). Although methane is also a cryogenic liquid, it has a higher storage range, between minus 260 and minus 297 degrees Fahrenheit (minus 162 to minus 183 degrees Celsius).

In 2023, a Chinese rocket became the first methane-fuelled launcher to orbit. American companies like Rocket Lab, Stoke Space, and Relativity Space are also developing similar engines for their future vehicles.

However, rocket launches carry risks. The US Space Force and NASA aim to understand how dangers differ from explosions of methalox rockets compared to traditional launches. This research is vital as the frequency of launches increases, with companies planning multiple flights per day from closely positioned launch pads.

Currently, operational or under-construction launch pads for methalox rockets exist at Kennedy Space Center and Cape Canaveral Space Force Station in Florida, Vandenberg Space Force Base in California, and NASA’s Wallops Flight Facility in Virginia. SpaceX continues testing Starship from private land in South Texas, overseen by the Federal Aviation Administration for public safety.

Vocabulary List:

1. **propellants** /prəˈpɛlənts/ (noun): material burned to make rockets go
2. **methane** /ˈmɛθeɪn/ (noun): a gas used as a fuel
3. **thrust** /θrʌst/ (noun): strong push that moves something forward
4. **cryogenic** /ˌkraɪoʊˈdʒɛnɪk/ (adjective): very cold; related to very low temperatures
5. **reusable** /riˈjuːzəbəl/ (adjective): able to be used again many times
6. **soot** /sʊt/ (noun): black powder made by burning fuel

Comprehension Questions

Multiple Choice

1. What type of engines gained momentum around 15 years ago?

   Option: Hydrogen-fuelled engines
   Option: Methane-fuelled engines
   Option: Solid-fuel engines
   Option: Liquid-fuel engines

2. Which company produces the Raptor engine?

   Option: Blue Origin
   Option: Relativity Space
   Option: Rocket Lab
   Option: SpaceX

3. What is the primary benefit of methane as a rocket fuel?

   Option: It is the cheapest fuel
   Option: It creates less soot
   Option: It has higher energy density
   Option: It has lower storage temperatures

4. Which rocket uses more than half a million pounds of thrust from its engines?

   Option: Falcon 9
   Option: Starship
   Option: New Glenn
   Option: Vulcan

5. Where is the Kennedy Space Center located?

   Option: California
   Option: Texas
   Option: Florida
   Option: Virginia

6. What is the primary concern regarding rocket launches?

   Option: Cost of launches

Option: Frequency of launches
Option: Risk of explosions
Option: Development of new rockets

True-False

7. Refined kerosene is preferred for its complicated handling.

8. Methane is ideal for reusable engines.

9. SpaceX's Falcon 9 rocket is powered by methane.

10. The first methane-fuelled launcher to orbit was from a Chinese rocket in 2023.

11. Liquid hydrogen requires high storage temperatures to prevent leaking.

12. The US Space Force is researching dangers of methalox rockets compared to traditional launches.

Gap-Fill

13. Rocket launches primarily used a mix of liquid and solid propellants for over _____ decades.

15. In 2023, a Chinese rocket became the first _____-fuelled launcher to orbit.

16. The operational launch pads for methalox rockets exist at Kennedy Space Center and _____.

17. Methane has a higher storage range compared to _____ hydrogen.

18. NASA’s Wallops Flight Facility is located in _____.

Answer

Multiple Choice: 1. Methane-fuelled engines 2. SpaceX 3. It creates less soot 4. Starship 5. Florida 6. Risk of explosions
True-False: 7. False 8. True 9. False 10. True 11. False 12. True
Gap-Fill: 13. six

15. methane 16. Cape Canaveral Space Force Station 17. liquid 18. Virginia

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