



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

Vocabulary quizzes

Multiple Choice (Select the Correct answer for each question.)

1. What do constellations primarily represent in the night sky?

- Option: Groups of stars
- Option: Planets
- Option: Galaxies
- Option: Comets

2. What is the main function of processors in a computer?

- Option: Storage
- Option: Processing data
- Option: Networking
- Option: Input

3. A terawatt is a unit of power equal to how many watts?

- Option: 1,000 watts
- Option: 1 million watts
- Option: 1 billion watts
- Option: 1 trillion watts

4. What is typically included in a proposal?

- Option: Decorative elements
- Option: Business strategies
- Option: Personal opinions
- Option: Random thoughts

5. What does thermal energy relate to?

- Option: Sound
- Option: Heat
- Option: Light
- Option: Electricity

6. What are propellants primarily used for?



- Option: Cooling engines
- Option: Creating thrust
- Option: Generating electricity
- Option: Storing fuel

7. Which of the following is a primary component of natural gas?

- Option: Ethane
- Option: Propane
- Option: Methane
- Option: Butane

8. What does thrust measure in a propulsion system?

- Option: Speed
- Option: Force
- Option: Weight
- Option: Distance

9. Cryogenic technology is most commonly used in which field?

- Option: Cooking
- Option: Space exploration
- Option: Fashion design
- Option: Agriculture

10. What is the benefit of reusable launch vehicles?

- Option: Increasing cost
- Option: Reducing waste
- Option: Limiting access
- Option: Increasing energy

Gap-Fill (Fill in the blanks with the correct word from the vocabulary list.)

11. After the combustion process, the exhaust contained a significant amount of _____ .
12. The rocket's performance _____ expectations during the test flight.
13. The startup secured additional _____ to expand its operations.
14. The platform has different service levels, with each _____ offering unique features.
15. Many _____ supported the innovative project through crowdfunding.



16. The event offered _____ access to its VIP guests.
17. The team built significant _____ heading into the final stages of the project.
18. During the long trip, we had a three-hour _____ at the airport.
19. The company issued _____ for all employees attending the conference.
20. The documentary was _____ with subtitles for better understanding.

Matching Sentences (Match each definition to the correct word from the vocabulary list.)

21. Over the years, she gradually accumulated a vast knowledge of history.
22. The school's alumni reunion brought together graduates from all classes.
23. The event was designed to celebrate and honor military spouses.
24. The ancient temple was sadly desecrated by vandals.
25. Archaeologists planned to excavate the site for hidden artifacts.
26. The prosecutors presented strong evidence during the trial.
27. The skeletal remains were found in the abandoned building.
28. Plants use chlorophyll to absorb light for photosynthesis.
29. Environmental degradation can have severe impacts on biodiversity.
30. The city's proposal for a new park received public support.

Answer

Multiple Choice: 1. Groups of stars 2. Processing data 3. 1 trillion watts 4. Business strategies 5. Heat
6. Creating thrust 7. Methane 8. Force 9. Space exploration 10. Reducing waste

Gap-Fill: 11. soot 12. surpassed 13. funding 14. tier 15. backers 16. exclusive 17. momentum 18. Layover
19. Travel orders 20. Captioned

Matching sentence: 1. accumulated 2. reunion 3. spouses 4. desecrated 5. excavate 6. prosecutors 7. skeletal
8. chlorophyll 9. degradation 10. proposal



CATEGORY

1. Sci/Tech - LEVEL5

POST TAG

1. ESL learning
2. esl news
3. launch industry
4. Level 5
5. NASA
6. rocket fuel

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