NASA Langley's Aerothermodynamic Capabilities for Entry, Descent, and Lan

Aerospace Engineering · Practice Test · 30 Questions

1. What is the primary focus of the review presented in this document?

A) Hypersonic flight research
B) Mid to low lift-to-drag ratio vehicle geometries for EDL
C) Winged craft development
D) Propulsion demonstrations

2. Which of the following is NOT listed as a critical area within the aerothermodynamic environment for EDL missions?

A) Aerodynamics
B) Thermodynamics
C) Structural Integrity
D) Heat-transfer

3. According to the text, which method is often prohibitively expensive for defining EDL aerothermodynamic environments?

A) Ground-test experimentation
B) Computational Fluid Dynamics (CFD) simulations
C) Flight-testing
D) Wind tunnel testing

4. What is a primary role of wind tunnel testing in recent years, in addition to its customary role?

A) Replacing CFD simulations entirely
B) Providing high-fidelity data for computational model development and validation
C) Focusing solely on vehicle design
D) Reducing the need for flight-testing

5. Which NASA LaRC facility is currently mothballed and non-operational?

A) 31-Inch Mach 10 Air Tunnel
B) 20-Inch Mach 6 Air Tunnel
C) 15-Inch High-Temperature Mach 6 Air Tunnel
D) 20-Inch Mach 6 CF4 tunnel

6. The 31-Inch Mach 10 Air Tunnel is primarily employed in which types of studies?

A) Heat-transfer and boundary-layer transition studies
B) Instrumentation development and diagnostics
C) Aerodynamic and fluid-mechanics studies
D) CFD model development

7. Which LaRC wind tunnel is primarily used for heat-transfer and boundary-layer transition studies due to its wide Reynolds number operating range?

A) 31-Inch Mach 10 Air Tunnel
B) 20-Inch Mach 6 Air Tunnel
C) 15-Inch High-Temperature Mach 6 Air Tunnel
D) 20-Inch Mach 6 CF4 tunnel

8. The 15-Inch Mach 6 High-Temperature Air Tunnel is considered a leg of which larger facility?

A) 20-Inch Mach 6 Air Tunnel
B) Unitary Plan Wind Tunnel
C) 31-Inch Mach 10 Air Tunnel
D) CF4 Tunnel

9. What is a key characteristic of the 20-Inch Mach 6 CF4 tunnel that allows it to simulate high-temperature, reacting air at lower Mach numbers?

A) Lower shock density ratio
B) Perfect-gas properties
C) Higher shock density ratio
D) Lower operating temperature

10. The NASA Langley Unitary Plan Wind Tunnel (UPWT) is a closed-circuit, continuous-flow pressure tunnel with how many separate legs?

A) One
B) Two
C) Three
D) Four

11. Which measurement technique provides global heat-transfer information with an order-of-magnitude more data points than discrete-gage techniques at a fraction of the cost?

A) Infrared thermography
B) Pressure-sensitive paint
C) Temperature-sensitive paint
D) Phosphor thermography

12. What does Pressure-Sensitive Paint (PSP) measure?

A) Surface temperature
B) Surface pressure
C) Heat-transfer rates
D) Flow-field velocity

13. Which technique is employed to obtain surface flow-field patterns by observing the movement of oil on a model's surface?

A) Schlieren systems
B) Laser-induced fluorescence
C) Oil flow visualization
D) Pitot probes

14. What type of measurement technique is generally more expensive and provides less spatial resolution but is often necessary for temporal data?

A) Global surface measurement techniques
B) Discrete surface measurement techniques
C) Flow-field diagnostics
D) Model fabrication methods

15. Which of the following is NOT a discrete surface temperature and heat-transfer measurement technique mentioned?

A) Thin-film resistance heat-transfer gages
B) Coaxial thermocouples
C) Infrared thermography
D) Thin-skin calorimeter gages

16. What type of balances are typically used for aerodynamic force and moment measurements?

A) Strain-gage balances
B) Pressure transducers
C) Thermocouples
D) Laser velocimeters

17. Which technique is available for visualization of flow-field shock structures in all tunnels?

A) Laser vapor screening
B) Schlieren systems
C) Planar laser-induced fluorescence (PLIF)
D) Pitot probes

18. What is the primary role of the LAURA code at NASA Langley?

A) Supersonic flow simulations
B) Boundary-layer transition prediction
C) Hypersonic conditions simulations
D) Aerodynamic trim-tab design

19. Which computational solver uses unstructured grids to deal with complex topologies?

A) LAURA
B) FUN3D
C) OVERFLOW
D) LASTRAC

20. What was a critical design consideration for the Mars Science Laboratory (MSL) entry vehicle due to its size, angle of attack, and entry velocity?

A) Laminar flow on the leeside
B) The possibility of turbulent flow on the leeside
C) Low heating rates
D) Minimal aerodynamic loads

21. What issue was investigated using global phosphor thermography in the LaRC 20-Inch Mach 6 Air Tunnel for the MSL entry vehicle?

A) RCS jet interactions
B) MMRTG breakup analysis
C) Heat shield attachment-point cavities
D) Turbulent aeroheating

22. The MSL heat-shield cavity correlations were developed in terms of the ratio of cavity diameter to boundary-layer height versus what other parameter?

A) Mach number
B) Reynolds number
C) Momentum thickness Reynolds number
D) Stagnation temperature

23. For the MSL turbulent aeroheating studies, which algebraic turbulence model was adopted as the design method?

A) Cebeci-Smith
B) Baldwin-Lomax
C) LAURA
D) FUN3D

24. Why was aerodynamic force-and-moment testing performed in the LaRC UPWT for the MSL entry vehicle?

A) To verify expected hypersonic performance
B) To verify expected supersonic performance
C) To study RCS performance
D) To analyze MMRTG breakup

25. What was the general finding regarding the maximum interaction effects of the MSL Reaction Control System (RCS) jets?

A) They exceeded 50% of the RCS-generated torques
B) They were less than 30% of the RCS-generated torques
C) They were negligible
D) They required significant design changes

26. What is the Orion Multi-Purpose Crew Vehicle (MPCV) being developed as?

A) A Mars rover
B) A lunar lander
C) A re-entry vehicle for human missions beyond Low Earth Orbit
D) A satellite for Earth observation

27. For the Orion vehicle, a turbulent flow design environment has been specified due to its large size, high-angle of attack, and high entry velocity. What experimental studies were conducted to obtain turbulent aeroheating data?

A) Discrete heat-transfer measurements
B) Global phosphor thermography
C) Infrared thermography
D) Pressure-sensitive paint

28. What type of material is the Orion heat shield manufactured from?

A) Titanium
B) Aluminum
C) Avcoat (an ablative material)
D) Ceramic

29. What was the primary purpose of the IRVE-3 mission?

A) To demonstrate a Mars lander
B) To test a hypersonic inflatable aerodynamic decelerator (HIAD)
C) To return solar wind particles to Earth
D) To develop a new propulsion system

30. What phenomenon was investigated in the LaRC 20-Inch Mach 6 Air Tunnel for the IRVE-3 mission due to the flexible aeroshell's expected deformation?

A) RCS jet interactions
B) Boundary-layer transition and heating
C) Wake-flow structure
D) Aerodynamic trim-tab effectiveness