



2024-25 Design, Build, Fly Q&A #1

Boeingcraft

Cesana

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General Questions

1. What constitutes a commercial beverage bottle? For instance, could the bottle be a reusable drink bottle?

Can we use any commercially available plastic bottles regardless of the original content or does it have to be specifically from beverages?

Is there a specific shape/beverage restriction for the bottles? For example, would a bladder style container work? Or could you use an olive oil container, if you consider olive oil a beverage?

Can the bottles be a commercial reusable bottle?

Answer: It must be a beverage bottle that is available for purchase (soft drinks, sport drinks, water, etc), including reusable drink bottles made of materials other than glass. A bladder is not a bottle. Olive oil is not considered a beverage for this competition.

2. [...] must the bottle have an external volume label? If so, can it be attached by the team or must it be from the manufacturer?

Is it permissible to use a commercially procured bottle for the fuel tanks, even if it does not have a labeled capacity, as long as it satisfies the minimum capacity requirement?

Answer: Bottles without volume labels or permanent marking are allowed. Teams are not allowed to apply their own label to the bottle. However, it is up to the teams to demonstrate the minimum volume requirement is met in tech inspection. It is not up to the tech inspector to determine the volume of a team's unmarked bottle.

3. Since we are allowed to bring multiple X-1 vehicles, and for M2 the X-1 is not being released, does the X-1 have to be flight capable for M2 or could it just be anything the team wants? Essentially, what defines an X-1 test vehicle for M2?

Can the different X-1 vehicles that the team may bring and use, differ slightly from each other (different wingtips, different dihedral, size of control surfaces, different wingspans) in design or even majorly (flying wing vs conventional), or can they only differ in total weight?

Does the shape of X1 glider aircraft have to stay the same for Mission 2? The rules only state that teams may bring multiple X1 test vehicles?

The rules state that multiple X-1 gliders can be brought to the competition. Is it necessary for all of them to be fully operational (including electronics, strobes, etc.)?

Answer: ALL X-1 test vehicles approved in tech inspection must be capable of performing ALL required missions – GM, M2 and M3 – and must be the same configuration and size. The weight of each X-1 test vehicle approved does not have to be fixed and can be adjustable to achieve a desired mission score.

4. Is the employment of an electromagnet mechanism to drop the X-1 allowed? The rules only disallow magnets used as a latching mechanism for access hatches, so we assume it's okay but just wanted to check?

Answer: No. Magnets are not an acceptable means for mechanical attachment of any component for retention during take-off, flight and landing.

5. Does the X-1 have to stay intact upon landing? Assuming the strobe lights are still operating?

If the X-1 test vehicle sustains damage but still has working lights upon landing, does this affect the bonus points score?

For an X-1 with multiple LEDs, do all the LEDs need to remain flashing after landing for X-1 bonus points to be awarded?

Answer: The only requirement is that the ALL strobes/lights must remain functioning. Damage to the X-1 test vehicle is not a criteria.

6. Can the X-1 be a purchased off-the-shelf model, modified as needed to comply with the competition rules?

We were wondering if the X-1 can be a modified version of a commercially available airplane with changes made to meet the requirements and goals of the competition. As opposed to being required to build the X-1 airplane from the scratch?

Answer: The X-1 test vehicle may be purchased, modified, manufactured or any combination thereof.

7. Does the 0.25" minimum gap between the X-1 test vehicle and the main aircraft not apply to the attachment point? What will be considered the boundary between the X-1 test vehicle itself and the attachment point that sticks into/out of/onto it?

Answer: Obviously there cannot be a gap between the airplane and the X-1 attachment point. The rules state that the minimum gap is between the top of the X-1 test vehicle wings and the airplane. .

8. Is the mechanism that holds the fuel tank bottle onto the pylon considered part of the pylon, and if so, are there restrictions on this mechanism?

Answer: The mechanism to attach the fuel tank to the pylon is part of the pylon. The only requirement is that it must pass tech inspection for securing the fuel tank for all phases of the mission.

9. Are the fuel tank bottles filled before a mission begins or do they need to be filled during the timed staging window?

Answer: The fuel tanks must be filled to the desired weight prior to entering the staging box.

10. Do the external fuel tanks need to be exposed to air (i.e. can the pylon encase the fuel tank bottles)?

Can we make a pylon that is a capsule to the bottle, or does this count as changing the bottle?

Can pylons be designed such that the cap of the bottle is fully covered without eclipsing the entire bottle?

Are aerodynamic fairings allowed for externally mounted fuel tanks?

Can pylons be designed such that the cap of the bottle is fully covered without eclipsing the entire bottle?

Answer: The pylon cannot enclose the bottle nor add an aerodynamic fairing in front of or behind the bottle. The bottle must be fully visible when viewed from the front and rear. The pylon attachment may completely encircle the bottle outside diameter.

11. Can we [use] different materials between the outside bottles and the bottle inside the fuselage?

Answer: Yes.

12. During the ground mission can we use electronic commands, for example can we put the x1 in place and secure it via radio control, or does it need to be manually?

Can the pilot actuate a mechanism that is responsible for securing (and later dropping) the X-1 during the ground mission?

Answer: The attachment can be made with the aid of the RC transmitter to control the mechanism.

13. In the ground mission, to put the pylons [on] can we disable the wingtip for putting the pylon and assemble it again?

Answer: Yes. Removing and reassembling components is part of the timed mission. All components removed to install the pylon must be put back on the airplane

14. If we have the wing below the fuselage can we take the x-1 below the wing?

Answer: Yes.

15. Can we [use] different material in the same bottle?

Is it allowed to [use] materials like steal, lead, copper and other metals [as weight in the bottles]?

Would it be permissible to use different materials as payload in the external bottles compared to the bottle placed inside the fuselage?

Is the fuel in the fuel tanks required to be removable, or could it be something like epoxy or concrete?

Answer: Yes, different materials can be combined to add weight to the fuel tanks as long as the materials and any combination of those materials remains inert (i.e., not hazardous, not reactive, including in the event of a crash). Different materials may be used in individual fuel tanks for a given mission if the team chooses to achieve a desired mission score. The choice of materials is up to each team to decide as long as it meets the safety criteria. The material does not need to be removable from the bottles. Lead shot is not an acceptable material.

16. Is the cap considered part of the bottle/fuel tank?

Can the caps on the bottle be permanently attached, i.e. glue or tape?

Answer: Yes and yes.

17. Can pylons be designed in such a way that the bottle can be screwed in as a method of mounting the bottle to the aircraft?

Answer: This is not allowed since the cap is part of the bottle and the bottle cannot be threaded into the pylon using the cap threads. Also, the requirement that the bottle must be in full view from the front prohibits this type of attachment.

18. We want to know if an electronic flight controller is required, or if we could achieve the flight path through the stability characteristics of a glider?

Answer: As stated in the rules, a flight controller for the X-1 test vehicle **may** be used, meaning it is not required.

19. Can you put a homing light/heat beacon on the target (middle of bonus box) before flying the mission?

Answer: No.

20. In what unit of weight is the X-1 weight measured? The unit, and subsequent scaling of the weight value, significantly impacts the M3 score calculation?

Answer: Pounds.

21. Can the fuel tanks be pressurized?

Answer: No.

22. Must the internal fuel tank be removable and not permanently secured in the plane?

Answer: Yes, the fuel tanks cannot be installed prior to entering the staging box or starting the ground mission.

23. Is parachute a valid method for landing the X-1 glider?

Can the X-1 glider deploy a streamer or recovery parachute during descent?

Answer: No, nothing can be deployed from the glider before or after release.

24. Does fuel tank orientation matter (eg. bottle cap forward or backward)?

Answer: Fuel tank orientation is up to each team to determine.

25. Can fuel tanks be positioned on the upper surface of the wing?

Answer: Yes.

26. Can the fuel tanks be partially blended into the wing? If so, where is the limit where the fuel tank is considered inside the wing and no longer just having the wing act as a fairing?

Answer: The wings must be fully intact for M1 and at the start of the GM. No components can be permanently removed in order to install the pylons. Attachments for the fuel tanks cannot be present on the airplane at the start of the GM and for M1. The fuel tanks must attach directly to the pylon, so having a fuel tank “blended” into a wing as a fairing is not feasible.

27. How will the flight line judge determine the altitude of the plane? Must the pilot or observer have a method of determining the altitude on their own (for example, a barometer on the plane), or can the flight line judge provide the pilot or observer regularly with the information of plane altitude?

Answer: The Flight Line judge will determine if the airplane is at the required altitude by visual observation. As stated in the rules, the pilot or observer is strongly encouraged to request confirmation from the Flight Line judge prior to releasing the X-1 test vehicle. Arguing with or challenging the Flight Line judge will not be tolerated.

28. How is a pylon defined? Can two different structures be used to secure a single fuel tank (eg. one in the front and one in the back)?

Can there be a permanent fixture on the plane that attaches the pylon? Or would that permanent fixture be considered a part of the pylon?

Is there a minimum gap between the fuel tank bottles and the aircraft, outside of its contact with the pylons?

Answer: A pylon is a device that attaches to the airplane and secures the fuel tank to the airplane for all phases of flight. The example in the figure below clearly defines the wing, pylon and fuel tank. It is up to each team to determine the pylon design. There is no restriction on a pylon having multiple components or pieces as long as it meets all of the requirements in the rules. There is no minimum dimension for the pylon as long as there is a discernible gap between the wing and fuel tank bottle AND attachment of the fuel tank bottle to the pylon is external to the pylon and wing. There may be a permanent feature on the airplane wing to attach the pylon but these features must be internal and cannot be in the free airstream around the wing.



29. Can the pylons be installed on the wingtips horizontally (i.e., the fuel tanks are at the wing tips outside of the wings) beyond the 6 ft wingspan limit (so long as the entire wing itself is 6 ft)?

Answer: Yes but the 6 foot maximum wing span includes the pylon and fuel tanks in this scenario.

30. Can the blocks, used in the ground mission and staging box for access underneath the plane, restrain the wheels of the aircraft?

Answer: It is up to each team to determine how the blocks interface to or restrain the airplane.

31. For X-1 location, what is considered the “fuselage” for “under the fuselage”? Can we mount the X-1 on the bottom surface anywhere along the longitudinal direction?

Answer: The X-1 test vehicle can be mounted underneath the airplane anywhere in the longitudinal direction. If the attachment mechanism for the X-1 test vehicle is NOT inside the fuselage (i.e., inside the fuselage with access via an optional bomb bay door), then the attachment and release mechanism MUST be uninstalled for M1 and at the start of the GM and installation will be part of the timed mission along with installation of the pylons. “Under the fuselage” means under the bottom surface of the airplane, wings or booms directly above the X-1 test vehicle wings where the 0.25 inch clearance requirement is implemented.

32. Does there have to be a proof of flight video for each unique X-1 configuration?

Answer: No.

33. There is no explicit wording on the fullness of the external fuel tanks during M2. Is there a minimum weight/volume that they must carry in M2? Could they be partially full? Could they be empty?

Answer: There is no requirement on the “fullness” of the fuel tanks. The amount of inert materials to carry for weight is up to each team to determine to achieve their desired mission score, not to exceed the max weight declared in tech inspection.

Answer:

34. If the x1 is configured as a flying wing with vertical stabilizers as endplates, may these stabilizers make contact with the aircraft wing, or must they adhere to the 0.25-inch clearance requirement?

Answer: If the stabilizers are on the wing tip, they must adhere to the 0.25 inch clearance requirement.

35. What constitutes "stable flight" for the X-1 glider after release? For example, are there pitch/roll angle requirements, minimum glide time, or other constraints?

Answer: Stable flight is well defined in aerospace engineering. It will be up to the flight line judge to determine if this requirement is met by visual observation. Obvious deviations included but are not limited to stall, tumble, sudden roll greater than required to make the 180 degree turn, etc. Since it will be by visual observation, no specific parameters and values can be assigned and the decision of the flight line judge will be final.

36. Can the X-1 lights be flashing prior to loading the X-1 under the airplane and become not visible/turn off when loaded?

Answer: First, the lights must be visible at all times to verify they do not come on prior to release. Second, this would be acceptable as long as the lights are visible keeping in mind that if the lights come on during the mission prior to release at any point due to flight loads, buffeting, etc, no bonus points will be awarded.

37. We would like to verify that the X-1 glider lights are only required for M3 bonus points and not for M3 completion/score?

Answer: Correct.

38. The X-1 glider is supposed to be carried underneath the airplane fuselage between the left and right external fuel tanks. Does this mean that the entire glider has to fit between the external fuel tanks or that just the fuselage of the glider has to fit between the external fuel tanks? (i.e. can the wings of the glider extend past the external fuel tanks so long as the wings are in front of or behind the fuel tanks?)

Does the X-1 test vehicle have to be mounted within the chord of the wing or can it be fore or aft of the wing as long as it's between the fuel tanks?

Answer: The attachment point for the X-1 test vehicle must be between the external fuel tanks. If the X-1 test vehicle wings extend to or past the fuel tanks, the 0.25 inch clearance requirement must be met. The X-1 test vehicle and the external fuel tanks do not have to be in the same location in the longitudinal direction.

39. The X-1 glider is supposed to execute a 180 degree turn and then fly a descending pattern or orbit before landing. Can the 180 degree turn be part of the orbit itself, or do these need to be two separate maneuvers?

Answer: The 180 degree initial turn may be the start of the orbit or pattern to the bonus boxes.

40. Is it allowed to connect the X1 to the RC receiver of the carrier aircraft while connected to the carrier aircraft? The connection would be interrupted after releasing the X1?

Answer: The interface between the airplane and the X-1 test vehicle is up to each team to determine. By definition, the interface is interrupted at release.

41. Must the same bottles be emptied and filled before each mission or can there be multiple, different bottles of the same specification, which are prefilled (or left empty) before the competition?

If we were to use some sort of binder in our fuel tanks such as cement or wax, do we have to use the exact same tanks in Mission 2 as in Mission 3, or can we use separate yet otherwise identical bottles that we keep empty for Mission 3

Answer: It is up to each team to decide how much material to add to each bottle for weight prior to any mission attempt, other than the GM, which must be the max weight declared in tech inspection. Separate empty bottles may be used for M3 as long as all bottles are approved in tech inspection. For this year only, replacement bottles may be approved by tech inspection due to damage to the previously approved bottles.

42. Can multiple fuel tanks be attached to the same pylon?

Answer: No.

43. The rules state that the fuel tank bottle's surface may not be altered. What about reversible attachable components (like clamping), would this be regarded as altering the bottles? Upon start of the Ground Mission, would such components need to be detached from the bottles, or would it be allowed that they are attached beforehand, but not yet to the pylons?

Can something be permanently attached to the bottle used as an external fuel tank using clamps, brackets, or straps, as long as the surface of the bottle is not modified?

Answer: **The rules are hereby modified to allow for installation of an adapter to the bottles with the following limitations. The adapter may be permanent or removable. The adapter facilitates a mechanical connection between the bottle and pylon that must withstand all flight and landing loads. The adapter is limited to no more than 0.50 inches wide and 0.50 inches high from the top of the bottle. The adapter may be no longer than 5.00 inches. The adapter may implement clamps that partially or fully enclose the outer diameter of the bottle. The clamps must be within the 5.00 inch maximum adapter length.**

44. Should the configuration drawing in the design report include the X1 aircraft?

Answer: No.

45. Is the X-1 test vehicle allowed to do a 180 degree turn in any direction (up-down too)?

Does the 180 degree turn have to be a bank, or could it be a maneuver such as a split S?

Answer: The 180 degree turn must be a left or right bank turn only.

46. Can the pylon attachment mechanisms and hatches be open before the start of GM?

Answer: No, all hatches, access panels, bomb bay doors, etc must be closed and secured prior to the start of the GM and M2 and M3 missions (for installation of internal fuel tank and X-1 test vehicle).

47. Can the X-1 glider be carried between the twin-booms?

For our design, can the X-1 glider be carried between twin-booms?

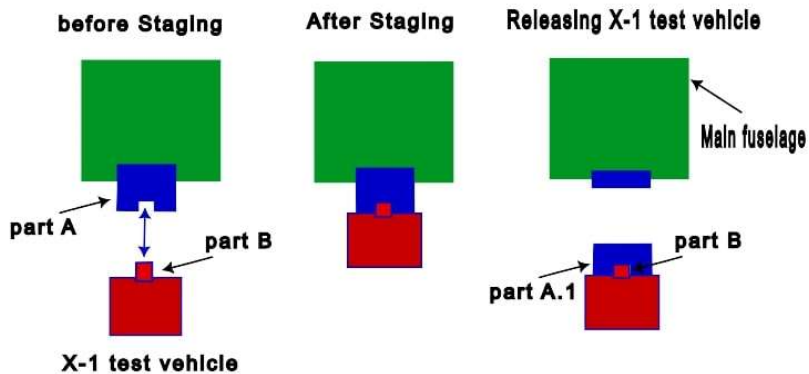
Answer: Yes. But if the X-1 test vehicle attachment and release mechanism are NOT internal to the fuselage, it cannot be installed for M1 or at the start of the GM, where installation is part of the timed event. The mechanism must be attached to the airplane before attaching the X-1 test vehicle to the mechanism. It may be installed for M2 and M3 prior to entering the staging box.

48. We have a system that interprets a digital signal from the receiver, converts it into PWM output for the servos, and uses the onboard gyro to stabilize the outputs—would this count as a stabilization subsystem and hence be legal?

Answer: Specific design implementation questions are not answered in Q&A (see FAQ). The rules allow for "Flight stabilization subsystems and rate gyros", so if this is what the implementation intent is, it is likely allowed. But the only confirmation can be during tech inspection, so staying with trad

itional stabilization methods is highly recommended.

49. Our X-1 release mechanism consists of two parts: **Part A**, which is attached to the UAV before the Ground Mission (GM), and **Part B**, which is attached to the X-1 vehicle (as shown in the attached figure). When the X-1 is released, it deploys with **Part B** and a small segment of **Part A** (please check the figure attached). Will the test vehicle's weight measured in the technical inspection include both parts of the mechanism or only the part fixed to the test vehicle before staging? And is it acceptable to attach **Part A** to the UAV before the GM and staging?



Answer: First, if the release mechanism is external to the fuselage, it must be absent for M1 and installed as part of the timed mission for GM. Second, since the weight of the X-1 test vehicle must be measured and recorded as part of M3, this cannot be done using this configuration because part of the release mechanism now becomes part of the 0.55 lb maximum weight, which is a safety requirement. Based on the figure shown, this would not be allowed.

Power

50. Looking for clarification on the stored power rules:

- Individual battery packs cannot exceed the FAA limits for hand carry on commercial air flights of 100 Watt-hours (rated capacity x rated voltage) per battery pack and as further defined in: <https://www.faa.gov/hazmat/packsafe/lithium-batteries>
- Propulsion power total stored energy cannot exceed 100 Watt-hours.”

Does this mean for each propulsion system, or total airplane power? i.e., for a dual prop setup are we limited to ~50 Wh per motor?

Answer: Propulsion power total stored energy cannot exceed 100 Wh. If more than one propulsion system as defined in the rules is implemented, the sum of all propulsion batteries cannot exceed 100 w-hrs. The specific answer to the question above is “it depends”. If two motors are implemented in a single propulsion system as defined in the rules, a single propulsion battery not to exceed 100 Wh is required. If the motors are part of two individual propulsion systems as defined in the rules, two propulsion batteries not to exceed 50 Wh each are required.

51. Does the battery for the X-1 autonomous glider battery also have to be Commercial-Off-The-Shelf (COTS)?

How many batteries can the X-1 glider have?

Do X-1 glider batteries require labels from the manufacturer??

Answer: The X-1 test vehicle battery must be a commercial battery, but there is no restriction on chemistry type for this battery. The number of batteries is not limited and labels will not be inspected for the X-1 test vehicle only.

52. Is the usage of a commercial 12S battery pack with two 6S batteries within allowed? The rules state that batteries must not be run in series or parallel, however does this also apply to a single battery pack which is only run in series with itself?

Answer: Internal construction of a commercially procured battery pack is not subject to DBF rules as long as the battery pack meets all of the requirements as a single battery pack.

Are teams allowed to modify the battery connectors to accommodate higher amperage through a connector? For example, if a battery comes with an xt90 connector, only allowing 90A max, can teams swap out the plug on the battery to allow more amps to flow from the battery? Answer: Yes, changing connectors is allowed as long as the attachment of the lead wires to the batteries is unaltered.

53. The rules state that only one type of battery may be used. Does this refer to the basic type, like NiCad/NiMH or lithium-based, or does it also refer to the capacity, meaning the same capacity must always be used?

Answer: The rules state that only one chemistry type may be used for propulsion batteries. The rules also clearly state that the receiver battery may be a different chemistry from the propulsion batteries. Also, as stated in the rules, all propulsion batteries (if implementing more than one propulsion system) must be “identical”. Using different capacity batteries for different mission attempts is allowed.

54. The rules state that when using a lithium-based battery, the arming fuse must be rated according to the battery. Can the battery’s maximum continuous current rating be higher than 100A if the arming fuse’s maximum current rating is still only 100A?

Answer: Yes.