Rev B

Not-a-Boring Competition 2026

Full Rules and Requirements

Last Updated August 2025

Teams at the 2025 Not-a-Boring Competition at Hyperloop Plaza in Bastrop, TX. March 2025

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Introduction

Created by Elon Musk, founder of Tesla and SpaceX, The Boring Company (TBC) creates safe, fast-to-dig, and low-cost transportation, utility, and freight tunnels. TBC's mission is to solve traffic, enable rapid point-to-point transportation, and transform cities. In September 2021, TBC hosted the first Not-a-Boring Competition (NABC), which challenged engineers to build tunnel boring machines (TBMs) in an effort to accelerate innovation in tunneling technology. Talented teams from around the world answered the call and demonstrated innovative tunneling technology.

This year, TBC is again inviting teams to design, build, and race their own tunneling machines!

TBC is also hosting two Mini Competitions which aim to provide a lower barrier-to-entry to rookie and pre-collegiate teams who want to get involved with NABC.

General Information

This document defines the rules for both the main event and the mini competitions.

This document does not represent the full scope of the rules governing the Not-a-Boring Competition. Rules are subject to change.

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Full Competition

Full Competition teams in the 2026 Not-a-Boring Competition will compete across 3 categories*:

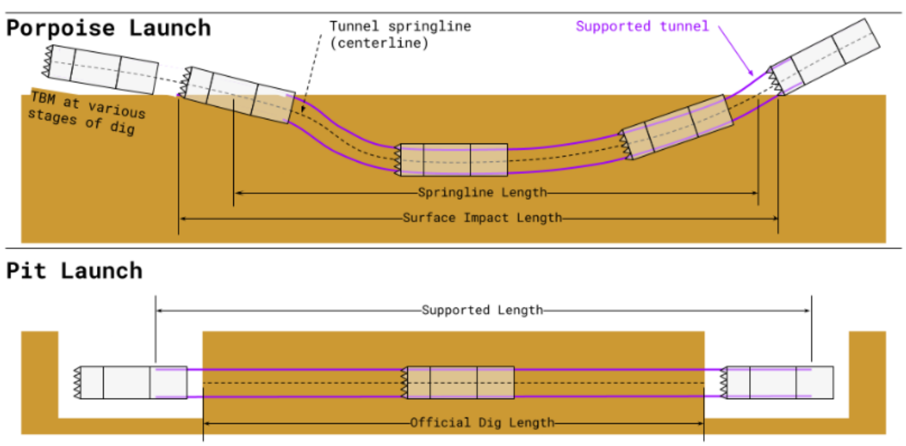
1. Fastest to complete a horizontal tunnel (Champion Award).
2. Innovative design, build, or test (Innovation Award).
3. Most impressive design, build, or test by a rookie competitor (Rookie of the Year Award).

* TBC may add, remove, or modify competition prizes at any time.

Competitors in all categories should design a tunnel boring machine meeting the following top level requirements. Your machine shall:

1. Dig a tunnel with a cross section of at least $0.2m^2$ (equivalent to a circular tunnel cross section of 0.5m in diameter).
2. Be capable of following a nominal tunnel alignment (tunnel path) which meets the following criteria but is otherwise up to the team:
    a. The straight-line distance between where the supported tunnel's springline (centerline) enters and exits the ground must be at least 30 meters.

Qualifying Tunnel Length Metric: Supported distance between ingress and egress springline.
In Porpoise Launch example below, this would be less than the shown *Springline Length*. In the Pit Launch example, this would be less than the shown *Supported Length*.



    b. The TBM should breakthrough within 0.5m of the nominal alignment.
        i. Deviations from the nominal breakthrough location exceeding 0.5m will be penalized in dig time, but not disqualified.
    c. The tunnel crown (top of the supported tunnel) must reach a depth of greater than 0.5m at its deepest point.
    d. The maximum depth of the tunnel crown is up to the team (within reason).
3. Be of your own design, including any supporting equipment.

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   a. During Competition Week safety inspections, teams will be expected to have in-depth knowledge of the assembly and operation of any out-of-house manufactured assemblies (hydraulic power units, electrical enclosures, etc.).
4. Be monitored, controlled, and powered according to the following criteria:
   a. The machine's 6 degrees of freedom (6DOF) state including position and orientation must be reported at all times.
   b. Report relevant telemetry at a rate of at least 0.1 Hz.
   c. Be remotely controlled from the surface.
      i. No human or animal shall ride in any tunneling machine or in any in tunnel transportation device during the competition or during any pre-competition access.
   d. Not utilize combustion engines or explosive materials.

* TBC will allow teams to reduce the overall length of their tunnel to match their expected capabilities. For example, if a rookie team believes a realistically achievable tunnel length is 10m, they are allowed to manufacture a machine and tunnel support that can only tunnel this length. The design of the machine (on paper) must still be capable of completing a 30m tunnel.

In the event that no team is able to finish the full 30m tunnel, the team which tunnels the farthest will receive the Champion Award. In all categories, unanticipated disturbance of the surface (settlement or heave) due to your machine's tunneling operations will result in a penalty, but is otherwise allowed.

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Mini Competitions

Mini Competition teams will be competing for the same awards as Full Competition teams described above. Teams may choose to compete in one of two categories, which shall meet the below top level requirements as applicable by competition category.

Digging Mini Competition

Create an innovative soil excavation system for a TBM by designing and building a machine which meets the following requirements. Your machine shall:

1. Complete a vertical bore with a cross section of at least $0.2m^2$ (equivalent to a circular cross section of 0.5m in diameter) to a depth of at least 1m. No liner mechanism is needed.
2. Be of your own design, including any supporting equipment.
3. Be monitored, controlled, and powered according to the following criteria:
    a. Report relevant telemetry at a rate of at least 0.1 Hz.
    b. Be remotely controlled from the surface.
        i. No human or animal shall ride in any tunneling machine or in any in tunnel transportation device during the competition or during any pre-competition access.
    c. Not utilize combustion engines or explosive materials.

Tunnel Lining Mini Competition

Create an innovative tunnel support system for a TBM by designing and building a machine which meets the following requirements. Your machine shall:

1. Deploy and support a reinforcement system which supports dirt placed and settled on top of it within a test pit.
2. Be of your own design, including any supporting equipment.
3. Be monitored, controlled, and powered according to the following criteria:
    a. Report relevant telemetry at a rate of at least 0.1 Hz.
    b. Be remotely controlled from the surface.
        i. No human or animal shall ride in any tunneling machine or in any in tunnel transportation device during the competition or during any pre-competition access.
    c. Not utilize combustion engines or explosive materials.

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Eligibility

Both student and non-student teams are eligible to enter the competition so long as they adhere to the following rules:

1. Student led teams must have a Faculty Adviser.
2. Teams may consist of students from multiple schools, or individuals from multiple companies.
3. The team structure is flexible with a minimum number of 2 team members and no maximum number (within reason).
    a. Team member lists must be submitted with each deliverable and approved by the team's registered point of contact.
4. Teams do not publicly share confidential competition details like rules, geotechnical data, dates, locations, etc.
    a. Teams may share internal team information and recruiting information without TBC consultation.

For any question regarding eligibility, please contact us prior to the competition via email at competition@boringcompany.com.

Changes in your competition category will be accepted up to 1 week prior to the Preliminary Design Briefing, and during the competition season on a case-by-case basis.

After registering your team, with the exception of technical questions, communications to and from The Boring Company should only be made from the address of your team's registered point of contact and to competition@boringcompany.com.

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Competition Format

Once formed, interested teams must apply for the competition using the form on boringcompany.com/competition. Applying teams are screened on their eligibility per the requirements outlined previously.

Ultimately, teams selected to advance to Competition Week must successfully pass a number of pre-competition milestones, outlined in the Competition Deliverables and Schedule section.

After passing these milestones, selected applicants and their machines will compete during Competition Week. During Competition Week, teams will conduct several tests and additional briefings on their machines and operations to prove safety and reliability to TBC advisors. After completing these final assessments and passing the safety and reliability checks, at TBC's discretion, teams will be allowed to test their tunneling machine on Dig Day.

The Boring Company, at its sole discretion, may allow or disallow entrants from accessing the site or from participating in the competition.

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On-Site Logistics and Equipment

TBC will provide, at a minimum, equipment as described in the table below to be operated by TBC employees at the direction of teams. If a team supplies appropriate certifications, they may bring and operate their own equipment (subject to TBC approval).

Equipment Type	Make & Model	Capacity
Forklift	Toyota 8FG25*	5000 lb
Telehandler	JLG G12-55A*	12000 lb
Excavator	SANY SY155U*	35,000 lb
Eco Blocks	Generic 2000lb	N/A

*or similar

If there are additional pieces of equipment that your team may need, reach out to competition@boringcompany.com so we can look into seeing if we can provide it.

Additional logistics details will be provided later on in the competition cycle, but in general, please plan for the following restrictions:

1. TBC will not be providing cranes of any kind. If you need items lifted, they must conform to the weight limits of the forklifts and telehandlers described above, or you need to arrange for your own lift equipment.
2. The site does not have a loading/unloading dock. All unloading must occur at grade.
3. If using shipping containers/conexes for transport, TBC will store your conex (and only the conex) on our property as needed. Please work with your logistics providers to ensure that the conex is offloadable with the above-mentioned equipment, specifically that it can come off of the trailer expeditiously.
4. Expect roughly 45ft x 25ft for a launch/staging area, and a work area of roughly 35ft X 25ft for full competition teams. Expect smaller areas for mini competition teams. Please plan to fit within these rough bounds, or contact us if that poses an issue.
5. Pre-excavation of ingress or egress portals is allowed, but without prior approval from TBC, no excavations greater than 5 ft deep are allowed. Generally, complex pre-excavations complicate site logistics, regardless of who is doing the site work. Teams should carefully consider both the technical and logistical impacts that pre-excavation(s) will have on operations.

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On-Site Utilities

TBC will provide, at a minimum, utilities as described in the table below. The interfaces and specifications for these will be provided at a later date, if you need specific hookups, please reach out to us directly so we can work to accommodate.

Utility Type	Spec. Type	Max Draw	Interface
Water Supply	Gal/min, psi	TBD	TBD
Compressed Air	CFM, psi	TBD, <200 psi	TBD
120 VAC (60Hz) Power	Amp	20A per circuit (two circuits will be provided, for a total of 40A)	Standard US NEMA 5-20 wall outlet plugs
480 VAC power (see power section for details)	Power	100 kW max	Lugs (teams shall provide bare wire)
Wifi	N/A	N/A	Wireless access point

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Competition Week

The table below provides an overview of what to expect during the final week. The schedule is preliminary and will be revised with more details before the event.

Day	Activities
0	• Prep Day Full Competition teams (and optionally Mini Competition Teams) may each send up to 5 team members to perform site setup activities in order to minimize heavy equipment usage during Competition Week.
1	• Teams check-in • General safety meeting • Mining Readiness Review Presentations and TBC site tour
2	• TBM Safety Inspections
3	• TBM Safety Inspections • Mini Competition Teams (who didn't come on Day 0) check-in • Mini Competition Teams (who didn't come on Day 0) Mining Readiness Review and TBC site tour
4	• NABC 2026 Expo
5	• Safety Inspections
6	• Last day for mining operations • Winner ceremony and afterparty with all teams
7	• Cleanup day All team materials packed and loaded on trucks, with help from TBC.

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Detailed Requirements

In addition to the guidelines in the General Information section, the following guidelines and requirements apply to each subsystem or category as appropriate, regardless of competition class (Full or Mini competitions).

1 . System-Level Design

a. Emergency Stops
    1. At a minimum, one Emergency Stop button is required, which shall be clearly indicated as being the Emergency Stop (typically, this is a >= 1” red-on-yellow button with labels). It must be physically located within arms reach of the Operator Station (wherever the TBM driver is operating the machine from).
    2. At a minimum, the E-stop shall interrupt the flow of power to the machine, as near the source as reasonable. Additional lower level E-stops may also be implemented.
        1. Low voltage control power (<50V) may be allowed to remain active when an E-stop is pressed for telemetry and ease of restart so long as actuators are guaranteed to be inhibited from operation. This is generally accomplished via separate control and peripheral power low voltage buses.
    3. It must have a latching mechanism. Momentary buttons do not qualify as emergency stops.
    4. Utilize at least one normally-closed contact on the button itself such that either activation of the button or severance of the wiring to the button’s contacts results in the same safe condition.
    5. Returning the machine to a running state must require at least 2 actions. For example:
        1. Hardware:
            a. Reset the latched big red button.
            b. Press a normally open button which resets a latching safety relay
        2. Software:
            a. Reset the latched big red button.
            b. Reset a secondary software latch (e.g. Click a reset button on the GUI/HMI/operator console).

b. Safety Indication
    1. Teams shall include in their site layout an indication of if the machine is in a safe to approach state which is visible from across the site.

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2. The indicator shall be sufficiently simple such that an untrained observer (random member of the public) can determine the state of the machine (a stacklight or similar).

c. State Diagrams
   1. State diagrams are required for all systems (full machine and subsystems).
   2. Recommendations for State Diagrams:
      1. These are meant to (in part) guide the overall design of your machine (especially software) and define how systems interact (both with each other and with you, the operator).
      2. Your state diagrams should likely be relatively simple, so don't overthink the problem and introduce a bunch of unnecessary states that complicate the system behavior.
      3. For examples, look to PackML state diagrams (though again, aim for simplicity)
      4. Typically, in addition to state diagrams for each system, there is a "Theory of Operations" document which describes how a system behaves in each state, and may elaborate on state transitions if necessary. This isn't explicitly required, but it does make debugging much easier.

d. A system must always be in a defined state.

2. Safety

a. Lock Out Tag Out (LOTO)
   1. Teams must implement a LOTO safety system to prevent accidental operation of the machine when working on it.
   2. All team members shall watch this video, and team leadership shall pursue further resources to develop an effective and holistic LOTO system.

b. Accessibility
   1. Teams must not physically interact with the machine or auxiliary components if manual interaction is unsafe during operation.
      1. We recommend interacting with the TBM strictly via the Operator Station.
   2. In the event that a sub-surface component fails during a dig, teams may be permitted to construct a temporary pit (no deeper than 5 feet) to investigate and repair if possible.
      1. All components must be fully powered down and safe to approach prior to construction.
      2. Any construction requires competition approval.

c. Lift plans

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1. A lift plan for a particular assembly or sub-assembly must be reviewed with and approved by competition inspectors before any assembly or sub-assembly can be transported by machinery. The lift plan must include the following:
    1. The total weight of the assembly or sub-assembly in units of pounds.
    2. A diagram of the proper set up of the lift.
        a. Lift from below: forklift insertion points must be indicated on the diagram AND these points must be easily identifiable or otherwise indicated on the assembly or sub-assembly.
        b. Lift from above: rigging attachment points must be indicated on the diagram AND these points must be easily identifiable or otherwise indicated on the assembly or sub-assembly.
    3. Note: The diagram does not need to be an "official" drawing or detailed report. The intention is to ensure the lift (and competition in general) remains safe and that the team is thinking about the details of the lift. Ultimately, the heavy equipment operator can deny any lifting plan they deem unsafe.

3. Structures

a. Shrouding and Guards
    1. Rotating parts and pinch points shall be guarded to prevent injury (motor/pump shafts, chain drive, gear train, etc).

b. Engineering Analysis
    1. Teams must provide analysis documentation to demonstrate that all systems, subsystems, and components meet the structural requirements necessary for the nominal operation of the machine.
        1. Teams shall maintain and justify a factor of safety in all analysis to a level appropriate for the structure. For example, the safety factor on a machine's main shell may be chosen to be 1.5x (for cost and weight reasons, and while failure of the shell is catastrophic for the machine, it is not generally a safety concern). However, the safety factor for the lifting bolts used to transport the machine might use a value >5x (as the lift is a safety-critical operation). In general, factors of safety of 3x-10x are not uncommon in TBM systems.
        2. If a system does not meet structural factors of safety expectations, additional proof testing and hazard mitigation

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strategies may be requested by TBC prior to lift, moving or unloading their machines.

4. Hydraulics

a. Monitoring
   1. All hydraulic systems must report operating pressures and oil temperature to the Operator Station in the form of software indicators, electrically transmitted process data readouts, or physical gauges.
   2. An analog pressure gauge shall monitor the pump's output pressure either at the pump or at the operator's station.
      1. A gauge attached to a test point on the main system output is acceptable.
   3. An analog temperature gauge shall monitor the oil reservoir's temperature.
   4. Recommendations:
      1. All reservoirs should be equipped with low level switch and high level switch or a level probe which performs these same functions.

b. Hydraulic Power Units (HPUs)
   1. Oil Reservoir
      1. All oil reservoirs shall have a breather port to prevent overpressurization.
      2. All oil reservoirs shall include a sight gauge to indicate oil level.
         a. High level warning and low level warning marks shall be clearly indicated on the gauge.
   2. Motors
      1. All electrical motors used for hydraulics applications shall be driven by a soft starter or a VFD. Note: be careful about in-rush current on startup. All motors should be easily startable from a 100kW generator. We do not recommend using motors larger than 33kW without a VFD or 20kW without a soft starter.
         a. Note that starting large motors on comparably small generators will cause voltage droops which may affect your control system. VFDs, soft starters, and delta/wye starters will combat this voltage droop.
      2. All electrical motors shall have a name plate (or you should be able to quickly locate/produce a datasheet) displaying its voltage, current, and connection configuration.
   3. Pumps

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1. Pumps shall always start with zero load - we recommend using a normally open “unloading valve” that can be closed to build pressure.
    a. You may tie this unloading valve to the Top of Ramp output of a soft starter for the motor or your control system
2. All pumps must have a relief valve set to 10% or 20 bar (whichever is higher) above operating pressure.

4. Cooling
    1. All HPU’s shall be equipped with adequate cooling solutions. Proof will be required during safety inspections.

c. Hoses, pipes, or tubing
    1. All hoses, pipes, and tubing must be proof tested and accordingly tagged.
        1. See proof testing section for details.
    2. All pressure supply lines that feed multiple manifolds shall be equipped with ball valves for isolation and check valves in the return lines to prevent unwanted back pressures.
    3. Any systems operating above 3000 PSI should use code 62 type connections.
    4. All pipe and tube connections that use code 61 and code 62 flanges must have lock washers on the bolts.

d. Pressure vessels and enclosures
    1. Pressure vessels/enclosures shall have a nameplate rating (e.g., ASME, DOT, or equivalent) that identifies the maximum allowable working pressure (MAWP).
    2. Custom pressure vessels/enclosures shall be subject to additional scrutiny not listed here and shall be approved by a competition inspector prior to the start of design and throughout the design, build, and test process.
    3. All accumulators shall have accumulator safety blocks that are equipped with an isolation valve, a relief valve, a manual bleed valve. In addition, one of the following must also be met:
        1. A normally open drain valve will be included which will safely and quickly discharge pressure from the system in an emergency condition.
        2. Accumulators naturally bleed pressure to a safe level within 5 minutes or less.
    4. All accumulators should be equipped to monitor pre-charge pressure (gas pressure) and inlet pressure.

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5. Teams shall provide live control and telemetry of pressure vessel pressure and temperature.

e. Proof testing
    1. It may not be included in inspections directly, but we strongly recommend that you conduct proof testing and tagging as described below. TBC can refuse operation to any team if pressure vessels and/or related equipment are deemed unsafe.
        1. Any custom components (e.g. a custom machined manifold or reducer) or custom assembly (e.g. a crimped fitting + length of hose material + crimped fitting) must be statically pressure tested to and held at 1.5x max working pressure for 5 minutes without leak or failure.
            a. Each PASSED custom component shall be permanently tagged with:
                i. The name of the person who conducted the pressure testing.
                ii. The pressure to which it was tested.
                iii. The date on which the test occurred.
                iv. The type of fluid contained in the assembly (e.g. Hydraulic Oil).
            b. Note: If your team purchases custom components or assemblies from a manufacturer or vendor, your team is responsible for requiring that the manufacturer or vendor conducts pressure testing and applies tags that meet the criteria stated above, or your team is responsible for conducting the pressure test once the custom components or custom assemblies are received.
        2. Hydraulic assemblies (which can include an assortment of custom components and off-the-shelf components) must be statically pressure tested to 1.0x max working pressure.
            a. Each PASSED hydraulic assembly shall be permanently tagged with:
                i. The name of the assembly.
                ii. The name of the person who conducted the pressure testing.
                iii. The pressure to which it was tested.
                iv. The date on which the test occurred.
                v. The type of fluid contained in the assembly (e.g. Hydraulic Oil).
        3. Proof Testing Example:

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a. Assembly: An off-the-shelf hydraulic motor is connected to an off-the-shelf hydraulic power unit via 2x hydraulic hoses.
    i. Required testing:
        1. 2x hydraulic hoses (before being integrated into the assembly) are proof tested to 1.5X MAWP and tagged accordingly.
        2. The components are assembled, and the assembly is tested to 1X MAWP and tagged accordingly.
        3. This assembly is now acceptable for operation.

5. Pneumatics

a. Monitoring
    1. All pneumatic systems must report operating pressures to the Operator Station in the form of software indicators, electrically transmitted process data readouts, or physical gauges.
    2. An analog pressure gauge located at the pressure vessel or Operator Station shall monitor the pressure vessel's pressure.
b. Sources
    1. No compressed gas source shall reach a pressure of greater than 300 PSI while at the competition or on the machine.
        1. Compressed consumables related to manufacturing and not machine operation are exempt from this rule if and only if all appropriate use and safety standards are followed and their use is approved by competition inspectors.
c. Plumbing
    1. Compressed gas pressure vessels must include a manual relief valve for bleeding pressure.

6. Geotechnical

a. The competition site is located on the TBC property, the address is 130 Walker-Watson Road, Bastrop, TX, USA.
b. Site details can be found in the geotechnical report provided to teams after the Preliminary Design Briefing.
    1. Teams are not permitted to share the geotechnical report.
    2. Prior to PDB, teams may utilize online sources, such as the US Geological Survey, to determine approximate nominal ground conditions of the site.
c. Ground conditioning additives must be approved by TBC.
d. Grout mixtures must be approved by TBC.

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e. Any advanced probing or coring must occur within a 0.75 m diameter of the tunnel axis.
f. Muck Extraction:
    1. Teams must know approximately how much muck will be extracted during the course of a dig.
    2. Teams must have a reasonable muck disposal plan (it is acceptable to dump in place if the muck volume is small and without additives, but we expect that will not be the case for most teams).

7. Power Systems

a. Teams shall utilize power systems which are legal to transport on public roads without permits (for example nuclear power sources are not allowed).
b. Teams may draw a maximum of 100 kW of power at any time, measured from the source. Carefully consider inrush currents on system startup, as these must also remain below 100 kW.
c. Systems energized at 50 V and below are considered “low voltage”.
d. Cables shall utilize a color scheme which clearly differentiates between voltage, phase, and function.
    1. Ex. your system may utilize orange cabling for all 480V power lines and Brown, Orange, and Yellow electrical tape to indicate the phase.
    2. Ex. your system may utilize brown and blue for 24V and 0V signal cabling
    3. Ex. your system may utilize black, red, and white for 120V L1, L2, and Neutral.
    4. It is highly recommended that your team follow an established standard for electrical color coding. This will make inspections faster and troubleshooting easier.
e. TBC will provide a power supply which meets the following specifications:
    1. Up to 100 kW instantaneous power draw.
    2. The main output will be 3-phase 480 V AC at 60 Hz.
        1. If you require 50 Hz power, please reach out to us.
    3. The supply will include a secondary output in the form of 2 GFCI-protected wall outlets (pairs of receptacles on a 20A circuit, for 4 total receptacles). Draw on this output DOES count towards the 100kW limit.
    4. Teams should assume the supply will not have further configuration parameters. For example, if teams want to use 240V AC, they should include a transformer in their machine/ground support design.
    5. In the case of step up or inversion:
        1. DC voltage cannot exceed 1000V.
        2. AC voltage cannot exceed 700V.
f. Batteries

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1. Definitions:
    1. Pack: A full battery system, inclusive of monitoring and safety systems.
    2. Module: A pack is made of battery modules. Most off-the-shelf "hobby batteries" marketed as "1S2P" or "6S1P" are battery modules.
    3. Cell: Modules are made of battery cells. A 1S2P module contains a total of 2 cells in parallel, where a 6S1P module contains 6 cells all in series.
2. All batteries within the team's machine must conform to the following requirements:
    1. Battery module discharge rates must remain within the manufacturer's specification.
    2. Any in-house fabricated battery modules or packs must utilize connectors which have a feature ensuring that the positive and negative terminals cannot be accidentally connected backwards.
    3. Any exposed connectors shall be sufficiently spaced to mitigate arcing.
3. Batteries systems above the low voltage threshold of 50V must also conform to the following requirements:
    1. A battery management system must monitor and isolate the battery in over-temperature conditions.
    2. A manual isolation switch shall be present which completely and physically disconnects the battery from the rest of the system.
    3. In-house battery pack architecture and layout needs to be approved by TBC prior to use.
    4. Must include an indicator light (independent of software control i.e. directly on the line voltage or through physical control circuitry) which indicates if there is voltage potential in the system.
4. High voltage battery packs powering drives and motors must be isolated from low voltage systems and conform to the following additional requirements:
    1. Be secured with a positive locking feature which prevents accidental disconnection from external forces and vibrations.
    2. Be free of conductive surfaces that aren't part of the electrical connection.
    3. The manual isolation switch must include two separate isolation contactors which are normally open (a double pole relay or switch would meet this requirement).

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4. Contain at least one fuse which: is rated lower than the rating of the manual isolation disconnect (such that the fuse should trip before a manual isolation is needed); and trips before damage to the cells occur from unexpected high current draw.
5. Contain a battery management system which outputs at least the following telemetry:
    a. Overall pack state of charge (in units of % of full charge).
    b. Overall pack voltage and current draw.
    c. Voltage of each module within the pack.

g. High voltage systems
    1. Any capacitors in the system shall be discharged over an appropriate resistor after being de-energized. Discharge time must be no longer than 30 sec and bring the system down to a low voltage level (<50 V) and should include an indicator to show when this threshold has been met.
    2. Circuits shall be protected with appropriate breakers and fusing, and shall include ground fault monitoring in the form of either:
        1. An externally implemented zero sequence CT monitor which opens normally open contactors or UVR coils on breakers.
        2. A breaker or circuit protection device with integrated ground fault monitoring.

       For example: Implementation of a Bender RCM420 monitoring the primary 3-phase feeder.
    3. Components shall be rated to nominal operating conditions and cooled according to specifications.
    4. TBC recommends that metrics including output voltage, current, and supply temperature be included in vehicle telemetry and interlocks, and be visible on the GUI.

8. Communications and Telemetry

a. Teams must ensure constant wireless or wired communication with every component of their machine.
    1. Recommendation: Teams should actively monitor each communication link, including communication between the main software process and the GUI. This makes debugging comms issues much faster.

b. Teams must implement a Telemetry GUI visualizing critical control and safety sensors. It is recommended that every sensor and every control output be included for debugging. Note: this may or may not be integrated into the Operator GUI (see the Software Section).

c. Telemetry values must be updated at a minimum rate of 0.1 Hz (to both the Operator GUI and Telemetry GUI if separate). Note: we recommend sampling at a higher rate, if possible, for a more reactive machine.

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d. Teams must create an IO (input/output) List of every component/sensor and control output on their machine for inspection.
   1. The IO List must include information on nominal operating thresholds for each component. Add other information as helpful, but for each IO it must have:
      1. Low Alarm- value below which the machine is interlocked/safed.
      2. Low Warn - value below which IO is outside expected operating bounds, and a warning is given to the operator.
      3. High Warn - value above which IO is outside expected operating bounds, and a warning is given to the operator.
      4. High Alarm - Value above which the machine is interlocked/safe.
      5. Units - units of the sensor's measurement.
   2. Hint: using this IO List to autofill GUIs where applicable makes it much easier to iterate your system quickly.

e. We recommend showing your sensor values in a format which includes these thresholds, as in the table below:

Sensor Val	Low Alarm	Low Warn	Actual	High Warn	High Alarm
HPU Pressure Inlet (bar)	5.0	6.0	7.8	8.0	10.0
Water Pressure (bar)	3.0	4.0	8.5	7.0	8.0
EPB (bar)	1.0	4.5	4.2	9.0	9.5

f. All sensors shall have a measurement range appropriate for the process they are intended to sense. For example, if you have a force sensor intended to measure a load of 1 N, do not select a sensor with a 1 kN range. If a sensor is intended to sense a nominal load between 0 and 50N but the system has a failure mode where it could exert 100N then a sensor which can sense greater than 100N is recommended.

g. Teams should consider the harsh environment their systems are intended to operate in. Temperature swings, as well as ingress of water and dust are common occurrences underground and teams should spec sensors, connectors, and cabling appropriately.

h. Sensor signals shall be appropriately filtered when necessary.

i. The following requirements apply to in-house-fabricated connectors and cables:

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1. Pins/sockets shall be properly attached to wires using either crimp connectors or solder connections.
2. Crimp connections shall be made according to the connector manufacturer's specifications with an appropriate crimping tool.
3. Solder connections shall only be made to pin/sockets and or connectors which are specifically designed for such use.

j. All connectors which connect to high voltage systems shall include a locking mechanism which prevents connections from coming apart accidentally or due to vibrations. It is recommended that all connections have such features.

k. TBC recommends that CAN and Ethernet connections be made using twisted-pair wires with appropriate termination and shielding. Likewise, signal wires exposed to strong sources of magnetic fields or EMI environments should be appropriately shielded and the shield should be connected to ground on at least one side of the cable.

9 . Guidance, Navigation, and Controls

a. The guidance and navigation algorithm shall be designed such that it can be tested prior to arriving at the competition without needing to construct a tunnel. TBC inspectors will ask to see results of your guidance and navigation system, either simulated or from prior test digs.

b. Teams will be provided with at least two control points at the dig site, which define a local coordinate system in Easting, Northing, Elevation. This system may not align with true North, nor will your machine necessarily start at (0, 0, 0).

c. Teams shall provide an estimation of the point on their machine furthest along the tunnel.

d. Navigation telemetry shall be provided to TBC on a single MQTT topic and according to the following specifications:

1. Must be in the following JSON format:

```
{
      "team": <string-formatted team name>,
      "timestamp": <UNIX timestamp>,
      "mining": <boolean mining flag>,
      "chainage": <float-formatted chainage in m>,
      "easting": <float-formatted easting in m>,
      "northing": <float-formatted northing in m>,
      "elevation": <float-formatted elevation in m>,
      "roll": <float-formatted roll in radians>,
      "pitch": <float-formatted pitch in radians>,
      "heading":    <float-formatted    heading    in
radians>,
      "extra": {
            "optionalSensor": <data>,
```

```
                "otherOptionalSensor": <data>,
        }
}
```

2. The MQTT topic shall be in the format of nabc26/your_team_name.
3. The MQTT broker address will be provided at the competition.
4. The mining boolean shall be used to filter telemetry for when your TBM is actively mining vs when you are testing systems.
5. Chainage is defined as the linear distance traveled of the centerline of your machine. For example, if you were mining in a straight line due North, chainage would equal your machine's northing. If instead you were mining in a circle, and completed the full circle, your northing would be the same as you started, but your chainage would be equal to the circumference of the circle.
6. Easting, Northing, Elevation, and Heading should all be relative to the TBC-provided site coordinate system as described above, with heading being zero when facing due North and positive when facing towards the East.
7. Teams shall send the above telemetry at a rate of 0.1 Hz nominally.

e. TBC encourages teams to explore interesting guidance and navigation techniques, but to also always have a simple fallback to determine the position of their machine.

10. Software

a. General

1. The software system must follow the behavior specified in the state diagrams (see the System Design Overview Section).

b. Teams must actively monitor every IO on the IO List and throw an appropriate interlock if any IO is unresponsive for greater than 10 seconds (interlocks may be disabled on a case by case basis with approval from TBC competition inspectors).

c. Operator GUI

1. Aim to provide all information and inputs needed to run the TBM on the Operator GUI.
2. It is often helpful to have a page/tab with the most important information, and then other pages/tabs with more specialized information per component.

d. TBC recommends the following with regards to software design:

1. Teams should design their software systems to be as resilient as possible. This includes:
    1. Resilience to failure of individual components

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        a. Ex: A pump can be switched to an open loop control mode upon failure of a flow sensor
    2. Resilience to failure of entire subsystems
        a. Ex: Failure of the navigation system can be overcome by steering the machine's articulation system manually.

2. In general, every output from the control software should have a manual operation mode to be used if feedback to a closed loop control loop has failed.
3. In the event of a machine, ground station, or total power loss, the machine must boot/transition into an e-stopped state (it must not move and requires two inputs to move again).
4. In the event of a machine, ground station, or total power loss, the software system should boot/transition (though homing or data reloading is acceptable) into a state where all IO and navigation data reflect the physical machine state. For example, on a reboot, a relative encoder value must be restored to match physical reality.
5. If low level control (for example microcontrollers) are disconnected from the network, all actuation should stop. In other words, if a low level controller gets disconnected, the software system should go into a global abort, and the microcontroller should go into a local abort.
6. In the event of machine power loss, the GUI must be able to warn the operator of the issue and reconnect on reboot.
7. In the event of a network loss, the GUI must be able to warn the operator of the issue and reconnect to the machine if the network is restored. In addition, any stale data, even non-critical non-interlocking IO, must be indicated on the operator GUI or telemetry GUI.

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Notice of Anticipated NABC 2027 Rules

While an annual competition is not guaranteed, depending on team performance and results of this year's Not-a-Boring Competition, the following anticipated rule changes are expected to be in place for the 2027 Competition:

- Introduction of a required horizontal turn after some nominal chainage (ex: after mining for 4 m, the machine would need to conduct a turn to the left or right). The chainage where this turn would need to begin is to be determined.
- Incentives for minimizing launch and breakthrough site prep (like pits, trenches, ramps, etc.). This is likely to take the form of hefty time and distance penalties.

These requirements are NOT applicable to this year's 2026 NABC, but teams should carefully consider the design of their machines now for applicability to future competitions.

Recommendations from TBC

In addition to the hints and best practices discussed throughout, TBC recommends the following:

- Get in touch with other teams! Many different groups have worked on similar problems, and there may be shared lessons learned that will save your team a lot of unnecessary work
- Do not neglect the challenge of finance or production timeline. While solving the technical problem is exciting, ultimately, the competition requires more than just a good idea. Execution of your design concept is impossible without funding and time to produce your machine
- With regards to analysis, it can be easy to get stuck in the details. Always work back to first principles, making relevant assumptions to simplify the problem
    - Remember to consider the effects of these assumptions!
- When it comes to justifying your design's efficacy, it is hard to argue with test data. Test as much as you reasonably can, and as early as you can
    - Don't overthink tests! You can learn a lot more, and faster, by putting together a quick, scrappy test to get some results
- Just like with analysis, simulations are a powerful tool that are easy to get "lost in the sauce." You can only model what you already understand (testing is a great way to build understanding). Don't let this discourage you from creating simulations to virtually test your design concepts, but carefully consider simplifying assumptions and their impacts on the overall results
- Design, build, and test as many (all) of their machine's systems in-house (within reason)

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- Minimize dependency on heavy machinery during competition week (no cranes will be provided).
- Simplify as much as possible, especially your launch setups
- Lean on the experience of industry, academia, and veteran competition teams, but always verify that the information you receive is relevant to your team's specific operational circumstances

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Competition Deliverables and Schedule

The 2026 Not-a-Boring Competition schedule will be updated and amended throughout the season. Dates are subject to change, No Earlier Than (NET) milestone dates are provided below:

NET Date	Milestone
May 28th, 2025	Full Rules and Requirements document released to teams
Jun. 16th, 2025	Team Overview and Plans Briefing*
Jul. 14th, 2025	Mid-Summer Check In*
Sept. 8th, 2025	Preliminary Design Briefing due
Sept. 15th, 2024	Preliminary Design Briefing due for rookie teams
Nov. 3rd, 2024	Final Design Package due
Winter 2025	Final Design meetings
Spring 2026	Mining Readiness Review
Spring 2026	Competition Week

*early registration teams only

All teams, regardless of which competition category they are competing in, will follow the same competition schedule.

Following the submission of all competition deliverables, TBC will review submissions and may select a reduced set of teams that will continue through the competition.

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Team Overview and Plans Briefing (All Competitions)

The Team Overview and Plans Briefing (TOP Briefing) should consist of a slidedeck presentation, submitted as a PDF file to competition@boringcompany.com, with a maximum of 5 slides.

The TOP Briefing is meant to ensure you are considering specific non-technical challenges associated with competition, including finance, and logistics, and schedule. Secondarily, it is expected to be your best-guess at your design so far, outlining possible design concepts you are exploring and may pursue for your machine this year. Your team is allowed to make changes to these when submitting future deliverables. Any questions should be directed to competition@boringcompany.com.

The TOP Briefing shall consist of:

1. Description of team and list of all associated team members and advisors
    a. Year in school (if applicable)
    b. Major
    c. Interest in TBC employment in the next year (full time, internship, or none)
2. Funding Plan and Timeline
    a. Anticipated cost breakdown in the categories of:
        i. Engineering (hardware, software, materials, and services to design and build your final machine)
        ii. Testing (cost of parts and services needed to test your designs, but won't specifically be used for your final machine)
        iii. Logistics (cost of transportation and equipment for moving your machine)
        iv. Other (anything else, specific in your presentation)
    b. Current funds on hand
    c. Plan to close your anticipated funding needs
3. Logistics Plan
    a. Equipment transportation plans
    b. Team transportation plans
    c. List of anticipated required on-site equipment (and plan to supply it if not TBC-provided)
4. Top Level Timeline
    a. Anticipated Top Level Schedule with milestones for at least the following:
        i. Design phase "closure" (of course, test results will result in design modifications, but after this milestone, overall concepts should be solidified)
        ii. At least 2 component/subassembly-level tests (for example, a ground conditioning system test where you expel conditioning agent or a

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stand-in conditioning agent throughout the system as if you were tunneling but from the surface; a cutterhead spin test where you energize your main drive(s) with any supporting systems and spin your cutterhead as if you were tunneling; etc.)

iii. Full system test

iv. Machine ship date for Competition Week

5. Design Overview
   a. Top 3 design concepts the team is thinking about
      i. Description of the core problem being addressed by the concept
      ii. Description of concept
      iii. Primary risks associated with the concept

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Preliminary Design Briefing

The Preliminary Design Briefing (PDB) is the first large-scale deliverable submitted in the form of a slidedeck presentation in PDF format via email to competition@boringcompany.com, with a maximum of 30 slides. In addition to the PDB, teams will submit their signed Non-Disclosure Agreement (NDA) for their team and individual team members as PDF files in a zipped folder, instructions for which will be sent to registered teams after the TOPS briefing.

All deliverables shall be submitted with the following filename format: nabc26_teamName_pdb.pdf. Note that the PDB is not meant to be the final design of your machine. It is your best guess of your design at the time of submission. After PDB, it is okay for your design to change, but the overall concepts should remain consistent.

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Full Competition

The Preliminary Design Briefing for teams competing in the Full Competition shall consist of:

1. Description of team and list of all associated team members and advisors
    a. This must include: Team member name, role on the team, year in school and major, if applicable, and interest in TBC employment (internship, full time, none, etc.)
    b. Note: This may be a separate document/spreadsheet (it is not required to fit in the 30-slide PDB limit)
2. Design description for your tunnel boring machine (TBM). At a minimum, this should include:
    a. Machine top-level design summary and layout, which should include a picture
    b. Machine dimensions
        i. Overall
        ii. By subsystem
    c. Machine mass
        i. Overall
        ii. By subsystem
    d. Machine power source
        i. Power budget
3. Machine excavation system theory
    a. Initial calculations/analysis to justify your design direction
    b. Analysis showing expected time to complete the nominal 30 m tunnel
4. Machine structural design overview
    a. Initial calculations/analysis to justify your design direction
5. Machine power source and safety considerations
    a. Initial calculations/analysis to justify your design direction
6. Machine operator controls and interface
    a. List of safety interlocks in the system
    b. Mock-up of the operator interface
7. Machine guidance and navigation system overview
    a. Initial calculations/analysis to justify your design direction
    b. Analysis showing your expected error in breakthrough location
8. Top level project risks and their mitigations
    a. Please split up technical (engineering design, uncertain assumptions, etc.) vs non-technical (budget, transportation, etc.) risks
9. Machine production and testing schedule
    a. Include updates to the top level milestones of design closure, your two major-subsystem tests, full system test, and machine ship date
10. Machine cost breakdown and funding plan

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a. Current team cash-on-hand
b. Dollar amount of submitted funding requests (i.e. if you've submitted a request for a grant from your campus for $1,000 and two sponsorship requests from companies for $500 each, you would have $2,000 in total submitted requests)

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Digging Mini Competition

The Preliminary Design Briefing for teams competing in the Digging Mini Competition shall consist of:

1. Description of team and list of all associated team members and advisors
    a. This must include: Team member name, role on the team, year in school and major, if applicable, and interest in TBC employment (internship, full time, none, etc.)
    b. Note: This may be a separate document/spreadsheet (it is not required to fit in the 30-slide PDB limit)
2. Design description for your digging device. At a minimum, this should include:
    a. Machine top-level design summary and layout, which should include a picture
    b. Machine dimensions
        i. Overall
        ii. By subsystem
    c. Machine mass
        i. Overall
        ii. By subsystem
    d. Machine power source
        i. Power budget
3. Machine digging system philosophy
    a. Initial calculations/analysis to justify your design direction
    b. Analysis showing expected time to complete the vertical bore
4. Machine structural design overview
    a. Initial calculations/analysis to justify your design direction
5. Machine power source and safety considerations
    a. Initial calculations/analysis to justify your design direction
6. Machine operator controls and interface
    a. List of safety interlocks in the system
    b. Mock-up of the operator interface
7. Design scalability
    a. How does your machine design fit into the context of a larger tunnel boring machine (TBM) that would compete in the full Not-a-Boring Competition?
8. Top level project risks and their mitigations
    a. Please split up technical (engineering design, uncertain assumptions, etc.) vs non-technical (budget, transportation, etc.) risks in their own sections
9. Machine production schedule
    a. Include updates to the top level milestones of design closure, your two major-subsystem tests, full system test, and machine ship date
10. Machine cost breakdown and funding plan

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a. Current team cash-on-hand
b. Dollar amount of submitted funding requests (i.e. if you've submitted a request for a grant from your campus for $1,000 and two sponsorship requests from companies for $500 each, you would have $2,000 in total submitted request

Final Design Package

All entrants who have successfully advanced past the Preliminary Design Briefing phase will be asked to submit a Final Design Package (FDP). Following the submission of the Final Design Package and The Boring Company's review, a select number of teams may be invited to give a Final Design Presentation. The Final Design Package shall be a text document (not a slide presentation), with a maximum total length of 120 pages, which addresses the items below. Analysis results that specifically support the below items should be included in-line. Any additional analyses, part specifications, and/or other supporting documentation shall be included in a separate document titled "Supplemental Documentation". The Supplemental Documentation has no page limit and will be referenced by reviewers only on an as-needed basis.

Following the FDP, overall machine design should remain mostly the same with only minor changes to systems due to lessons learned from additional analysis, testing, and manufacturing.

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Full Competition

The Final Design Package for teams competing in the Full Competition shall consist of:

1. Description of team and updated list of all associated team members and advisors
2. Design description for the TBM. At a minimum, this should include:
    a. TBM top-level design summary & general machine layout
    b. TBM dimensions
        i. Overall
        ii. By subsystem
    c. TBM mass
        i. Overall
        ii. By subsystem
    d. TBM power source and consumption
        i. Power budget
    e. TBM state diagrams
        i. Overall
        ii. By subsystem
    f. TBM excavation system
        i. Include analysis showing the expected nominal and maximum cutting torque, if applicable
        ii. Estimated tunneling time
            1. Estimated tunneling time by subsystem (i.e., what are your limiting factors?)
    g. TBM propulsion mechanism
        i. Include friction analysis
        ii. Include Earth Pressure Balance (EPB) analysis if applicable.
        iii. Maximum advance rate
    h. Tunnel liner material and mechanism
        i. Include estimate of factor of safety
            1. If the SF is less than 10, teams must provide test results and/or calculations that verify the design. Testing is always preferred over calculations
            2. Recommend performing a test to failure
        ii. Include description of failure modes
        iii. Lining storage and delivery system, if applicable
    i. Muck Removal System
        i. Include estimate of mechanism throughput
        ii. Muck transport system
        iii. Soil settlement / heave calculations and estimations (excavation and earth pressure balance)

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j. Hydraulics System
    i. P&ID diagrams
        1. Overall
        2. By subsystem
    ii. Hose making, hardline making method (TBC recommends outsourcing this, if possible)
    iii. Proof testing method and procedure

k. Electronics System
    i. Updated I/O List in the format specified in the Rules
    ii. List of all Electronic Control Units and explanation of what each Electronic Control Unit is responsible for
    iii. Overview of how these components communicate with each other
    iv. Full breakdown of power consumption per subsystem
    v. Full system schematics and electrical layout

l. Software System
    i. High Level explanation of software system
    ii. Software communications/network architecture
    iii. E-stop implementation description
    iv. Machine operator controls and interface
        1. List of safety interlocks in the system
        2. Mock-up of the operator interface

m. Cooling System
    i. Estimate thermal output
        1. Overall
        2. By subsystem/component
    ii. Expected steady state temperatures
        1. Without cooling system
        2. With cooling system
            a. Expected temperatures must be below max operating temperature of the component.
               Note: Expected temperatures must be below max operating temperature of the component per the manufacturer

n. TBM navigation mechanism
    i. Include 3D tunnel path and written explanation
    ii. Include uncertainty calculations to justify system feasibility
    iii. Include estimate of error in breakthrough location

3. (Returning teams only) List and description of machine improvements from NABC 2025
    a. For each major lesson learned or failure from the prior year, please list:
        i. Lesson or failure description and root cause

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   ii. Design and operational mitigations addressing it
   iii. Note: Mitigations should be hardcore. The expectation should be that repeated failures from prior years are impossible
  b. Estimated percentage of your machine which is new
4. Design and Manufacturing Ownership
  a. A list of out-of-house designed systems, examples include:
   i. Soil conditioning designed or provided by an outside party
   ii. Major portions of an individual TBM subsystem, including but not limited to:
    1. Power electronics
    2. Safety system
    3. Navigation system
   iii. Out-of-house designed systems **do not include**:
    1. Singular components or sensors, like (but not only):
     a. Gearboxes
     b. Inclinometers
     c. Rectifiers
    2. Components you design (like electronics boards or weldments) but have manufactured elsewhere
  b. For every out-of-house designed system provide:
   i. A justification for why you an out-of-house system as opposed to doing something in house
   ii. Why the specifically chosen system fits your use case well
  c. NOTE: The intent of this section is to provide proof that your team has a deep understanding of any out-of-house systems so that teams do not arrive at competition with systems that are a black box. Every team will likely have some out of house systems to include here.
5. Predicted tunnel alignment
  a. Minimum alignment curvature
   i. Vertical
   ii. Horizontal
  b. 3D STEP file of tunnel alignment
6. TBM launch and retrieval frames/components structural analysis
  a. Predicted loads
  b. Failure mode description
  c. First principles calculation for safety factor
  d. FEA analysis for safety factor
7. TBM structural analysis
  a. Predicted loads
  b. Failure mode description

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   c. First principles calculation for safety factor
   d. FEA analysis for safety factor
8. Equipment lifting and transportation structural analysis
   a. Predicted loads
   b. Failure mode description
   c. First principles calculation for safety factor
   d. FEA analysis for safety factor
   e. Lifting, transportation procedures
      Important: all lifting points need to be marked, including allowable force
9. Subsystem and full TBM functional test program before the TBM arrives for Competition Week
   a. Provide minimum viable test plans for critical machine systems
   b. Provide all available test results of tests already conducted
10. TBM production schedule
   a. Provide a breakdown of what has been produced already vs what still needs to be produced
   b. Include updates to the top level milestones of design closure, your two major-subsystem tests, full system test, and machine ship date
11. TBM cost breakdown
12. Funding plan
   a. Current team cash-on-hand
   b. Dollar amount of submitted funding requests
13. List and description of any stored energy on the TBM (i.e., pressure vessels, batteries)
14. List of any hazardous materials, if applicable
15. List of any materials injected into the ground during mining, if applicable
   a. Proof that substance is allowed to be used in Bastrop, TX, USA
16. Description of safety features including:
   a. Mechanisms to mitigate a complete loss of TBM power
   b. Mechanisms to mitigate leaks, environmental contamination
   c. Single points of failure within the TBM
   d. Recovery plan if TBM becomes immovable
   e. Include description of failure modes (top 11)
   f. Provide descriptions of all safety interlocking mechanisms
17. A CAD 3D-model (.step file) and corresponding Bill-of-Material (BOM) need to be uploaded together with the FDP

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Digging Mini Competition

The Final Design Package shall consist of:

1. Description of team and updated list of all associated team members and advisors
2. Design description for your digging device. At a minimum, this should include:
    a. Machine top-level design summary and layout
    b. Machine dimensions
        i. Overall
        ii. By subsystem
    c. Machine mass
        i. Overall
        ii. By subsystem
    d. Machine power source
        i. Power budget
    e. Digging machine parameters
        i. Maximum advance rate
        ii. Estimated tunneling time
            1. Estimated tunneling time by subsystem (i.e. what are your limiting factors?)
3. Design descriptions of your machine. At a minimum, this should include:
    a. Machine thrusting mechanism
        i. Include friction analysis, both axially (into the ground) and torque, if applicable
    b. Muck Removal System
        i. Include estimate of mechanism throughput
        ii. Muck transport system
    c. Machine Structural Analysis
        i. Digging machine itself
            1. Predicted loads
            2. Failure mode description
            3. First principles calculation for safety factor
            4. FEA analysis for safety factor
        ii. Launch and/or supporting structures
            1. Predicted loads
            2. Failure mode description
            3. First principles calculation for safety factor
            4. FEA analysis for safety factor
    d. Electronics System
        i. Sensor list and location map

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ii. List of all Electronic Control Units and explanation of what each Electronic Control Unit is responsible for
iii. Overview of how these components communicate with each other
iv. Full breakdown of power consumption per subsystem
v. Full system schematics and electrical layout

e. Software System
   i. High Level explanation of software system
   ii. Software communications/network architecture
   iii. E-stop implementation description
   iv. Machine operator controls and interface
      1. List of safety interlocks in the system
      2. Mock-up of the operator interface
f. Cooling System, if applicable
   i. Estimated thermal output
      1. Overall
      2. By subsystem/component
   ii. Expected steady state temperatures
      1. Without cooling system
      2. With cooling system
      Note: Expected temperatures must be below max operating temperature of the component per the manufacturer.
g. Hydraulics System, if applicable
   i. P&ID diagrams
      1. Overall
      2. By subsystem
   ii. Hose making, hardline making method (TBC recommends outsourcing this, if possible)
   iii. Proof testing method and procedure

4. Descriptions of all safety interlocking mechanisms
5. Equipment lifting and transportation structural analysis
   a. Predicted loads
   b. Failure mode description
   c. First principles calculation for safety factor
   d. FEA analysis for safety factor
   e. Lifting and transportation procedures
   Important: all lifting points need to be marked, including allowable force
6. Subsystem and full machine functional test program before arrival for Competition Week
   a. Provide minimum viable test plans for critical machine systems
   b. Provide all available test results of tests already conducted

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7. Machine production timeline and status
    a. Include updates to the top level milestones of design closure, your two major-subsystem tests, full system test, and machine ship date
8. Machine cost breakdown and funding plan (resources and schedule)
9. List and description of any stored energy on the machine (i.e. pressure vessels, batteries)
10. List of any hazardous materials, if applicable
11. List of any materials injected into the ground during mining, if applicable
    a. Proof that substance is allowed to be used in Bastrop, Texas
12. Description of safety features including:
    a. Mechanisms to mitigate a complete loss of machine power
    b. Mechanisms to mitigate leaks, environmental contamination
    c. Single points of failure within the machine
    d. Include description of failure modes (top 6)
13. Description of system scalability
    a. How will this help you build a full TBM next year?
14. A CAD 3D-model (.step file) and corresponding Bill-of-Material (BOM) need to be uploaded together with the FDP

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Mining Readiness Review

All finalists attending the Not-a-Boring Competition are required to prepare a Mining Readiness Review presentation, which will be presented to TBC engineers and competition organizers during Competition Week.

The Mining Readiness Review shall be a slide presentation which can be completed in 30 minutes and addresses the items below. Following the presentation, there will be a 30 minute question and answer period. Additional analysis, part specifications, and/or other supporting documentation shall be included as backup slides as appropriate.

The Mining Readiness Review serves as the final deliverable for the competition prior to safety checks. Its purpose is to provide an overview of your system to TBC engineers and to provide a quick way to determine the readiness state of your machine upon arrival. It will also give TBC the opportunity to learn more about you and your team. <u>Your machine is not expected to be ready to mine when you submit and present your MRR</u>, but you should have a path towards all subsystems being ready by the end of the week that you lay out in this presentation.

The Mining Readiness Review shall consist of:

1. High level overview
    a. List of team and subsystem leads, along with all team members and advisors
    b. Machine top-level design summary and layout
    c. Machine dimensions
    d. Machine mass
    e. Machine power budget
    f. Machine parameters
        i. Maximum advance rate
        ii. Estimated tunneling time
            1. Fastest possible time if everything went perfectly
            2. Likely time to complete tunnel
            3. Worst case scenario (within reason) tunneling time
    g. Breakdown of team budget over the course of the year
2. TBM System Review
    a. A single slide showing all machine subsystems and their readiness state (ready meaning if we went outside, could the machine be turned on and start digging right now)
        i. Note: Many (if not all) of these items will be NOT READY at the beginning of the week. All should become READY before mining

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   b. Design overview and readiness state for each subsystem (no slide count limit, but be mindful of the 30 minute overall presentation length. See the end of this requirements list for an example slide format to follow)
      i. Description of design and supporting analysis
      ii. List of any single points of failure in the subsystem
      iii. Ready to mine status of subsystem
      iv. Top 3 risks associated with the subsystem
      v. Top 5 actions that need to be taken to make subsystem ready to mine
   c. Summary of biggest overall risks and mitigation plan
3. Mining logistics plan
   a. Updated site layout plans
   b. Equipment unloading and launch setup plans
      i. Required machinery (and if TBC operators are needed)
      ii. Rough unloading schedule (so TBC can work to allocate operators)
   c. Muck removal/storage plans
   d. List of hazardous materials and location of material safety data sheets
   e. Machine retrieval plans
4. One slide (and only one slide) describing a part of your machine or process you're most proud of
   a. Examples might include: Your best/coolest/most interesting part or assembly or a unique, internal process you're using
   b. Note: The goal is to allow you to highlight something that you think WE should know about, but that might not fit elsewhere in the presentation

As a reminder again, your machine is **not** expected to be in a ready to mine state when this presentation is given. By the end of the week, you should be able to say that you've addressed all open actions and mitigated critical risks before tunneling.

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Competition Safety Inspections

During Competition Week, Competition Inspectors will work with teams to understand their designs and ensure safe operations. Details for the Safety Inspection List will be provided at a later date, but generally, the inspections will be across the following categories:

1. Logistics
   a. Loading and unloading plans will be reviewed, and any procedures for lifting will be checked and approved
2. Systems
   a. Discussion of the overall theory of operation of the machine. Justify that the system is capable of mining a full (or partial) tunnel
3. Mechanical
   a. Structural analysis will be checked, and hardware will be inspected for possible pinch points, interference, vibration tolerance, etc.
4. Electrical
   a. Wiring diagrams and schematics will be checked, and physical writing will be inspected to ensure they match the diagrams. Connections will generally be tested for tolerance to pull-out and vibration
5. Fluids
   a. P&ID diagrams will be checked and all hydraulic and pneumatic systems will be inspected and compared to analysis. Proof certifications and tags will be checked
6. Software
   a. State diagrams will be inspected and tested against machine operation. The machine and GUI's response to loss of power, network, etc. will be tested. Analysis and simulations for guidance and navigation will be checked

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Revision History

Rev.	Date	By	Description
A	May 2025	NaBC Team	- Initial Release
B	Aug 2025	NaBC Team	- Update logistics section with eco blocks - Clarify PDB requirements around team list, design summary, risks

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