DARPA Subterranean Challenge
Competitors Day

Competition Details
SubT Challenge Competitors Day Agenda

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 27, 2018</td>
<td>8:00 am - 9:00 am</td>
<td><strong>Registration</strong></td>
</tr>
<tr>
<td></td>
<td>9:00 am - 9:30 am</td>
<td><strong>Welcome to Competitors Day</strong></td>
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<tr>
<td></td>
<td>9:30 am - 10:00 am</td>
<td><strong>SubT Challenge Overview</strong></td>
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<tr>
<td></td>
<td>10:00 am - 11:00 am</td>
<td><strong>End-User Perspectives</strong></td>
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<td></td>
<td>11:00 am - 12:00 pm</td>
<td><strong>Lunch</strong></td>
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<td>12:00 pm - 1:30 pm</td>
<td><strong>SubT Virtual Testbed Overview</strong></td>
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<td></td>
<td>2:00 pm - 3:30 pm</td>
<td><strong>Presentations from Funded Teams</strong></td>
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<tr>
<td></td>
<td>3:30 pm - 4:30 pm</td>
<td><strong>Q&amp;A</strong></td>
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<tr>
<td></td>
<td>4:30 pm- 5:30 pm</td>
<td><strong>Closing Remarks</strong></td>
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</tbody>
</table>

- **Why SubT?**
- **Why SubT Challenge?**
- **Ways to Compete: Systems or Virtual**
- **Systems Competitor Workflow**
- **Virtual Competitor Workflow**
- **SubT Challenge Guidelines**
- **How to Win**
- **SubT Challenge Artifacts**
- **Challenge Elements**
- **Timeline in Near-term**
- **Things Competitors Should Do Next**
- **Summary**
The Official Subterranean Challenge Guidelines and Rules
Version posted on www.subtchallenge.com supersedes all docs
The *Official* Subterranean Challenge Guidelines and Rules

Version posted on [www.subtchallenge.com](http://www.subtchallenge.com) supersedes all docs

- Releases scheduled NLT ninety days in advance of each event
- Site-specific details to be incorporated into each version release
- Questions and clarification comments welcome via the [SubT Community Forum](http://subtchallenge.com/community)

[Distribution Statement A. Approved for public release. Distribution is unlimited.](#)
How to Win

Find all **SubT artifacts quickly and accurately**

**artifact_report:**

```python
{
    location: [ x, y, z ]
    type: "red backpack"
    detect_time: ...
    agent_pose: ...
}
```

Receive points for finding an artifact, with **time bonuses** for earlier reporting

Receive points for reporting: accurate **location**
accurate **type**

*(based on DARPA ground truth)*

Distribution Statement A. Approved for public release. Distribution is unlimited.
How to Win: An Illustrative Run

Run Score = Number of points accumulated per run
  • Max achievable run score is determined by total number of artifacts
How to Win: Overall Team Rankings

**Event Score**: Team’s total score for the (Circuit or Final) event

**Systems**
- Best run score over multiple runs on the test course

**Virtual**
- Best average run score over multiple runs across multiple scenarios

*notional scenarios depicted*
SubT Challenge Artifacts


- Expected artifacts in each Circuit Event to be announced NLT ninety days before
- Teams will know what types, but not where and how many of each type
- Total number of artifacts to be found will be site-specific

SubT Challenge Guidelines, §8.3
SubT Challenge Artifacts: The Case for Multi-modal Perception

**Insight:** Artifacts may be more robustly detected, identified, and localized using multi-sensor approaches

<table>
<thead>
<tr>
<th>Artifacts</th>
<th>Vision</th>
<th>LIDAR</th>
<th>Thermal</th>
<th>Acoustic</th>
<th>RF</th>
<th>Multi Gas</th>
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</thead>
<tbody>
<tr>
<td>Survivors</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ingress/Egress Points</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electric Pump</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Open/Closed Valves</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red Backpack</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio, Cell Phone</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Tools/Fire Extinguisher</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Power Plugs/Electrical Boxes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Oxygen Level</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Smoke/Steam/Gas Leak</td>
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<td>✓</td>
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<tr>
<td>Ventilation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Structural Crack</td>
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<tr>
<td>Motion/Vibration</td>
<td>✓</td>
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<td></td>
<td>✓</td>
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<tr>
<td>Standing Water</td>
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<td>✓</td>
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</table>

*notional artifact-sensor mappings*
Challenge Elements to Inspire Technology Breakthroughs

Austere navigation
GPS-less and sparsely featured surroundings

Degraded sensing
Low-light, obscured, and scattering conditions

Severe comms
Physical impediments to reliable links

Dynamic terrain
Physical changes to the environment

Endurance limits
Operationally relevant spatial scales

Terrain obstacles
Mobility-stressing terrain features

Technology Impact

Autonomy  Perception  Networking  Mobility

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Challenge Elements

light/darkness, particulates, water puddle, mud, rubble/uneven terrain, inclines, steps/ledges, vertical shafts, dynamic obstacles, constrained passages

- Different sets of challenge elements may be presented at different Circuit Events
- Extreme conditions (temperature, fire, hazmat) and breaching or burrowing are out-of-scope
- Anticipated duration for each Circuit run is 60-90 minutes and each Finals run is 60-120 minutes

_subT Challenge Guidelines, §8.1-8.2_
Calling All Teams: Team Registration, Qualifications, and Test Events

Register
• Potential competitors can show their interest by registering their teams at [www.subtchallenge.com](http://www.subtchallenge.com)

Qualify
• Team registration is required prior to submitting qualification materials

Test
• Registered teams will receive important competitor-relevant updates and notices of information releases

Compete
• Team registration is open on a rolling basis

*SubT Challenge Guidelines, §5*
Calling All Teams: Team Registration, Qualifications, and Test Events

Register

↓

Qualify

↓

Test

↓

Compete

• Prospective teams are required to demonstrate basic safety and baseline performance

• All teams in both competitions (Systems and Virtual) must qualify for each event

• SubT Challenge Qualification Guide will be posted by October 31, 2018

• Qualification submissions are accepted on a rolling basis
  • Must be submitted NLT 100 days before each event

SubT Challenge Guidelines, §6
DARPA will hold one or more SubT Integration Exercise (STIX) events.

STIX events are optional and not a prerequisite to participate in the Circuit or Finals events.
- Teams must qualify to participate in the STIX event and must do so NLT 100 days before each STIX event.

STIX Operations Guide is expected to be released no later than 90 days before each STIX event.

SubT Challenge Guidelines, §7
Next Steps for SubT Challenge Competitors

1. Register your team!
   Get announcements and emails

2. Sign up and join the discussion @ SubT Community Forum!
   Start teaming | sharing | learning

3. Follow DARPA social media!
   @DARPA on Twitter, Facebook, LinkedIn, and Instagram
   #subtchallenge

4. Connect with DARPA/SubT Challenge Public Affairs!
   Keep us posted on exciting advances

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Official Resources

• DARPA Subterranean Challenge Website
  • https://www.subtchallenge.com

• SubT Challenge Competitors Package
  • SubT Challenge Competition Guidelines
  • SubT Challenge Competition Rules
  • SubT Challenge Qualification Guide
  • SubT Integration Exercise (STIX) Operations Guide
  • Circuit/Finals Operations Guides
  • Terms and Conditions

• DARPA SubT Community Forum
  • https://community.subtchallenge.com
    • Teaming
    • Questions
    • Announcements

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Let the Challenge Begin!
Break – we will resume the broadcast at 1:30 PM EST