



Virtual Competition Rules:

Challenge Event 2

Version 2c

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2 Introduction

This document describes the Challenge Event 2 Rules of the DARPA Triage Challenge (DTC) – Virtual Competition. This document supersedes previous versions of the DARPA Triage Challenge Rules. Significant revisions from past versions in this document are indicated by blue text. Teams are encouraged to closely review the entire document. The intent of this document is to provide participants guidance on competition design and scoring objectives to inform their development efforts in preparation for the second competition event. This document is subject to change and may be superseded by later versions. The latest official versions of all documents are posted on the DARPA Triage Challenge Website (triagechallenge.darpa.mil) and the DARPA Triage Challenge Community [Forum](#).

DARPA intends to release a draft of the Competition Rules no later than nine months before each Challenge Event. The final version of the Competition Rules will be released no later than three months prior to each respective event.

The DARPA Triage Challenge Chief Judge has the final authority to make any decisions related to the rules or scoring. All decisions made by the Chief Judge are final.

The main goal of the DARPA Triage Challenge is to inspire development of scalable, timely, and accurate capture of novel injury signatures to enhance triage decision-making in austere, complex, and mass-casualty settings. The challenge elements and the competition structure itself are intended to address the additional goal of increasing the diversity, versatility, cost-effectiveness, and robustness of relevant technologies and systems capable of addressing the myriad needs of a wide range of mass casualty incidents (MCIs) rather than single-purpose or specifically tailored solutions. The third goal of the DARPA Triage Challenge is to establish a collaborative community by bringing together multi-disciplinary teams and cross-cutting approaches across disparate fields to address the autonomy, perception, and diagnostic needs of the medical triage community.

3 Overview

Under the authority of 10 U.S.C. §4025 to stimulate innovations using prize competition, the DARPA Triage Challenge will use a series of competition events to drive breakthrough innovations in the identification of physiological features (“signatures”) of injury. These new signatures will help medical responders perform scalable, timely, and accurate triage. Of particular interest are MCIs, in both civilian and military settings, when medical resources are limited relative to the need.

The DARPA Triage Challenge’s long-term vision is 1) an initial, or primary stage of MCI triage supported by sensors on stand-off platforms, such as uncrewed aircraft systems (UASs) or uncrewed ground systems (UGSs), and algorithms that analyze sensor data in real-time to identify casualties for urgent hands-on evaluation by medical personnel; followed by 2) a secondary stage, after the most urgent casualties have been treated, supported by non-invasive sensors placed on casualties and algorithms that analyze sensor data in real-time to predict the need for life-saving interventions (LSIs) by medical personnel. Injury information provided by these sensors in primary and secondary triage could be integrated with other information about the scene to accumulate evidence about the injury mechanism and characteristics in order to enhance overall situational awareness, and to focus further physiological interventions.

To advance progress towards this vision, the DARPA Triage Challenge aims to bring together multi-disciplinary teams and industries that will identify physiological signatures and develop sensor and algorithm strategies for complex MCI settings. Teams participating in the DARPA Triage Challenge will be tasked with developing and demonstrating strategies for capturing high-value signatures for either primary

¹ Patterns in sensor data that reflect or predict injuries of high importance for triage assessments

or secondary triage, or for both. While aspects of the DARPA Triage Challenge involve sensors and sensor-delivery platforms, the priority is the development of physiological signatures and models to detect them, not the development of new sensor or platform technology.

4 DARPA Triage Challenge Schedule Overview

The DARPA Triage Challenge is a 3-year effort with 3 sequential 12-month phases for Primary Triage (Systems and Virtual Competitions) and Secondary Triage (Data Competition) in parallel, each culminating in a challenge event (Figure 1; see the DTC website for competition details). In each phase, competitors will develop signatures and detection and analysis strategies for each Competition. DARPA will host two competition events in each phase; a workshop and a challenge event.

Competition events will become progressively more difficult and realistic from Phase 1 to Phase 3.

The workshops will provide an opportunity for practice runs for all tracks and an opportunity for Systems competition teams to collect data from physical simulations of scenarios similar to the end-of-phase challenge event.

Table 1 provides additional information on schedule and format of Competition events and workshops.

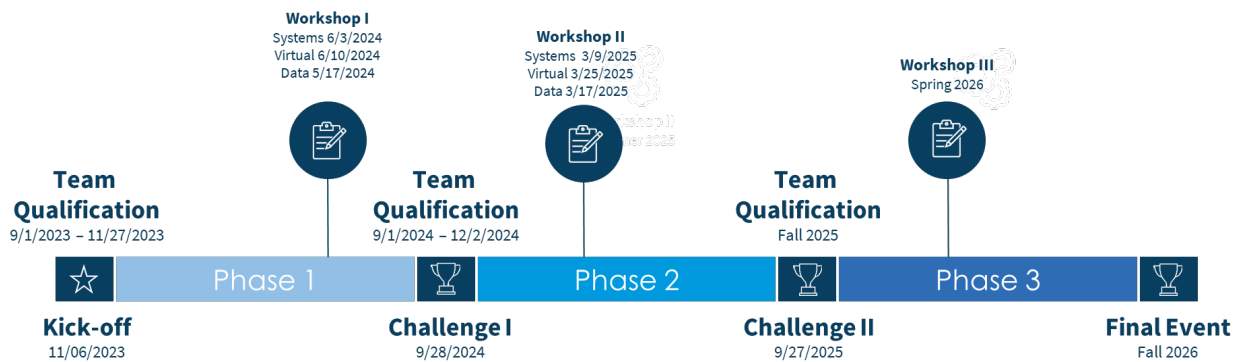


Figure 1- Program structure and schedule for the DTC.

Virtual Competition			
Event	Location	Est. Duration	Date
Year 1			
Challenge Kick-off	Hybrid	2 days	Nov 6-7, 2023
Workshop - Month 8 <i>Lessons-learned session</i>	Virtual	1 day	6/17/2024
Challenge 1 - Month 12 <i>Evaluations / runs</i>	Virtual	1 month	7/30/2024-8/30/2024
Challenge 1 - Month 12 <i>Awards /lessons-learned session</i>	Hybrid	1 day	10/5/2024
Year 2			
Workshop - Month 4	Virtual	1 day	3/25/2025
Workshop Month 4 <i>Lessons learned session</i>	Virtual	1 day	Spring 2025
Challenge 2 - Month 12 <i>Evaluations / runs</i>	Virtual	TBD	8/30/25
Challenge 2 - Month 12 <i>Awards /lessons-learned session</i>	Hybrid	1 day	10/4/2025
Year 3			
Workshop - Month 4	Virtual	1 day	Spring 2026
Final Challenge - Month 11 <i>Preliminary rounds</i>	Virtual	TBD	Fall 2026
Final Challenge - Month 11 <i>Finalists only - Runs and Awards</i>	In person	1 day	Fall 2026

Table 1 - Schedule of DARPA-organized Challenge events and workshops..

5 Prizes and Funding

Teams are encouraged to pursue high-risk, high-reward approaches to meet and exceed the objectives of the Challenge Events. Monetary prizes will be awarded for the Systems, Virtual, and Data Competitions at each of the Challenge Events (Table 2).

Challenge I Fall 2024	Systems [self-funded]	Virtual [self-funded]	Data [self-funded]
	1st \$120,000	1st \$60,000	1st \$120,000
	2nd \$60,000	2nd \$30,000	2nd \$60,000
	3rd \$20,000	3rd \$10,000	3rd \$20,000
Challenge II Fall 2025	Systems [self-funded]	Virtual [self-funded]	Data [self-funded]
	1st \$300,000	1st \$300,000	1st \$300,000
	2nd \$150,000	2nd \$150,000	2nd \$150,000
	3rd \$50,000	3rd \$50,000	3rd \$50,000
Challenge III Fall 2026	Systems [DARPA-Funded and self-funded]	Virtual [Self-funded]	Data [DARPA-Funded and self-funded]
	1st \$1,500,000	1st \$600,000	1st \$900,000
	2nd \$750,000	2nd \$300,000	2nd \$450,000
	3rd \$250,000	3rd \$100,000	3rd \$150,000

Table 2 – Prize structure for the three Challenge Events

DARPA-Funded Teams

DARPA-funded teams (Systems and Data Competitions) are only eligible for the prizes in the Final Events (selection for DARPA-funded team has closed). The Government's obligation for prizes under DTC is subject to the availability of appropriated funds from which payment for prize purposes can be made. No legal liability on the part of the Government for any payment of prizes may arise unless appropriated funds are available to DARPA for such purposes.

Self-Funded Teams

Self-funded teams (all three competitions) are eligible for prizes in all of the Challenge Events.

Virtual Competition Prizes and Funding: For all three Phases prizes for the Virtual Competition will be awarded to the best performing teams, [provided the team exceed the minimum scoring benchmark see section 9.6.7](#)The Government's obligation for prizes under DARPA Triage Challenge is subject to the availability of appropriated funds from which payment for prize purposes can be made. No legal liability on the part of the Government for any payment of prizes may arise unless appropriated funds are available to DARPA for such purposes.

To be eligible for prizes, teams must first be registered in the team qualification portal. The award process requires recipients to furnish information that may trace or identify recipients either individually or as an organization (e.g., Social Security Number or Tax Identification Number). The primary contact of each registered team is responsible for providing the award information necessary for prize disbursement. DARPA will reach out by email to the primary contact of each registered team to either confirm their vendor status or request the required forms (e.g., SF-3881 or PIF). DARPA is not responsible for disbursement of prizes to any team members other than the primary contact/organization.

At the end of each competition event, teams will be invited to discuss their technical approaches and

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lessons learned in a townhall-style hotwash. The extent of technical details shared does not need to exceed data agreements established upon qualification.

6 Qualifications

Prospective DTC competitors must demonstrate track-appropriate performance capabilities to be eligible to participate in DARPA Triage Challenge. All teams in all three competitions (Systems , Virtual, Data; see the [DTC website](#) for competition details) must complete two types of qualification: a Team Qualification at the beginning of each phase, and a later event-specific Event Qualifications for each Workshop and Challenge Event. Successful Team Qualification is a prerequisite to Event Qualifications in the same phase.

The initial *DTC Event Qualification Guide* is available on the [DTC website](#). The *DTC Event Qualification Guide* will continue to be updated for each event. The latest revision will be posted on the [DTC Website](#) and [DTC Community Forum](#).

6.1 Team Qualification

Teams must qualify for DARPA Triage Challenge competition events during the designated qualification window by completing the *Team Qualification* form on the [DTC Team Portal](#). Team Qualification submissions will be accepted on a rolling basis but must be submitted by the deadline (3). Team qualification is required to receive access to datasets and prior to event-specific enrollment.

Team Qualification Windows by Phase	
Phase 1	9/1/2023 - 11/13/2023
Phase 2	9/1/2024 - 06/30/2025
Phase 3	Fall 2025

Table 3 – Team qualification schedule.

6.2 Event Qualification

Prospective teams are required to demonstrate baseline performance and utility capabilities (e.g., safety measures for the Systems Competition, simulator usage for the Virtual Competition, and algorithm capability for the Data Competition), to be eligible to participate in events. **All** teams (DARPA-funded and self-funded) in all competitions (Systems, Virtual, and Data) must qualify for each event including the DTC workshops, Preliminary Events (i.e. Phase 1 and Phase 2 Challenge Events), and Final Event.

The latest revision of the *DTC Event Qualification Guide* will be posted on the DARPA Triage Challenge Website and DTC Discourse Community Forum. Event Qualification submissions will be accepted on a rolling basis but must be submitted by the deadline to be eligible to participate in the event (Table 4). The specific qualification deadlines for each event are provided in the *DTC Event Qualification Guide*.

Failing a previous qualification attempt does not preclude a team from resubmitting a revised qualification submission within the qualification deadlines for any given event. DARPA may adjust the qualification rules for each event and may choose to award qualification waivers for teams that have successfully participated in a prior Workshop or Challenge Event.

DARPA reserves the right to disqualify any team that is found to violate either the rules or applicable laws and regulations.

Event	Event Qualification	Event Date
Workshop 1	3/5/2024 - 4/5/2024	6/3/2024 - 6/8/2024
Challenge 1	6/28/2024 – 7/30/2024	7/30/2024 - 8/30/2024
Workshop 2	12/5/2024 -1/15/2025	3/25/2025
Challenge 2	5/28/2025 – 6/30/2025	Systems 9/27/2025 – 10/4/2025 Data and Virtual 8/30/25 - Submission 10/4/2025 - Awards
Workshop 3	Winter 2025-2026	Winter 2025-2026
Challenge 3	Summer 2026	Fall 2026

Table 4 – Event qualification schedule.

7 DARPA Triage Challenge Technical Workshops

DARPA encourages vibrant information exchange and collaborative interactions among all DARPA Triage Challenge participants, to include DARPA technical staff, independent verification and validation (IV&V) teams, representatives from competitor teams, infrastructure developers, and other government partners. To that end, DARPA will host a virtual workshop for the Virtual Competition in each phase which will offer a forum for community building and cross-pollination of technical ideas and approaches.

In each phase (8 months into Phase 1, 4 months into Phases 2 and 3) DARPA will host a multi-day hybrid workshop. This will include live practice sessions for Systems Competition competitors to test their systems on simulated casualty scenes similar to the next challenge event and virtual practice sessions for Virtual Competition teams to test their algorithms in simulated casualty scenes similar to the next challenge event. The practice sessions will be followed by a virtual ‘lessons learned’ discussion for all tracks and an opportunity to discuss real-world needs with Government partners.

At the workshops, teams will have opportunities to confirm integration with the DARPA virtual platform and scoring systems, and inform their development efforts. Runs at the workshops are not officially scored, but teams are encouraged to operate according to the Competition Rules to prepare for the Challenge events.

We will hold a virtual lessons learned meeting shortly after the workshop for teams to discuss experience gained regarding technical aspects of their systems at the workshop tests.

8 Human Subjects Research (HSR)

For the Virtual Competition, use of training data provided by DARPA does not constitute HSR, and competitors do not need to obtain IRB approval to use these data. **Self-funded teams are prohibited from the collection or use of any other human subject data as part of their involvement in the DARPA Triage Challenge, beyond data and data-collection opportunities provided by DARPA, because DARPA HSR supervision is not feasible for teams not under DARPA contract.** Self-funded teams should carefully consider this limitation and should take this into account in their technical approach, leveraging other strategies as appropriate (e.g., simulations).

DoD Definition of Human Subjects Research (HSR)

The term “human subject” can be applied to research efforts that meet EITHER of the following criteria: A

living individual about whom an investigator (whether professional or student) conducting research:

- Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or
- Obtains, uses, studies, analyzes, or generates identifiable private information, personally identifiable information, or identifiable biospecimens.

Human Subjects Research involves:

- Activities that include both a systematic investigation designed to develop or contribute to generalizable knowledge and involve a living individual about whom an investigator conducting research obtains information or biospecimens through intervention or interaction with the individual, or identifiable private information, or biospecimens.

8.1 Handling of DARPA-provided data

Primary Triage:

Primary triage datasets are owned by the Army and developed by its Telemedicine & Advanced Technology Research Center (TATRC), and shared with DARPA under appropriate authorities, exclusively for research purposes (including DTC).-The TATRC datasets entrusted to DARPA have been intentionally de-identified to ensure—to the greatest extent practicable—that there is no reasonable basis to believe that the data could be used to trace a specific identity or present a risk of harm to any individual. However, TATRC datasets may incidentally or unintentionally contain sensitive information and images (including facial imagery). Therefore, as previously acknowledged in the DTC Qualification process, competitors agree they will *not* attempt to re-identify, share, or re-use Army/TATRC data as provided by DARPA.

9 Primary Triage: Virtual Competition Rules

9.1 Virtual Testbed

DARPA is investing in the development of the DTC Virtual Testbed, illustrated graphically in Figure 4, comprising of (1) DTC Simulator, an extensible Unreal Engine (UE5)-based simulation environment employing MetaHumans augmented with physiology data; (2) automated testing and assessment tools; and (3) associated software support infrastructure. This suite of simulation tools is intended to support teams in both the Systems and Virtual Competitions as they develop and evaluate their approaches.

An initial version of the DTC Virtual Testbed and associated simulated sensing videos was released in November 2023. This will be followed by regular releases with updates and enhancements (see Table 5 for the initial roadmap). DARPA intends to continue adding significant improvements and new capabilities to the Testbed over the life of the challenge. The Phase 1 challenge included support for user-generated paths, four main sensing modalities (RGB and thermal camera, audio, LiDAR), and 30 simultaneous casualties consisting of 4 injury classes (hemorrhage, burn, respiratory distress, and TBI) distributed over 20 different human 3D models. The human models will varied by age (16 and older), size (varying BMI), and skin tone (using the 6 types from the Fitzpatrick scale). Proposed capabilities for the Phase 2 challenge are highlighted blue in Table 5.

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Version	Release Date	Changes From Previous Version				Expected Use
		Nav Path	Injury Types	Sensing Modalities	# UGV / UAV Options	
(Phase 0)	11/23	Fixed	Hemorrhage, Burn, Respiratory Distress	RGB, Thermal, Audio	1 UGS 1 UAS	Phase 1 training / dev
0.1 (Phase 1) – Minor rel	3/24	Manual teleportation				Phase 1 training / dev Phase 1 Workshop Qualification
0.2 (Phase 1) – Workshop	6/24	User Defined Waypoints	Traumatic Brain Injury			Phase 1 Workshop Phase 1 Challenge Qualification
0.9 (Phase 1) – Pre-Challenge	7/24			Audio		Phase 1 Challenge Preparation
1.0-1.3 (Phase 1) – Challenge	9/24 (DARPA)					Phase 1 Challenge
	11/24 (all)					Phase 2 training / dev Phase 2 Workshop Qualification
1.4 (Phase 2 interim release)	1/25	-Autonomy via ROS -1 Agent per run		-Two-way audio for limited phrases -Teams can configure sensors	-Quad copter -Skid steer -Akerman	
1.5 (Phase 2) – Workshop	3/25	-2 agents per run	-Muscular-skeletal Injuries -Chem exposure (respiratory agent) -Poly trauma -Partially obscured casualties -“Walking wounded”	-Lidar -RADAR	-4-legged model	Phase 2 Workshop
1.6 (Phase 2) – Minor rel	6/25	-5 agents per run			4 UGS	Bug fixes to support Phase 2 training / dev
2.0 (Phase 2) – Challenge	9/25 (internal DARPA release)					Phase 2 Challenge
	11/25 (release to teams)					Phase 3 training / dev
2.3 (Phase 3) – Workshop	3/26				5 UAS	Phase 3 Workshop
2.5 (Phase 3) – Minor rel	6/26				5 UGS	Phase 3 training / dev Phase 3 Challenge Qualification
3.0 (Phase 3) Challenge	9/26					Phase 3 Challenge
	11/26					Future Development

Table 5 – DTC Virtual Testbed Anticipated Release Plan and Capability Growth

The DTC Virtual Testbed will use data from a physiology engine combined with injury timelines to simulate realistic MCIs and UxSs to provide a platform for training primary triage platforms and algorithms (Figure 4). The Testbed will also be used for challenge scoring at the end of each competition. A Virtual Testbed ICD that defines how teams provide input to the testbed (e.g., navigation waypoints / path / [autonomy controls](#), platform configuration, sensor configurations, etc.) and the required format / content of the casualty reports / logs was published in early 2024 for the Phase 1 challenge. Any interface changes in Phase 2 will be documented via updated versions of the ICD when new releases of the Testbed are provided.

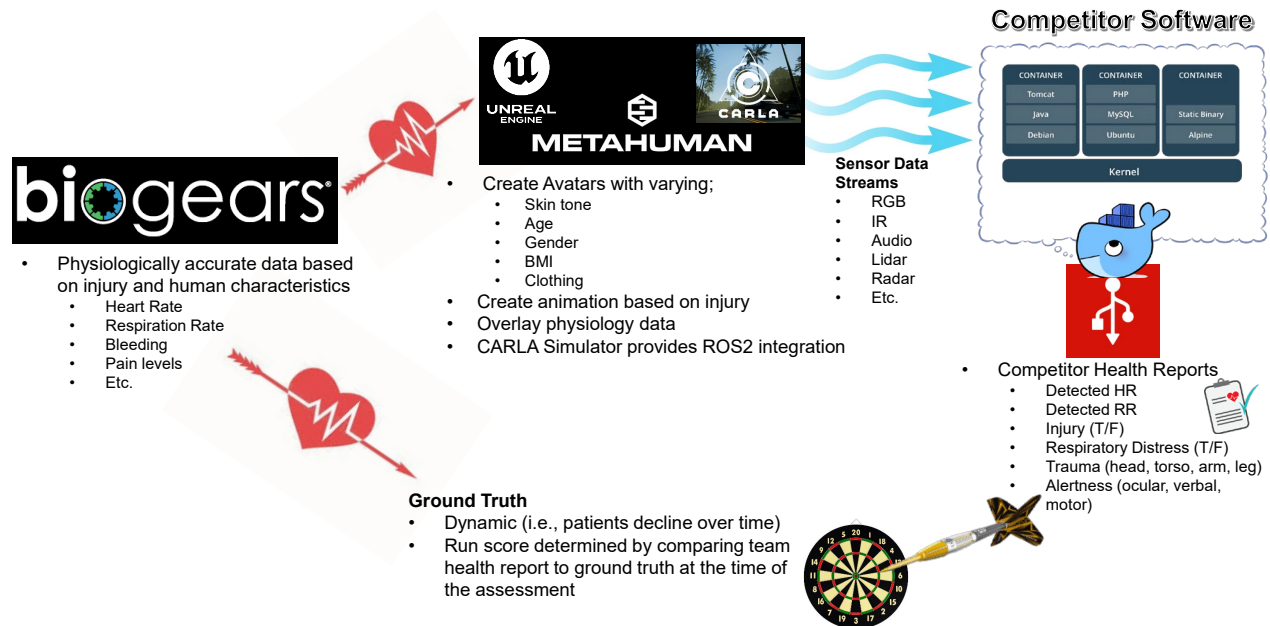


Figure 2- Virtual Testbed

9.2 Virtual - Technical Challenge Elements

The challenge elements used in the Virtual Competition will correspond to those of the Systems Competition to the fullest extent possible.

The Challenge competition courses will be designed to assess performance across various challenge elements, including: *degraded sensing*, *obscuring obstacles*, *terrain obstacles*, *dynamic obstacles*, and *dynamic casualties*. The challenge elements are expected to become progressively more difficult from Phase 1 to Phase 3.

1. **Degraded Sensing:** The courses are expected to include elements that range from constrained passages to large open fields, lighted areas to complete darkness, and clear to dusty conditions. Sensors will need to have the dynamic range to reliably operate in these environments. Dust, fog, smoke, talking, flashing light, heat spots, and loud background audio effects are within scope of this challenge element. Extreme temperatures, fire, and hazardous materials are not expected to be within scope.
2. **Obscuring Obstacles:** Casualties may be fully visible to partially obscured to completely obscured, such as buried under a shallow layer of rubble. Sensor modalities capable of penetrating rubble will have an advantage in such situations. Stand-off sensor access to skin may

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be possible but cannot be assumed. Casualties may also be grouped with limbs, torso, or other body parts overlapping.

3. *Terrain Obstacles*: Systems will be required to demonstrate robustness in navigating a range of terrain features and obstacles. Terrain elements and obstacles may include constrained passages, large drops/climbs, inclines, and rubble. UAVs may be subject to atmospheric turbulence. The environments may include natural or human-made materials; structured or unstructured clutter; and intact or collapsed structures and debris.
4. *Dynamic Obstacles*: Responders, “walking wounded”, or other physical changes to the environment will test the agility of the system autonomy to identify, reidentify, and assess casualties.
5. *Dynamic Casualties*: Some treatable injuries may rapidly be fatal, so taking too long to find and assess casualties may result in the window for effective LSI to be missed. While competitors are not expected to re-evaluate casualties for changes in status, casualties who are not evaluated within an appropriate timescale may have a change in status (for example, progression of untreated hemorrhage or airway injury).

The scale and complexity of competition courses is expected to increase each year. The design of the first Challenge Event courses is intended to assess the ability of teams to address the variety of challenging environments presented in a post-battle environment. In Year 1, platforms traveled through an area based on user defined waypoints and associated travel times / dwell times. The technical challenge elements in Year 2 will [include autonomous travel, multiple platforms, degraded sensing and dynamic obstacles](#).

9.3 Virtual - Scored Event Submissions

9.3.1 Versions and releases

Applied Research Associates, Inc. (ARA), the DARPA performer providing the Virtual Testbed, will release four several versions; version 1.0 was released in November 2024, [version 1.4 will be released January 2025, version 2.0 will be released in Fall 2025 \(Phase 2 Challenge Event\)](#), and version 3.0 will be released in [November 2026](#) (Phase 3 Final Event). ARA will also release at least one version between each of these versions. These interim versions will be released prior to the virtual workshops for each challenge year.

The virtual competition scoring runs are expected to be performed by the IV&V teams (i.e., NOT self-evaluated). The challenge teams will not be permitted to witness the evaluations live.

9.3.2 Scored Competition Scenarios

Multiple scenarios will be devised for each simulated environment (e.g., all scenarios are the same incident and same virtual location, but will vary by the location of casualties, human model assigned to a casualty, and injury assigned to each human model).

For Phase 2, there will be up to two simulated environments. Each simulated environment is expected to have at least 3 different casualty scenarios. Following the completion of scoring, the run scores, and logs will be released. Following the completion of Phase 2, the event scenarios will be made available to competitors

for training.

Each qualified team must submit a single solution to be scored. The submitted solutions will be evaluated against m number of competition scenarios to test the versatility of the solutions. Each competition scenario will, in turn, be evaluated over n replications (reps) to account for random variability. See .

Competitors will be scored based on their ability to correctly evaluate casualties in the simulation. Casualties will be presented at different severities with both physical indicators of injury and severity (i.e. lacerations and burns) as well as underlying physiological manifestations of injury (i.e. changes in respiration and heart rate). Casualties will be scannable in multiple sensing modalities, beginning with RGB, thermal, and audio at a minimum for Phase 1.

The Event Score of the $m \times n$ runs is given by:

$$Event\ Score = \frac{1}{m} \sum_{i=1}^m \left(\frac{\sum_{j=1}^n run\ score_{ij}}{n} \right)$$

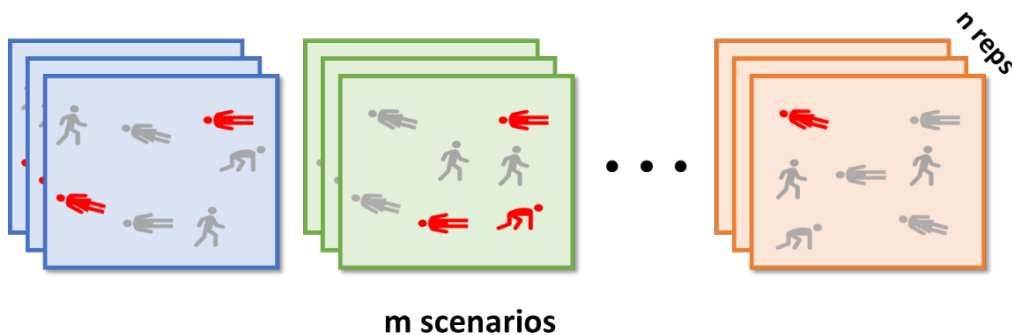


Figure 3 - Virtual Competition approach to scoring competition scenarios

9.3.3 Solutions Submissions

For scored event submissions, it is expected that qualified teams will submit a single solution in the form of a Docker Image to Amazon’s Elastic Container Registry, from where they will be pulled and evaluated against the competition scenarios. ARA will provide a NextCloud folder for manual uploads as a failsafe. Credentials and specific details will be provided to teams either on the Discourse forum or directly via email. Submissions must be self-contained and will be evaluated through an automated process. Entries that require additional user input or external commands will not be scored. See the Virtual ICD for further details [on expectations for valid Docker image interfaces and functionality](#). In June, ARA will provide competitors a limited window of time to test their submissions against the competition hardware setup to ensure their submissions produce and submit valid health reports for scoring.

The solution submission window for the first challenge will open approximately 2 months prior to the awards ceremony. The submissions will be evaluated and the final results will be announced alongside the

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Systems Competition results in Fall 2025.

Challenge Event	Submission Window	Results Release
<i>Challenge 1</i>	<i>7/30/2024-8/30/2024</i>	<i>10/5/2024</i>
<i>Challenge 2</i>	<i>7/30/2025-8/30/2025</i>	<i>10/4/2025</i>
<i>Challenge 3</i>	<i>Summer 2026</i>	<i>Fall 2026</i>

Table 6 – Submission window for the Virtual track competitors

9.3.4 Human Supervisor

The submitted solutions will be evaluated with no external operator interfaces such as command line inputs or user interventions. Virtual Teams are required to develop self-contained solutions that navigate, search, and evaluate entirely autonomously without human supervisor interactions using ROS2 messages.

9.3.5 User Interface Display

Teams must provide visual representations of their algorithms during the competition. This display must provide a visual of casualty status and location that a medic or other user could utilize to accelerate care. This can include object detection bounding boxes, pose estimation skeletons, rPPG waveforms, or any other relevant overlays and visual metrics that meaningfully describe casualty status. These visuals must be in the form of videos written to disk. The ICD will provide specifics on volume mount locations to which videos need to be written.

9.3.6 Staging Area

Each scored scenario begins with a Staging Area similar to the Systems Competition (see Systems Competition Rules), inside which all platforms in the team may spawn. Platforms will not be spawned outside of the staging area. At spawn time, platforms are provided their ground truth location and orientation. Orientation along with a GPS coordinate system will be used for casualty reporting and navigation.

9.3.7 DTC Simulator Mechanics

The DTC Simulator utilizes a number of simulator mechanics to address the environmental accuracy of the competition and reduce the operational disparity between the Systems and Virtual Competitions. To that end, team submissions must fully utilize and not seek to circumvent use of simulator mechanics.

9.3.8 Run Termination

A scored run terminates upon any of the following conditions:

- Time Expiration: The given time expires before another termination criterion is met
- Completed run: The competitor system sends a “done” message to the testbed
- Violation of minimum standoff distance. Autonomy logic brings agents within 1 meter of a casualty.
- Unexpected termination of competitor container

9.3.9 Score Disputes

Score Disputes are intended to provide teams a mechanism to submit a formal dispute or request for review by the Chief Judge. All score disputes must be sent by email to the DARPA Triage Challenge email address (triagechallenge@darpa.mil) within 24 hours of receiving competition log files. All disputes or requests will be reviewed by the Chief Judge in a timely manner. All decisions made by the Chief Judge are final.

9.4 Virtual - Preliminary Event Scenarios

9.4.1 Challenge Event Competition Environments

The scale and complexity of the environments is expected to vary across competition scenarios and across events. DARPA intends to release practice scenarios (in workshops) in advance of the Challenge Events to provide representative environments in which to develop and evaluate solutions.

In the Phase 2 competition events it is not expected that there will be space constrained portions of the course (e.g., tunnels, crawl space, etc.). In future years, it is possible that some portions of the environments will only be accessible via passages that are approximately one meter in height and/or one meter in width. The constrained spaces will be large enough for the available platforms to traverse but will limit visibility. The most constrained portions of the competition environments will not be immediately at the entrance.

9.4.2 Preliminary Event Casualties

DARPA will announce the anticipated casualty types in advance of each competition event. The casualty types used in the Virtual Competition will be similar to those used in the Systems Competition. Casualty placement throughout the competition scenarios will be consistent across all repetitions for any given scenario but will vary across scenarios.

9.4.3 Challenge Event Run Duration

Each run will be between 15 and 30 minutes of in-simulation time.

9.4.4 Team Configuration

For Phase 2, [the team configuration will be limited to 5 deployed autonomous systems](#), the same constraints as the Systems Competition. The DTC Virtual Testbed is expected to include a repository of Robot Operating System (ROS)-available mobile robot models and sensor payload models that will be available for teams to compose their team configuration.

9.4.4.1 System Constraints

[There will be a selection of UAS and UGS in the repository with a variety of maximum speeds and standoff distances to simulate the weight classes found in the Systems competition.](#)

- UGSs minimum stand-off distance = 2 meter

- UASs will have variable minimum stand-off distances based on size
 - Less than 250 g = 2 m
 - Between 250 g and 5 kg = 6 m
 - Greater than 5 kg = 10 m

9.5 Virtual - Communications and Reporting

9.5.1 Navigation

In Phase 2, the Virtual Testbed will support full autonomy of unmanned systems via controls exposed through the Robot Operating System version 2 (ROS2). Competitors are expected to fully control their system(s) within a run of a virtual scenario.

9.5.2 Reporting casualties

Similar to the Systems Competition, teams will submit relevant information (e.g., casualty health state report, casualty location, corresponding timestamps, etc.) to a virtual Base Station to provide near-real-time situational awareness updates and reports that are scored against concurrent ground truth. Scoring procedure is described in detail in Section 9.6 below. Details on report submission format can be found in the Interface Control Document (ICD) for the Virtual Competition, to be released separately.

9.5.3 Log Files

At the termination of a run, relevant log files are generated in the form of final JSON reports and comprehensive ROS bags. The log files include all casualty reports, their corresponding timestamps, score updates, and other details. Additionally, log files allow replaying and viewing of the run by Competition Staff to ensure fair and consistent team performance in the virtual scenario in keeping with the rules and spirit of the DTC.

9.6 Virtual - Scoring Criteria

The goal of the DARPA Triage Challenge is to develop scalable, timely and accurate capture of novel injury signatures to enhance triage decision-making in austere, complex, and mass-casualty settings.

In the Virtual Competition, teams are evaluated based on accuracy and speed in assessing casualty condition using one or more autonomous platforms and stand-off sensors. Casualties are distributed throughout the competition course in a manner which rewards teams that are able to rapidly find and assess casualties. The nature of the casualties is not known prior to a run by competitors and may vary from run to run. Results for the Virtual competition will be announced at the prize ceremony on the last day of the competition event. Teams are encouraged to participate in-person for the award ceremonies at Challenge events.

Upon **locating and assessing** casualty status, the team system must submit a Casualty Report containing injury diagnosis and accompanying clinical information to the evaluation system for scoring. In the Virtual competition, reports will be submitted to the virtual evaluation system. The reported casualty condition is compared against concurrent ground truth data for scoring. The detailed report format, protocol, and example implementation will be specified in the Virtual ICD, to be released at a later date.

9.6.1 Casualty Report

The Casualty Report captures clinical information about casualty condition relevant for triage decision making including vital signs, indicators of urgent distress, and injury and alertness assessments. Each Casualty Report is submitted to the virtual base station for scoring against concurrent ground truth. The ground truth casualty used for scoring is determined by the location and assessment time submitted in the Casualty Report, as detailed in the next section. Unlike in phase 1, the entire Casualty Report for a single casualty is submitted at one time.

The list of clinical features in the Casualty Report relevant to scoring is shown in Table 6, with definitions for Casualty Report fields provided in Table 7–10. Complete details on report contents and format can be found in the ICD, to be released separately.

9.6.2 Casualty Localization, Identification, and Association with Casualty Reports

Team systems will be required to locate casualties with sufficient accuracy to receive points for correct health assessment in the Casualty Report. The Casualty Report includes fields for location (latitude, longitude) and casualty ID. The reported casualty ID is an identifier assigned by the team system, unique within the run. A Casualty Report containing a previously reported casualty ID is rejected as an invalid submission (except for intentional reassessments, described in 9.6.2).

The Casualty Report must be associated with a ground truth casualty to receive points. The reported casualty location must be within a predetermined distance from the ground truth casualty to be associated. The distance requirement will be released in a future version of this document. If there is more than one casualty within the distance requirement from the reported location, the ground truth casualty which awards the most points will be associated with the Casualty Report. If a subsequent Casualty Report awards more points for the same ground truth casualty, it will supersede the previously associated Casualty Report. Association will be recomputed upon each report submission to maximize the possible points awarded to the team by association within the location constraint. For each ground truth casualty, teams may only receive points from a single associated Casualty Report.

9.6.1 Report Scoring

A single Casualty Report earns the team up to 25 points, with up to 5 additional bonus points for early reporting of vitals and time-critical information. In order to receive points, the Casualty Report must be associated with a ground truth casualty based on the reported location, and a minimum of 3 health assessment fields must be non-empty. Reports with less than three assessment fields will be ignored and discarded. After meeting these minimum criteria for scoring, the potential points awarded is determined by comparing the submitted health assessment to concurrent ground truth data for each associated casualty.

The Casualty Report contains a relative timestamp for each field (“time_ago”) that is used to compare the submitted assessment against ground truth measured at the same time. Categorical fields in the Casualty Report are awarded points based on whether they match ground truth; numerical fields (i.e., vitals) are awarded points based on whether they are within a predetermined range of the ground truth value. To receive points for Heart Rate, the reported estimate must be within +/- 5 BPM (beats per minute) of ground truth estimated over the preceding 10 seconds. To receive points for Respiratory Rate, the reported estimate must be within +/- 3 BrPM (breaths per minute) of ground truth estimated over the preceding 60 seconds. To receive points for Core Temperature, the reported estimate must be within +/- TBD degree (Fahrenheit). See

Table 7 for correctness criteria for vital signs.

A base level of 5 points is awarded for correctly locating a casualty (i.e., with reported location sufficiently near a ground truth casualty location). Points are then added or subtracted from the location points based on correct or incorrect health assessment by field with a minimum score per casualty of 0. All health assessment fields in the Casualty Report are optional. However, a casualty report must contain at minimum location and 3 assessment fields in order to be scored. A missing field in the health assessment neither adds nor subtracts points from the total points awarded for the Casualty Report. See Table 6 for more information about points awarded by report field.

To incentivize rapid assessment of time-critical information indicating immediate need for medical care, bonus points may be awarded for early casualty reports containing the following fields: Severe Hemorrhage, Respiratory Distress, and vital signs (Heart Rate, Respiratory Rate, and Temperature). Bonus points will be awarded for valid and correct reports received by the virtual base station within an initial “golden window” during a scored run. The duration of the golden window will be tailored to each casualty, beginning at the start of the run and ending when the expected likelihood of survival falls below a predetermined level for the simulated casualty condition. Casualties with high expected likelihood of survival over the entire run will not have a golden window. Teams will not be given golden window durations prior to a run. For a Casualty Report submitted within the golden window of the associated ground truth casualty, the following bonus points will be awarded: 2 bonus points each for correct assessment of Severe Hemorrhage and Respiratory Distress, and 1 bonus points for correct assessment of both Heart Rate and Respiratory Rate vital signs (Temperature not included in bonus). Note that bonus points will be awarded based on the time the report is received by the virtual base station.

Preliminary scoring criteria and bonus potential for clinical assessment in the casualty report are shown in Table 6. Definitions of casualty report fields can be found in Tables 7–10. Details about casualty report format and protocol can be found in the ICD.

Field	Values	Scoring Criteria
Location	(Latitude, Longitude)	+5 if within d meters of ground truth (GT) casualty location
Severe Hemorrhage ¹	[Present, Absent]	+4 if correct -4 if incorrect
Respiratory Distress ¹	[Present, Absent]	+4 if correct -4 if incorrect
Heart Rate ²	Beats per minute (BPM)	+1 if within 5 BPM of GT -1 otherwise
Respiratory Rate ²	Breaths per minute (BrPM)	+1 if within 3 BrPM of GT -1 otherwise
Core Temperature	Degrees Fahrenheit	+1 if within TBD°F of GT -1 otherwise
Trauma	Head: [Normal, Wound, Not Testable (NT)] Torso: [Normal, Wound, NT] Upper Ext.: [Normal, Wound, Amputation, NT] Lower Ext.: [Normal, Wound, Amputation, NT]	For each field: +1 if correct -1 if incorrect

Alertness³	Ocular: [Open, Closed, Not Testable (NT)] Verbal: [Normal, Abnormal, Absent, NT] Motor: [Normal, Abnormal, Absent, NT]	For each field: +1 if correct -1 if incorrect
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Table 6 Preliminary casualty report clinical assessment with scoring criteria

¹ Receives +2 bonus points if correctly reported within casualty-specific “golden window”.

² Receives +1 point if Heart Rate and Respiratory Rate vitals are both correct, and additional +1 bonus point if correct within casualty-specific “golden window”.

³ Receives +1 point if all alertness fields correct.

Vital sign	Correctness criteria
Heart rate	Response within ± 5 BPM from GT, as calculated from preceding 10 second window
Respiration rate	Response within ± 3 BrPM from GT, as calculated from preceding 60 second window
Core Temperature	Response within \pm TBD Degree Fahrenheit) from GT

Table 7 Correctness criteria for vitals in Casualty Report.

Field	Definition
Severe Hemorrhage	PRESENT if: Active bleeding external to the body with blood on clothes/body AND pooling blood of increasing size indicative of 30% or greater blood loss (over 1500mL)
Respiratory Distress	PRESENT if: tripod position and open mouth with intermittent gasping sounds OR abnormal head/neck position and open mouth with intermittent gasping sounds OR unequal chest-wall movement OR arrhythmic chest movement OR cyanosis visible on exposed skin OR Respiratory Rate (RR) > 0 breaths per minute (BrPM) and RR < 8 BrPM OR RR > 28 BrPM.

Table 8 Casualty Report field definitions for critical fields.

Field	Definition
Trauma	NORMAL if: No indication of injury. WOUND if: Non-amputation visible wound (e.g., burn, hemorrhage, abrasion) OR Blood-soaked torn/damaged clothing with blood at injury site OR Visible deformity of limbs (e.g., fracture) OR Movement indicating injury (e.g., hands pressed on wound, limping) OR Inability to move extremity due to visible injury OR Verbal confirmation of injury. AMPUTATION if: Traumatic removal of body part with visible blood at/around wound site OR Verbal confirmation of injury.

	NOT TESTABLE if: Unable to assess injury because body region is completely occluded or otherwise inaccessible.
Head	Upper part of the human body, including neck
Torso	Trunk of the human body, including abdomen, hips, and shoulders, excluding neck
Upper Ext.	Arms and hands, excluding shoulders
Lower Ext.	Legs and feet, excluding hips

Table 9 Casualty Report field definitions for trauma fields.

Field	Definition
Alertness: Ocular	<p>OPEN if: Both eyelids open and blinking spontaneously OR Both eyelids open without movement OR Responsive to prompts to open and uncover eyes.</p> <p>CLOSED if: Both eyelids closed AND Unresponsive to prompts to open and uncover eyes.</p> <p>NOT TESTABLE if: Cannot assess due to one or both injured or occluded eyelids.</p>
Alertness: Verbal	<p>NORMAL if: Responsive to prompts with coherent and relevant speech. Oriented to time, person, and place.</p> <p>ABNORMAL if: Responsive to prompts with confused or irrelevant speech OR Unresponsive to speech prompts with pain- or distress-related speech or non-speech vocalization.</p> <p>ABSENT if: No vocalization.</p> <p>NOT TESTABLE if: Cannot assess due to injured mouth, jaw, or throat.</p>
Alertness: Motor	<p>NORMAL if: Walking, standing, or sitting unsupported with coordinated movement of limbs OR Responsive to prompts to move, within limits of sustained injury.</p> <p>ABNORMAL if: Lying or sitting supported with minimal movement or twitching AND Unresponsive to prompts to move body.</p> <p>ABSENT if: Lying or sitting supported with no limb movement.</p> <p>NOT TESTABLE if: Cannot assess due to external immobilization of limbs or total occlusion of limbs.</p>

Table 10 Casualty Report field definitions for alertness fields.

9.6.2 Casualty Reassessment

Once a casualty is initially assessed it is essential to determine if the casualty status has changed. In phase 2 teams may score additional points by reassessing a casualty and submitting an update report. The update report must be submitted before the end of the run to be accepted. For scoring the update report, the reported casualty ID will determine the associated ground truth casualty alongside the initial report with the same reported casualty ID. For a given ground truth casualty and reported casualty ID, the ground truth casualty location must be within the distance requirement for both the initial report and the update report. Update reports that misidentify the ground truth casualty based on reported casualty ID and location will receive zero points. Only one reassessment per reported Casualty ID per run will be accepted.

Only a subset of the full Casualty Report will be eligible for reassessment points (see Table 11). For Alertness fields in the health assessment, teams may only score points for fields which were correct in the initial assessment and have since changed from those initial values. Similar to the initial report, ground truth at the reported assessment time will be used for scoring, and points will only be awarded if the reported casualty location is within d meters of the ground truth casualty location.

Field	Values	Scoring Criteria
Location	(Latitude, Longitude)	+2 if within d meters of ground truth (GT) casualty location
Heart Rate	Beats per minute (BPM)	+1 if within 5 BPM of GT -1 otherwise
Respiratory Rate	Breaths per minute (BrPM)	+1 if within 3 BrPM of GT -1 otherwise
Alertness¹	Ocular: [Open, Closed, Not Testable (NT)] Verbal: [Normal, Abnormal, Absent, NT] Motor: [Normal, Abnormal, Absent, NT]	For each field: +1 if correct -1 if incorrect

Table 11 Casualty Report fields for reassessment with scoring criteria.

¹ Points only received if initial assessment was correct and ground truth at reassessment time has since changed.

9.6.3 Casualty Count Bonus

At completion of a run, teams will receive bonus points for reporting at or near the correct number of casualties in the scenario. Bonus points will be determined by the degree to which there is a one-to-one match between reported casualties and ground truth casualties, without false positive reports. The amount of casualty count bonus points will be released in a future version of this document.

9.6.4 Report Time

Scoring will be based off the time a report is received by the virtual base station. The health assessment will be scored using the relative timestamp for each field provided in the Casualty Report (“time ago”) applied to the report receipt time. Bonus points will be awarded according to whether the report time is within the “golden window” for the associated ground truth casualty. Details regarding report format and responses are provided in the ICD.

9.6.5 Report Limits

Distribution Statement ‘A’ (Approved for Public Release, Distribution Unlimited)

To discourage guessing and preserve system bandwidth, a limit will be imposed on the total number of reports that can be submitted within a run. Any report submitted with a unique casualty ID will count toward the report limit. Teams may submit up to 3 reports per unique casualty ID; an initial report, a report addition to back fill the missing fields and a casualty reassessment see section 9.8.4. Any further reports beyond this limit are rejected and will not impact the score. Further information about the report limit will be released in a future version of this document.

9.6.6 Final Ranking

For the Virtual Competition, the final ranking will be determined based on each team's event score as described in Section 9.6.3. In the event that multiple teams have an identical event score, the team with the earliest final positive-scoring report across all scored runs will be ranked higher.

9.6.7 Minimum Benchmarks to Win Prizes

In phase 2 there is a minimum benchmark for winning prizes. All teams must have a working user interface in order to participate ; and have a minimum score of 1/3 of the total possible points excluding bonus in at least 1 run. See section 9.3.5 for details on minimum requirements for the user interface.

$$y = \text{total casualties in run}$$

$$y \text{ casualties} * \frac{25 \text{ points/casualty}}{3} = \text{minimum required score}$$

10 Appendix 1 DTC Glossary

Chief Official – Program manager or higher DARPA authority for the DARPA Triage Challenge.

Systems Competition – Primary Triage Competition run with actors on a real course (Track A, B).

Virtual Competition – Primary Triage Competition run on a virtual platform (Track C).

Data Competition – Secondary Triage Competition (Track D, E).

Chief Judge – DARPA-designated individual with the sole and final authority to make any decisions related to the rules or scoring.

Competition Course – Physical or virtual environment in which deployed systems are expected to explore, and search for casualties.

Judge – DARPA-designated individual with authority to make decisions related to rules, scoring, and safety, with decision-making authority only superseded by the Chief Judge.

Staging Area – Specified area immediately outside of the Competition Course entrance from which teams deploy their system.

Starting Gate – Installed structure or existing entrance which serves as the threshold between the Staging Area and the Competition Course.

Team Lead – Team-designated individual responsible for making team official decisions and communicating with the DARPA Competition Staff.