Systems Competition Rules

Event 2 Version 2c

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Defense Advanced Research Projects Agency
Biological Technologies Office
675 North Randolph Street
Arlington, VA 22203-2114
TriageChallenge@darpa.mil

1 Contents

2 Introduction

This document describes the Systems Competition Rules of the DARPA Triage Challenge (DTC). 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 first 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 This document is subject to change and may be superseded by later versions.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 Primary and/or Secondary Triage. 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.

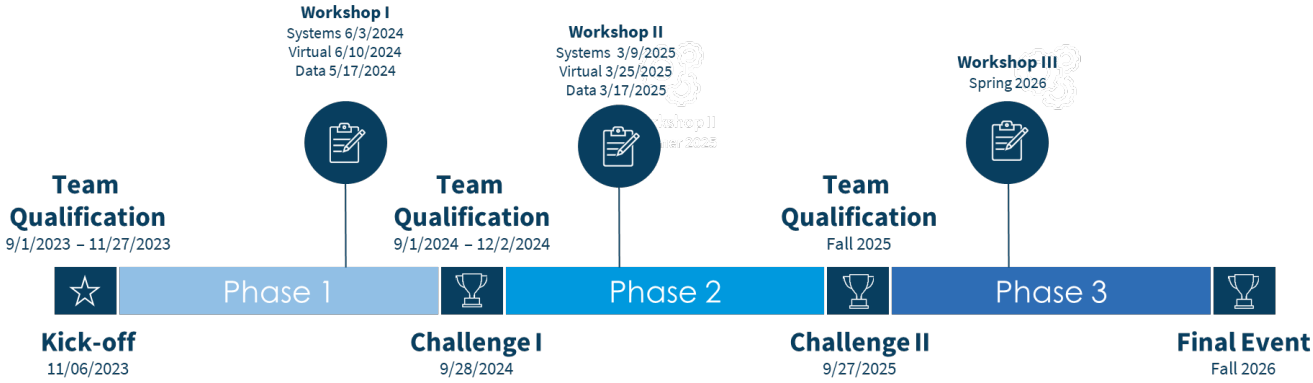


Figure 1: Timeline

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.

Systems Competition			
Event	**Format**	**Est. Duration**	**Date**
Year 1			
Challenge Kick-off	In person	2 days	Nov 6-7, 2023
Workshop - Month 8 *Evaluations / runs*	In person	6 days	6/3/2024 - 6/8/2024
Workshop - Month 8 *Lessons-learned session*	Virtual	1 day	6/17/2024
Challenge 1 - Month 12 *Evaluations / runs*	In person	7 days	9/28/2024 - 10/5/2024
Challenge 1 - Month 12 *Awards /lessons-learned session*	Hybrid	1 day	10/5/2024
Year 2			
Workshop - Month 4	In person	6 days	3/9/2025 - 3/15/2025
Workshop Month 4 ***Lessons learned session***	Virtual	1 day	Spring 2025
Challenge 2 - Month 12 *Evaluations / runs*	In person	7 days	9/27/2025 – 10/4/2025
Challenge 2 - Month 12 *Awards /lessons-learned session*	Hybrid	1 day	10/4/2025
Year 3			
Workshop - Month 4	In person	5 days	Spring 2026
Final Challenge - Month 11 *Preliminary Rounds*	In person	7 days	Fall 2026
Final Challenge - Month 11 *Finalists only - Runs and Awards*	In person	1 day	Fall 2026

*Table 1- Schedule of DARPA-organized Challenge events and workshops. *Note: DARPA-funded teams must attend all workshops in person. It is highly recommended that self-funded Systems teams also attend the workshops in person. For the Challenge events all Systems teams must attend in person.*

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 for all Challenge Events.

Systems Competition Prizes and Funding: The Phase 1 and Phase 2 prizes for self-funded Systems teams will be awarded to the best performing teams in each event, provided that the teams finish in the top 5 overall (including DARPA-funded Systems Competition) teams And achieve minimum benchmark standards see section 9.8.6. High-performing teams are also eligible to become a DARPA-funded team in Phase 2 and/or 3. 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

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 competition appropriate performance capabilities to be eligible to participate in DARPA Triage Challenge. All teams in all three competitions (Primary Triage Systems Competition, Primary Triage Virtual Competition, and Secondary Triage Data Competition; 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 *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 - 12/2/2024
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	9/28/2024 - 10/5/2024
Workshop 2	12/5/2024 -1/5/2025	3/9/2025-3/15/2025
Challenge 2	6/28/2025 – 7/30/2025	9/27/2025 – 10/4/2025
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 workshop in each phase which will offer a forum for community building and cross-pollination of technical ideas and approaches as well as an opportunity for testing in the Systems Competition.

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. The practice sessions will be followed by a 'lessons learned' discussion for all competitions and an opportunity to discuss real-world needs with Government partners.

At the workshops, teams will have opportunities to rehearse their runs, confirm integration with the DARPA instrumentation 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. In-person attendance at workshop events is required for all DARPA-funded teams. Self-funded teams may choose to attend virtually or in person, although Self-funded teams on the Systems track are **strongly** encouraged to attend in person.

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

8 Human Subjects Research (HSR)

For the Primary Triage Competition, Systems teams must be included in the IV&V Team's Institutional Review Board (IRB) protocol through a DoD Institutional Agreement for Institutional Review Board Review (IAIR) to access training data collected by the IV&V team and to collect data at DTC workshops and challenge events. For the Secondary Triage 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. For both Primary and Secondary Triage Competitions, DARPA-funded competitors require DARPA approval for the collection or use of any other human subject 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 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 Systems Competition Rules

9.1 Systems - Illustrative Scenario

The notional DARPA Triage Challenge primary triage setting is the first few minutes of an MCI where the number of casualties and/or the environment likely would preclude a timely initial assessment of each casualty by first responders.

The objective of the Primary triage competitions is to detect and identify physiological signatures of injury derived from data captured by stand-off sensors to enable early prioritization of casualties, allowing medical care professionals to quickly focus on the most urgent casualties. Competitors will develop algorithms that detect those signatures in real-time from stand-off sensors on robotic mobility platforms (e.g., UASs, UGSs) to provide decision support appropriate for austere and complex pre- hospital settings. Of particular interest are signatures of acutely life-threatening conditions that medics are trained and equipped to treat during primary triage, such as hemorrhage and airway injuries.

Challenge events for System competitors will be physical simulations of casualty scenarios. Although the setting and complexity of challenge events will vary over the course of DTC, the following features are expected to be maintained across events. Each competitor will have access to the same scenario and no two teams will operate on the same location simultaneously. Competitors will have only general information on the setting beforehand—for example, that it is a battlefield scenario, or a collapsed building following an earthquake. There will be actors and manikins exhibiting simulated injuries of varied type and severity (subject to the limitations of what can be simulated).

Competitor systems with stand-off sensors, robotic mobility platforms, and algorithms will need to autonomously process sensor data and provide real-time casualty identification and injury assessment. No part of a competitor's system may touch a casualty or manipulate the scene (e.g., clear rubble). Each scenario will have a time limit, with no scenario expected to have a duration greater than 30 minutes in Challenge 1.

9.2 Systems - Technical Challenge Elements

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 wet to dusty conditions. Sensors will need to have the dynamic range to reliably operate in these environments. Dust, fog, mist, 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 be possible but cannot be assumed. Casualties may also be grouped with limbs overlapping, or may be interacting with live responders.

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. The environments may include natural or human-made materials; structured or unstructured clutter; and intact or collapsed structures and debris.

4. *Dynamic Obstacles*: Live responders, "walking wounded", or other physical changes to the environment will test the agility of the system autonomy to identify 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 being 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).

6. *Endurance Limits:* It is expected that individual scenarios will run between 15-30 minutes. Teams will be permitted to replace batteries during their run, but teams should consider the implications

of returning to the original launch location and redeploying their systems.

9.3 Systems - Competition Courses

It is anticipated in Challenge 2 that there will be a night course. All courses are expected to be located outdoors where the ground will be pavement, grass, mud or gravel. Obstacles such as small piles of rubble, buildings and vehicles may be placed on the scene. Casualties (manikins and actors) will be located on the ground in various locations. Teams will take turns to deploy their systems on scene and the scenes are reset between runs. In the event of high wind or rain, runs may be delayed. Courses are expected to be up to 25,000sqft.

Figure 2 shows a notional workflow and communications plan for the competition events. The competing team will set up and begin their run in the designated Staging Area. At the beginning of a run, teams will deploy their systems onto the course where they will explore, locate, and triage casualties for no longer than the time limit set for the scenario. Observation data will be transmitted to the team's Base Station which will, in turn, provide triage reports to the DARPA Command Post (CP) where the reports will be automatically evaluated and scored. The DARPA Command Post will provide status back to the team's Base Station.

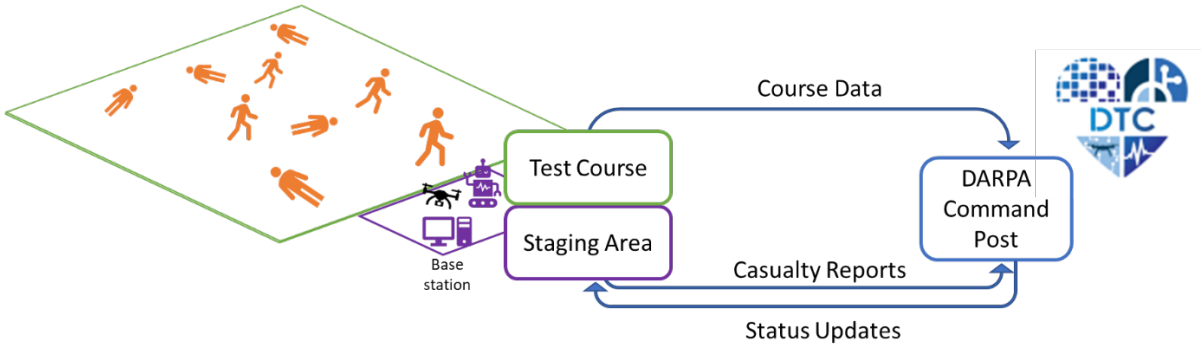


Figure 2 - Course workflow and data transmission

An Interface Control Document (ICD*)* and reference implementation will detail the mechanism for providing triage reports to DARPA. The latest revision of the *DTC* ICD will always be posted on the DTC Website and DTC Community Forum.

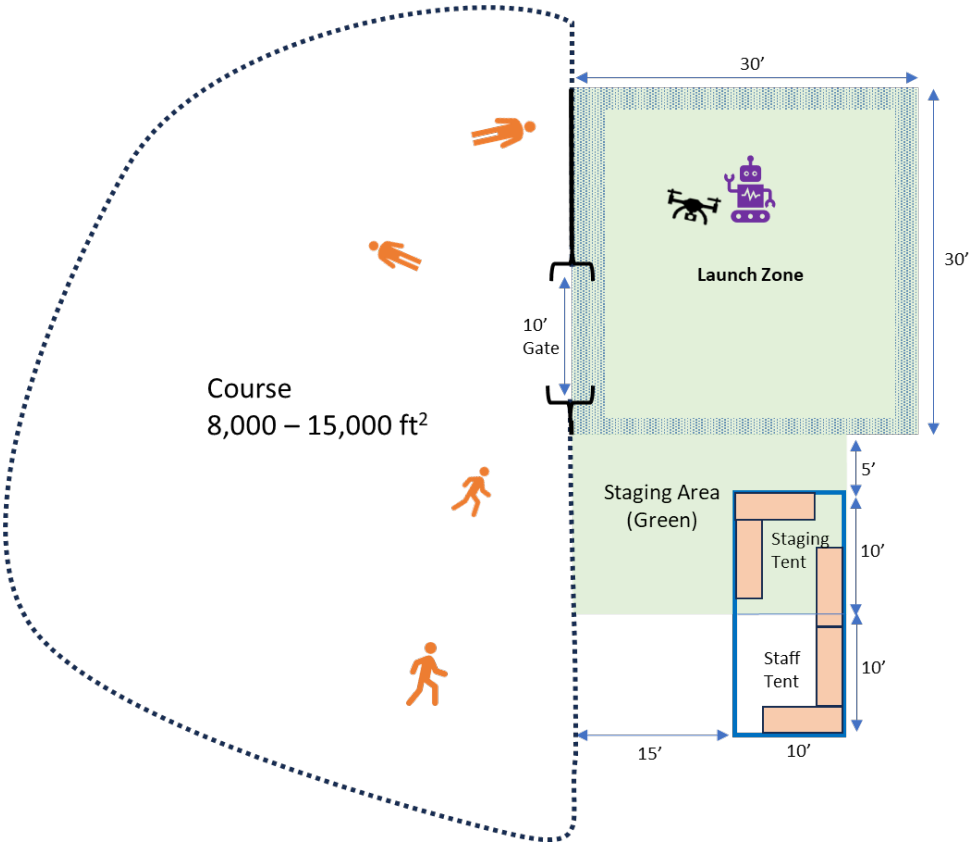
9.4 Systems - Event Operations

9.4.1 Competition Format

Prospective teams are required to demonstrate baseline performance and utility capabilities, as described in Section 0, to qualify for Challenge Event 2. It is anticipated that up to 14 teams may successfully qualify for the event. The event is expected to include four competition days. Qualified teams will be eligible to participate in the event, which will consist of two scored runs 15-30 minutes in duration. The total score for the event will be sum of a team's runs.

9.4.2 Staging Area

All systems will be required to start in the Staging Area behind the Starting Gate at the course entrance. No systems will be permitted to operate outside of the competition course boundaries except within the Staging Area. The Staging Area will include a 10'x10' tented and netted space for the team operators and a 30'x30' space for launching platforms. In the Staging Area, teams will be provided two and half (2.5) banquet tables, six (6) chairs, and one (1) 120V, single-phase, 20A circuit with NEMA 5-20R T-slot receptacles. Teams are permitted up to five (5) personnel in the Staging Area; these personnel are designated as the Pit Crew. See section 9.5 for Pit Crew details.



- *Figure 32 - Team Staging Area. Note that the staging tent may be either to the left or right of the launch zone depending on the course layout. The launch zone will be separated from the course by a wall with a 10' wide gate in the wall. The location of the gate will vary depending on the terrain. *Actual course shape and size will vary*

9.4.3 Course Access

Systems are allowed to enter, exit, or reenter the competition course at any time within the duration of the run. All human operators and personnel must stay within the Staging Area. No manual physical intervention or entry by any (human) team member on the course will be permitted. A system may only be handled or retrieved if it has crossed back into the Staging Area past the front face of the Starting Gate. Once a system has partially or completely crossed into the Staging Area, team personnel are permitted to handle the systems as long as the personnel stay within the Staging Area and do not pass the front face of the Starting Gate. Only authorized DARPA personnel are allowed to enter the course preceding or during a run. Once a run has finished and the course is clear up to two (2) team members will be permitted by the

Course Official to retrieve any UxSs that remain on the course.

9.4.4 Run Termination

A scored run terminates upon any of the following conditions:

- Time Expiration: The scored run time expires before another termination criterion is met.
- Run Completion: The deployed systems successfully report on all casualties and exit the course.
- Run Cancellation: Competition Staff cancels the run due to an external factor such as weather, including lightning, rain, snow, or wind.
- Emergency Stop: Competition Staff initiates an emergency stop because of an unsafe condition.
- By Request: The Team Lead requests an end to the run.

9.4.5 Terminated Runs

A team may be eligible for an additional attempt if a run is canceled or stopped due to an emergency or external factor outside of the team's control. The Chief Judge will review eligible cases and determine the course of action. The Chief Judge has the final authority to make any scoring-related decisions.

9.4.6 Score Disputes

Dispute Cards are intended to provide teams a mechanism to submit a formal dispute or request for review by the Chief Judge. The Dispute Card must be completed and delivered by the Team Lead to the relevant Course Official, Team Garage Coordinator, or Chief Judge. The Dispute Card must be submitted by 8 am the day following the completion of the run in question. All submissions will be reviewed by the Chief Judge in a timely manner. All decisions made by the Chief Judge are final.

9.5 Systems - Personnel Guidelines

Teams are permitted up to five (5) personnel in the Staging Area; these personnel are designated Pit Crew. Figure 4 provides a detailed workflow for how data may be shared between the systems, team Base Station, team personnel, and DARPA Command Post. Two categories of data are delineated: Status Data and Derived Data. Status Data includes real-time sensor streams from the deployed systems for the purposes of calibration, system status monitoring, teleoperation, and safety monitoring. Derived Data includes data that has been processed or fused to create derived information from the raw sensor streams. Derived Data specifically includes any casualty reports.

Pit Crew personnel are permitted to assist with operations tasks such as physically deploying the systems, performing repairs, modifying software or firmware, and changing batteries. General Pit Crew personnel are only permitted to access limited Status Data. They are not permitted to wirelessly communicate with the deployed systems and are not permitted to access Derived Data or Casualty Reports. Pit Crew may take on one of two additional specialized roles:

- **Safety Officers / spotters** are responsible for maintaining the safety of personnel and property and are permitted to communicate with the deployed systems solely for safety purposes.
- **Human Supervisors** are permitted to communicate with deployed systems, teleoperate deployed systems, activate safety emergency stops, and access Status Data.

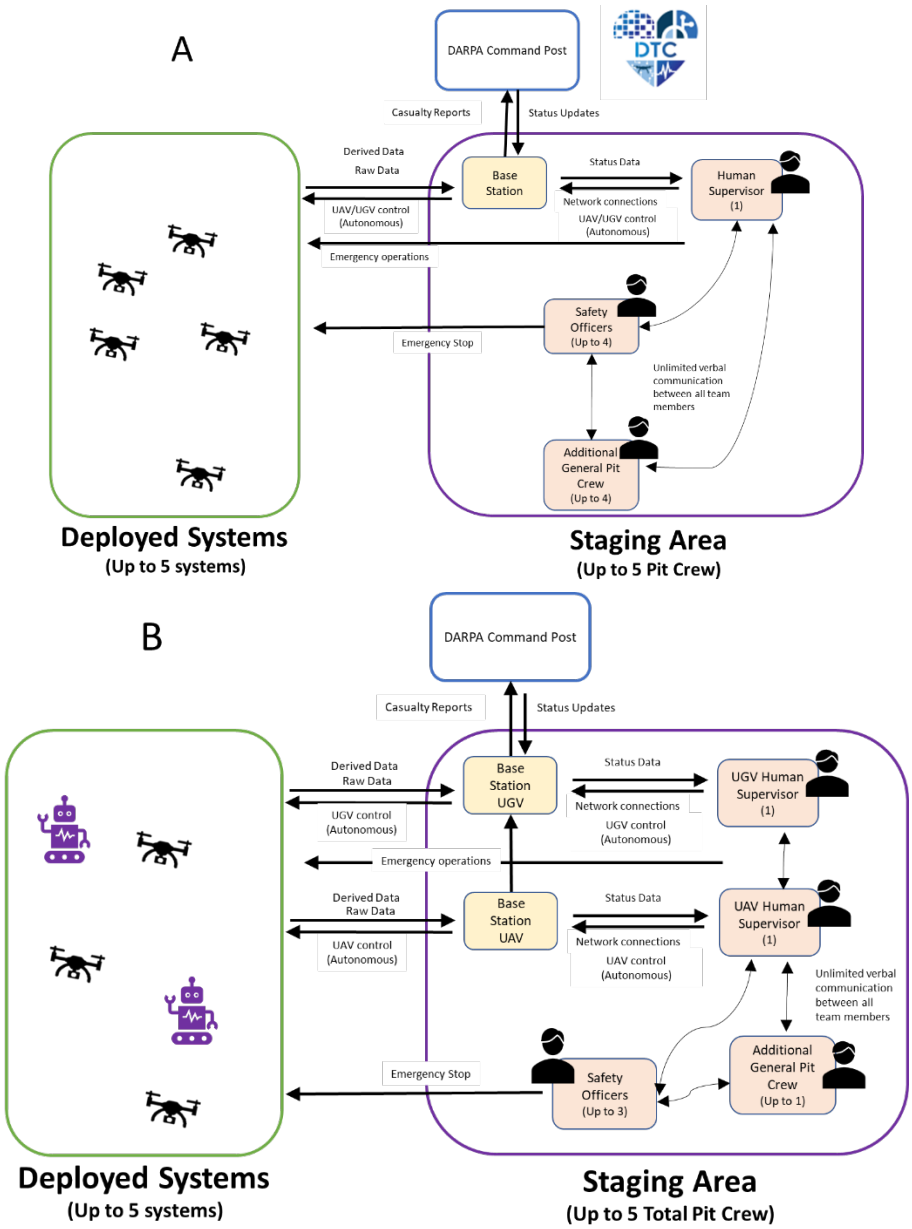


Figure 4 - Data Workflow for the Systems Competition. Teams using a single type of system either UAV or UGV have a single Human Supervisor and single Base Station (A). Teams using both types of systems have two Base Stations and one Human Supervisor for each Base Station (B).

9.5.1 Pit Crew Personnel

The role of the Pit Crew is to assist with operations tasks such as physically deploying the systems, performing repairs, modifying software or firmware, and changing batteries. Once a team's set up for their run has begun, the Pit Crew personnel may not be substituted with other personnel. When entering the staging area from the team garage, only the designated Pit Crew is permitted to arrive for

setup. Other members must remain in the team garage area.

The Pit Crew personnel, including Safety Officers and Human Supervisors, are permitted to verbally communicate without restrictions. The Base Station can also provide limited status data to the Pit Crew via a wired display to support operations tasks such as calibration and completing startup checklists. The Pit Crew is not permitted to directly interface with the Base Station in any way (e.g., toggling between windows via peripherals). The Pit Crew is only permitted to view limited system status data such as battery health, network status, and real-time telemetry.

Pit Crew personnel are permitted to view and access Status Data but are not permitted to view or access Derived Data. Pit Crew personnel are specifically prohibited from viewing or accessing Casualty Reports.

9.5.2 Safety Officers

The role of the Safety Officer is to preserve the safety of personnel and property. Safety Officers are permitted to activate Tier 1 wireless emergency stop transmitters and/or operate remote controls for safety purposes only. Safety Officers may only use wireless communications for emergency stop transmitters and limited system initialization (e.g., arming, initial takeoff).

The team is permitted to have up to four Safety Officers. If a team has more than one UxS they must have at least one safety officer to assist with spotting the UxS.

For aerial systems, the Safety Officer may aid in initial takeoff and hover as long as the system is within the Staging Area and does not intrude into the competition course. However, any further maneuvering of the aerial system must be initiated or controlled by a Human Supervisor. If the safety of personnel is at risk, the Safety Officer is permitted to take control of the aerial system for the sole purpose of safely landing the system. The Safety Officer is not permitted to take control of a system that has crossed into the competition course except to trigger a Tier 1 emergency stop for the sole purpose of preserving the safety of personnel.

The Safety Officer's primary role is to preserve the safety of personnel in the Staging Area rather than preserving the safety of the system. If the Safety Officer triggers a Tier 1 emergency stop for a system inside the competition course, the system that is triggered must stay inactive for the remainder of the competition run. A system may only have its Tier 1 emergency stop reset if it was triggered by a Human Supervisor.

Safety Officers are also permitted to perform all the roles of the Pit Crew personnel.

9.5.3 Human Supervisor

As the operational scenario suggests, DARPA is interested in approaches that are mostly autonomous without the need for substantive human interventions, and capable of remotely locating and providing assessments of causalities. The team is permitted to have one Human Supervisor per system type (UGV or UAV), Human Supervisors are required to have valid part 107 license if they are responsible for aerial vehicles.

The Human Supervisors are permitted to monitor and manage the communications with their deployed systems. The Human Supervisors are permitted to view, access, and/or analyze all data types. While systems controlled by the Base Station are in the course, they may not interact with the system except to teleoperate the system. Once a team's run has begun, the Human Supervisors may not be substituted with other personnel.

Human Supervisors are also permitted to perform all the roles of the Safety Officers, and Pit Crew personnel. Only the Human Supervisor may interact with the Base Station.

Role	Responsibilities and Access					
	View Limited Status Data	View Full Status Data	View Derived Data	Trigger Tier 1 EStop	Service UxS	Teleoperation Of UxS
General Pit Crew (Up to 5)	✓				✓	
Pit Crew: Specialized Roles (each general pit crew teammate permitted up to one specialized role)						
Human Supervisor (up to 2, one per system type)	✓	✓	✓	✓	✓	✓
Safety Officer (up to 4)	✓			✓	✓	

Table 5 - Roles and Responsibilities of Pit Crew.

9.5.4 Teleoperation

Teams must have the capability to take control and teleoperate their systems in the case of an emergency; competitors will not be permitted to teleoperate their deployed systems during regular operations on the challenge course. Teams may teleoperate their systems in the launch zone. Teams will have a limit to the number of times they may step in to correct their system while it is on the course for emergencies or directed by spotter team, once this limit is reached the system must RTL.The limit is TBD.

Due to the complicated nature of the course, tethers for power, communications, or physical retrieval are not permitted. No manual physical intervention or entry by any (human) team members on the course is permitted. Only authorized DARPA personnel are allowed to enter the course preceding and during the run.

9.5.5 Autonomous Operation

Teams are required to pilot their systems autonomously. However, teams must follow all applicable §107 regulations. DARPA has obtained a §107.35 waiver for participating teams to operate multiple systems (5) per pilot through autonomy. While the entire course will be visible from some portion of the staging area, there may be obstructed fields of view when seated in the staging tent. Pilots must use visual observers (Safety Officers) to help them maintain visual line of sight. Safety Officers must be in communication with the pilot at all times and have an agreed upon protocol for signaling UxS behavior. Safety Officers count towards the maximum of 5 team members in the staging area.

9.6 Systems - Preliminary Event Course

9.6.1 Course Layout

The competition courses are expected to simulate a variety of mass casualty incidents such as a large traffic accident or a collapsed building. The exact course layout will not be known to competitors in advance, and DARPA intends to alter the competition courses to randomize casualty types. Each of the two courses will contain a different scenario. An aerial map of the empty course will be provided to teams prior to their run. The flight zone boundary for each course will be marked along the edge. Where possible, the flight zone will be 25ft wider than the course. Team systems must remain inside of the marked flight zone.

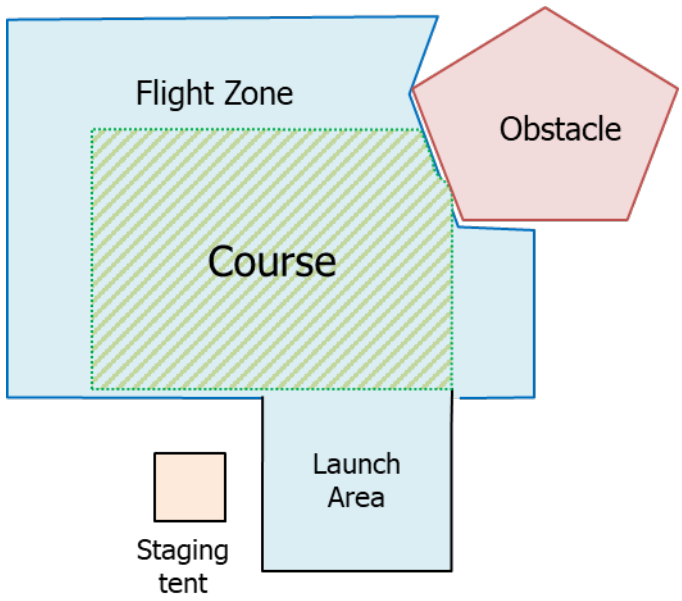


Figure 5: Flight zone around the course will be clearly marked and wider than course wherever possible.

9.6.2 Challenge Event 2 Course Challenge Elements

The scale and complexity of the competition courses in year 2 is expected to vary. The design of the second Challenge Event courses is intended to assess the ability of teams to address increasing complexity in the environment. The following subset of challenge elements are anticipated to be present in Year 2.

1. *Degraded Sensing*: The courses are expected to include elements that range from lighted areas to complete darkness, and wet to dusty conditions. Sensors will need to have the dynamic range to reliably operate in these environments. Dust, fog, mist, smoke, talking, flashing light, heat spots, and loud background sound effects are within scope of this challenge element. Extreme temperatures, and hazardous materials are not expected to be within scope.

2. *Obscuring obstacles:* Casualties may be fully visible to partially obscured. Stand-off sensor access to skin may be possible but cannot be assumed (e.g., clothing, makeup, dust).

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 inclines, vehicles, buildings and rubble. The environments may include natural or human-made materials; structured or unstructured clutter; and debris.

4. *Dynamic Obstacles*: Live responders, "walking wounded", or other physical changes to the environment will test the agility of the system autonomy to identify 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 life-saving intervention (LSI) being 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).

6. *Endurance Limits:* It is expected that individual scenarios will run between 15-30 minutes. Teams may be permitted to replace batteries in their staging area during their run, but teams should consider the implications of returning to the original launch location and redeploying their systems.

9.7 Systems - Guidelines

9.7.1 Prohibition on deployment of humans or animals

Teams may choose to deploy a wide variety of systems to complete the course objectives including but not limited to robotic platforms, sensors, and communication components. No humans or animals will be permitted as any part of the deployed systems that enter the competition course.

9.7.2 NDAA Compliance

UASs must be National Defense Authorization Act (NDAA) 2024 "American Security Drone Act of 2023," and NDAA 2023 Section 817(a) Compliant. All teams will need to submit documentation on the NDAA compliance of all UASs. Below is the definition of prohibited UASs reproduced with permission from https://www.diu.mil/blue-uas-policy.

The National Defense Authorization Act (NDAA) for Fiscal Year 2023 was passed on 23 December, 2022 and Section 817 remains in effect. Section 817 modified portions of FY23 NDAA Sec 848. The bill can be found in its entirety at Congress.gov.

Definitions

These definitions are extracted with permission from the Procedures for the Operation or Procurement of Unmanned Aircraft Systems to Implement Section 848 of the NDAA for Fiscal Year 2020, published 2 September, 2021. Terms that were modified by FY23 NDAA Sec 817 have been updated.

Covered UAS: Any UAS and any related equipment that:

1. *Are manufactured in a covered foreign country or by an entity domiciled in a covered foreign country;*
2. *Contain critical components, as defined in this document, manufactured in a covered foreign country or by an entity domiciled in a covered foreign country;*
3. *Use a ground control system or operating software developed in a covered foreign country or by an entity domiciled in a covered foreign country; or*
4. *Use network connectivity or data storage located in or administered by an entity domiciled in a covered foreign country*

Covered UAS Company: Any of the following:

1. *Da-Jiang Innovations (or any subsidiary or affiliate of Da-Jiang Innovations)*
2. *Any entity that produces or provides unmanned aircraft systems and is included on Consolidated Screening List maintained by the International Trade Administration of the Department of Commerce*
3. *Any entity that produces or provides unmanned aircraft systems and—*
    1. *is domiciled in a covered foreign country; or*
    2. *is subject to unmitigated foreign ownership, control or influence by a covered foreign country, as determined by the Secretary of Defense unmitigated foreign ownership, control or influence in accordance with the National Industrial Security Program (or any successor to such program).*

The term "covered foreign country" means the People's Republic of China, the Russian Federation, the Islamic Republic of Iran and the Democratic People's Republic of Korea. The term "place of manufacture" has the definition provided in FAR 52.225-18, as the "place where an end product is assembled out of components, or otherwise made or processed from raw materials into the finished product that is to be provided to the Government." If a product is disassembled and reassembled, the place of reassembly is not the place of manufacture.

The following are included in the definition of "critical components":

1. *Flight controller: The combination of embedded software on computing hardware, that issues commands to actuators based on the difference between the desired and actual position of a UAS.*
2. *Radio: A device that enables communication by packaging, transmitting, and/or receiving modulated signals into or from electromagnetic waves in the radio frequency (RF) spectrum.*
3. *Data transmission device: Electronic hardware that actively transfers electronic information from one digital system to another.*
4. *Camera: A device that converts focused light onto a photosensitive sensor for the purpose of recording or transmitting visual images in the form of photographs, film, or video signals.*
5. *Gimbal: A mechanism, typically consisting of electromechanical actuators and a mechanical frame, which rotates about one or more axes to stabilize and properly orient cameras or other sensors.*
6. *Ground control system: An electronic mechanism that enables a human operator to transmit data in order to influence the actions of an aerial vehicle remotely.*
7. *Operating software: A program that directs a computer's basic functions, such as scheduling tasks, executing applications, and controlling peripherals.*
8. *Network connectivity: The hardware and software required for communication between computers over the internet or other distributed and separately administered systems, for example, through the use of routers, switches, and gateways.*
9. *Data storage: The collective methods and technologies that capture and retain digital information on electromagnetic, optical, or silicon-based storage media.*

With the addition of the 2024 NDAA "American Security Drone Act of 2023," there are 2 major changes identified so far:

- all data transmission links including Bluetooth and Wi-Fi are now under the definition of "critical components":
- UAS Data encryption should meet Advanced Encryption Standard (**AES)-256** or equivalent

standard as established by the U.S. National Institute of Standards and Technology. It is the responsibility of the competitor to ensure all UAS data, signals that are collected, transmitted, or received by the UAS are sufficiently protected from compromise.

The definition of a UAS includes all systems that communicate with the UAV.

It is anticipated that future regulations may expand to include additional requirements such as:

1) Lidar on all unmanned systems cannot be from a covered country.
2) UGS will fall under the same set of rules as UAS.

Teams should plan to comply with all current regulations.

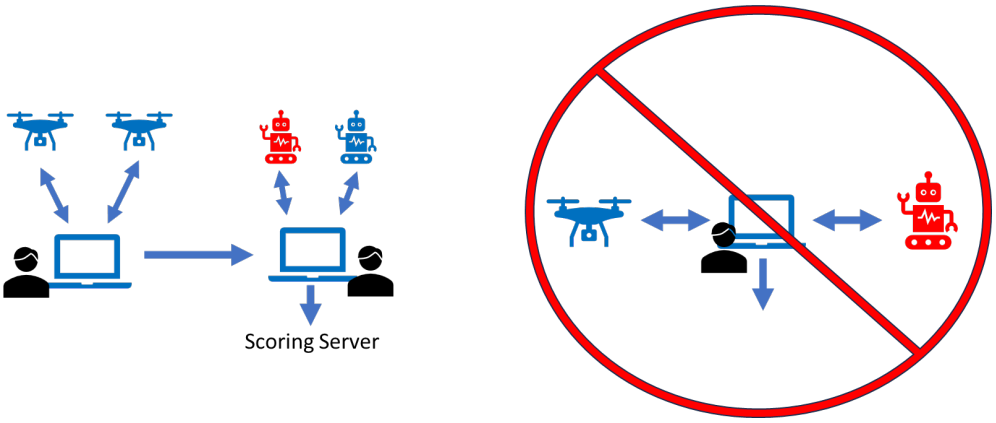


Figure 6: UGVs cannot communicate with the UAVs or the UAV Base Station. If your system has both UGVs and UAVs, you will need a second Base Station for the UGVs that is downstream of the UAV Base Station.

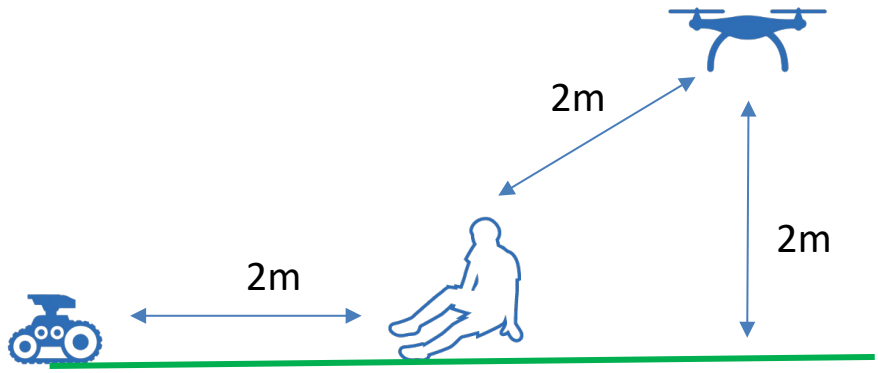
9.7.3 System Constraints

- UGS maximum weight = 200kg
- UAS/UGS maximum diameter = 1.5m
- UAS maximum weight = 9kg
- DARPA is interested in portable systems. Therefore, all system elements must pack down to be carried by a single vehicle (car, sports utility vehicle or pickup truck),
- Platforms must not produce any visible illumination other than what is legally required for UAS flight. See section 9.7.7
- While on course UGV platforms will have a maximum speed of 2m/s.
- While on course UAV platforms will have a maximum speed of 5m/s.
- Teams with multiple identical systems will need to mark the systems so they are identifiable from a distance during the day and at night. For example, using tape and lights of different colors for system A and system B.

9.7.4 Stand-off Distances

- 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
- UAS maximum altitude = 30 m



- Teams will adequately deconflict altitude when flying multiple UAS

Figure 7a: Standoff Distance. The standoff distance is measured from UxS to ground or nearest body part to nearest UxS part.

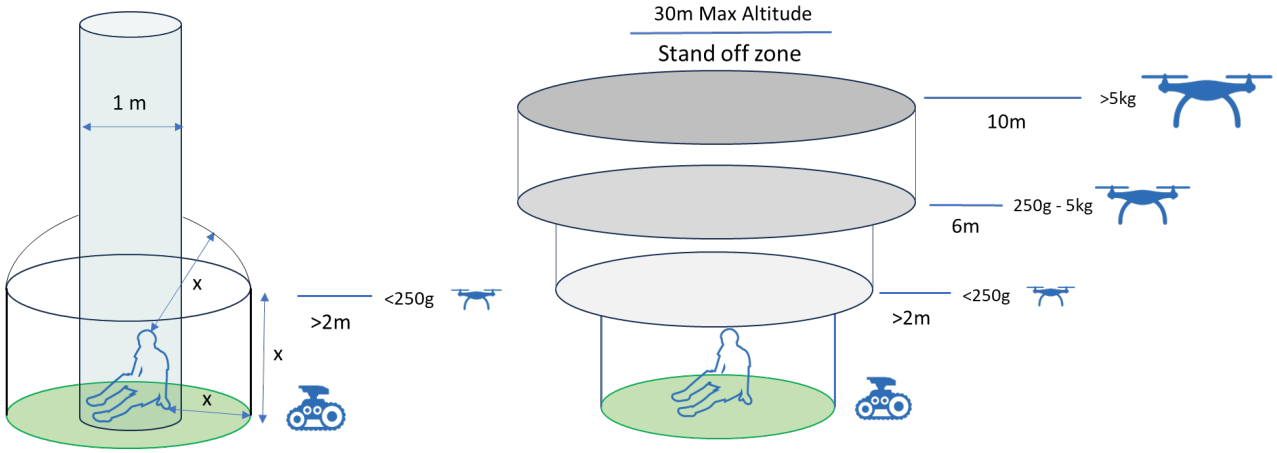


Figure 7b: Size-based standoff distances: Standoff distance is a hemisphere with a minimum height from the ground based on UAS size. The UAS may not hover in a 1m cone directly over the casualty.

9.7.5 Sensor Constraints

DARPA expects that multi-modal approaches will be required to improve signature identification and address multiple challenge elements that could degrade the usefulness of any one sensor (e.g., environmental conditions, casualty pose). Various sensor modalities and combinations will be allowed, including but not limited to LIDAR, acoustic, visual, RF, IR, UV, radar, gravity, compass/magnetic, GPS, and chemical.

- Sensors must be capable of detecting the desired signatures from the relevant stand-off distances (Figure 8).
- All sensor elements must be skin- and eye-safe.
- Sensors may not physically interact with casualties.
- All audio communication must be autonomous: no human communication is permitted between teams and casualties.

9.7.6 System Cost and Quantity Constraints

Teams are limited to a maximum of 5 deployed autonomous systems.

DARPA is interested in solutions that are cost-effective and attrition-tolerant. Due to the complexity of the environments, teams should expect and plan for some level of failures and/or attrition. While there are currently no limits on the aggregate cost of deployed systems, DARPA may introduce additional constraints as the competition progresses to appropriately incentivize such solutions.

9.7.7 System lighting

Teams may not use visible lighting for the purpose of illuminating the course. During night courses teams are required to have lighting on all systems sufficient for spotters to uniquely identify separate systems. The lighting on UAS must comply with FAA guidance of being visible for at least 3 statute miles and having a flash rate sufficient to avoid a collision. It is highly recommended that teams us colors to differentiate the L and R sides of the systems as well as differentiating the 5 separate platforms.

9.7.8 Base Station Constraints

The base station is the heart of the standoff system, integrating impute from up to 5 UxS and autonomously submitting reports to the DARPA command post. Teams must have separate Base Stations for UAS and UGVs. If teams have two Base Stations, the Base Station supporting the UAVs must be upstream of the UGV Base Station and must only send to the UGV Base Station, not receive.

9.7.8.1 Displays

Teams are required to have a user interface display that shows casualty locations and health metrics. Teams may choose to make this display part of their Base Stations or have an auxiliary display.
Teams must mirror their main base station displays to the DARPA command post.

9.7.8.2 Interfacing with the Base Station

Only the human supervisor may work with the base station. The human supervisor may not manually summit reports using the base station.

The human supervisor may only interact with the base station to control a system, monitor systems and correct comms issues with the systems or the scoring computer.

While a system is on course, the human supervisor may not touch the keyboard except to teleoperate a system. When all systems are in the launch zone, the human supervisor may use the keyboard to correct comms issues or other issues interfering with the operation of systems.

9.7.9 System Retrieval

All systems must begin the run in the Staging Area. It is encouraged but not required for the deployed systems to return to the Staging Area at the end of the run. Any systems that have not autonomously exited the course at the termination of a run will be retrieved by up to two (2) team members with guidance from the Course Official.

9.7.10 Emergency Stop

The emergency stop (E-Stop) requirements are designed to ensure the safety of personnel, equipment, and the competition course environment. All systems participating in the Systems Competition will utilize a complementary three-tiered emergency stop system.

Tier 1: Team Wireless E-Stop

Teams are required to implement a wireless emergency stop capability as a component of their system's communication architecture. The emergency stop must be able to be triggered from the team's base station and/or portable wireless transmitter. The Tier 1 E-stop transmitter must instruct mobile platforms within effective communication range to initiate a safe behavior. E-stop procedures implemented on the mobile platforms must, upon receiving a Tier 1 E-Stop trigger, initiate a safe behavior and complete the safe operation thereby rendering the platform completely motionless within 30 seconds.

Safety protocols dictate unique responses for Unmanned Ground Vehicles (UGSs) and Unmanned Aerial Vehicles (UASs) upon activation of the E-stop signal. UGSs are mandated to immediately cease all movement and maintain a stationary position until manual control is resumed by the operator. Conversely, UASs are instructed to either execute a return-to-launch (RTL) procedure or sustain a hovering state until manual intervention from the safety operator is initiated. UASs are restricted from landing in their current location unless specifically directed by the operator.

The emergency stop must include clear visual feedback of the mobile platform's safe, halted state (e.g., red LED). The emergency stop capability may be targeted to a specific platform but should also provide the functionality to rapidly render all platforms safe. A team must be able to render all platforms within communication range completely motionless within 60 seconds.

Tier 2: Recovery Wireless E-Stop

The tier 2 E-Stop will be optional for UASs but required for UGSs. The module specifications and configuration guidelines for the Tier 2 E-Stop are detailed in the *Transponder and Emergency Stop Integration Guide*. The tier 2 E-Stop is operated by DARPA.

Tier 3: On-Platform E-Stop

Teams must integrate at least one emergency stop button on each platform that weighs more than 10 kg. The button must be a red mushroom-capped button at least 25 mm in diameter, with clear markings indicating that it is an emergency stop button. The buttons must latch when triggered and must require a

twisting motion to release the latch. The buttons must be completely unobstructed and must be easily accessible by recovery personnel. The emergency stop procedures implemented on the mobile platforms must, upon receiving a Tier 3 E-Stop trigger, render all platforms completely motionless within 5 seconds.

E-Stop Qualification:

In accordance with the DTC Event Qualification Guide document, all teams are required to demonstrate emergency stop compliance to be eligible for participation in the Competition Events. Year 2 Workshop qualification requires teams to demonstrate fully functional emergency stopping in compliance with Tier 1, Tier 2 and Tier 3 outlined in this document. Demonstration requirements are outlined in the "Emergency Stop" section of the *DTC Event Qualification Guide*.

Emergency stop functionality and compliance will be verified by DARPA at each official DTC Challenge event. DARPA reserves the right to deny a team's participation in one or more runs if any of their mobile platforms are non-compliant with the emergency stop rule.

9.7.11 Dropped Components

Teams are not permitted to use dropped components and leave-behind peripherals.

9.7.12 Course Alteration

The course may not be willfully altered by any of the deployed systems, including but not limited to digging, burrowing, or intentional degradation or destruction of the environment's walls, floors, ceiling, immobile barriers or obstacles, or other course infrastructure or instrument.

9.7.13 Power Sources

All fuel and power sources will need to be approved by DARPA for use in the competition. Teams may be required to submit safety protocols and DARPA may require additional site-specific approvals which could require significant lead time. Most electric battery sources are expected to be approved. Combustible fuels are not permitted for DTC events. Teams are encouraged to address any potential concerns early.

9.7.14 Competition Networking

Casualty reports will be submitted from the base station over a DARPA-managed wired network. A wireless team's network will be available for teleoperation and encrypted data transmission between platforms and the base station. Further details may be found in the Operations Guide.

9.7.15 Internet and Cloud Resources

DARPA does not plan to provide or allow the use of internet (www) or cloud connectivity during the runs in the Systems Competition. Access to such resources is often limited in the field and in real-world scenarios following natural disasters. Team personnel in the Staging Area are not permitted to access the internet, communicate with team garage or make calls on any devices (e.g., cell phone, tablet, radio) during the competition run.

9.7.16 Data Protection

Teams are required to use encryption for data transmission between their base station and their UxSs. Data transfer from the base station computers to a computer approved for processing, analysis and/or data storage will be performed using approved transfer methods such as writeable CDs, DVDs, or memory cards, after being scanned for malware. At the end of an event, teams will remove and clear any removable memory in the UxS. Teams must review and sign the Data Management agreement provided as part of the IAIR.

9.7.17 Geofencing

Teams will be required to implement a geofence around the courses based on GPS coordinates and ceiling that will be provided by DARPA for each course and practice area before teams are permitted to fly on course. For teams, using other methods of Geofencing, the DARPA team will work with them to determine a viable solution.

9.8 Systems - 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 Systems 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.

Upon locating and assessing casualty status, the deployed system must submit a Casualty Report containing injury diagnosis and accompanying clinical information to the evaluation system for scoring. Reports will be submitted to the DARPA Command Post via the team's base station over an Ethernet link. The reported casualty condition is compared against concurrent ground truth data for scoring. Upon submitting a Casualty Report, teams will receive an automated system response including confirmation of report receipt and run status information. The detailed report format, protocol, and example implementation are specified in the Interface Control Document (ICD), to be released at a later date.

9.8.1 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 DARPA Command Post 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 at a later date.

9.8.2 Casualty Localization, Identification, and Association with Casualty Reports

Team systems will be required to geo-locate casualties with sufficient accuracy in order to receive points for correct health assessment in the Casualty Report. The Casualty Report includes fields for location (latitude, longitude) and casualty ID. Unlike the phase 1 challenge, identity for each casualty will no longer be provided on the course using AprilTags. The reported casualty ID is an identifier assigned by the team system, unique within the run. A Casualty Report with the same casualty ID as a previously received report will be ignored.

The Casualty Report must be associated with a ground truth casualty in order to receive points. The reported casualty location must be within a predetermined distance from the ground truth casualty in order to be associated. For the workshop the accuracy must be within a 2m radius of the casualty. This distance may be changed for CE2. 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 in order 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.

9.8.3 Report Scoring

A single Casualty Report earns the team up to 25 points, with up to 5 additional bonus points for early reporting (golden window) 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. 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. The accuracy needed to receive points for Temperature will be released in a future version of this document. 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 DARPA Command Post 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 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 DARPA Command Post.

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
Temperature	Degrees Farenheit	+1 if within *k* degrees °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
Alertness[3]	**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 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
Temperature	Response within ±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 oozing, squirting, or pooling blood **OR** >50% body area with blood present on clothes or exposed skin.
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 (manikin only) **OR** arrhythmic chest movement (manikin only) **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	**OPEN if:** Both eyelids open and blinking spontaneously (*actors only*) **OR** Both eyelids open without movement (*manikins only*) **OR** Responsive to prompts to open and uncover eyes (*actors only*). **CLOSED if:** Both eyelids closed **AND** Unresponsive to prompts to open and uncover eyes. **NOT TESTABLE if:** Cannot assess due to one or both injured or occluded eyelids.
Alertness: Verbal	**NORMAL if:** Responsive to prompts with coherent and relevant speech. Oriented to time, person, and place. **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. **ABSENT if:** No vocalization. **NOT TESTABLE if:** Cannot assess due to injured mouth, jaw, or throat.
Alertness: Motor	**NORMAL if:** Walking, standing, or sitting unsupported with coordinated movement of limbs **OR** Responsive to prompts to move, within limits of sustained injury *(Actors only).* **ABNORMAL if:** Lying or sitting supported with minimal movement or twitching **AND** Unresponsive to prompts to move body. **ABSENT if:** Lying or sitting supported with no limb movement. **NOT TESTABLE if:** Cannot assess due to external immobilization of limbs or total occlusion of limbs.

Table 10 Casualty Report field definitions for alertness fields.

9.8.4 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 according to 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. For the workshop *d* = 2m.

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
Alertness[1]	**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.

9.8.5 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.

9.8.6 Report Time

Scoring will be based off the time a report is received by the DARPA Command Post. 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. In response to each successfully submitted report, teams receive run status with both the clock time and the elapsed time into a run. Details regarding report format and responses are provided in the ICD.

9.8.7 Report Limits

To discourage guessing and preserve system bandwidth, the DARPA Command Post will limit the total number of reports that can be submitted during a run. Any report submitted with a unique casualty ID will count toward the report limit. 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.

9.8.8 Final Ranking

The final team ranking will be determined by the sum of the two scored runs. In the event that multiple teams have an identical score, the team with the earliest final positive-scoring report in either scored run will be ranked higher.

9.8.9 Minimum Benchmarks to Win Prizes

In phase 2 there is a minimum benchmark for winning prizes. Self-funded teams must be in the top 5 over all ranking; create a user interface and must achieve all three of the below metrics in at least one run.

Systems/Virtual	Definition	Performance
User Interface	Teams must demonstrate a working user interface display that incorporates the ability to visualize casualty location. End users must have the ability to view a representation of the casualty features.	UI demo
Casualty Localization	Accurately locate casualties with a minimum of 3 non-empty health assessment fields.	Localize TBD%
Triage Accuracy	Teams must achieve accuracy equivalent to state-of-the-art human performance for the most time-critical injuries.	Sensitivity TBD% Specificity TBD%

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).

Base Station – One or more computers or controllers that serve as the interface between the systems, the DARPA Command Post, and the Human Supervisor.

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.

Course Official – DARPA-designated individual that is based in each Staging Area to apply and enforce the rules and make safety-related decisions, with decision-making authority only superseded by the Judge and Chief Judge.

DARPA Command Post – Computer interface which receives casualty reports and map updates from teams and returns run status. Also refers to the main headquarters where the DARPA staff execute the Challenge.

Human Supervisor – Team-designated individual permitted to interface with the Base Station, provide high-level interactions with the deployed systems, use wireless communications, and access both course data and status data.

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.

Pit Crew – Team personnel permitted in the Staging Area to assist with operations tasks such as physically deploying the systems, performing repairs, modifying software or firmware, and changing batteries.

Safety Officer – Team-designated members of the Pit Crew responsible for preserving the safety of personnel and property, activating emergency stop transmitters, and/or operate remote controls for safety purposes.

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.

Starting Gate Fiducial – An easily identifiable object attached to or near the Starting Gate to assist teams to align with the official coordinate frame in which casualties are reported. These may include 2D barcodes, reflective targets, or survey prisms.

Team Garage Coordinator- DARPA-designated individual supporting team prep.

Team Lead – Team-designated individual responsible for making official team decisions (e.g., termination of a run) and communicating with the DARPA Competition Staff.