DARPA TRIAGE CHALLENGE

Systems Competition Rules:

Event 1 Version 1h

June 28, 2024

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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 This document is subject to change and may be superseded by later versions.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.

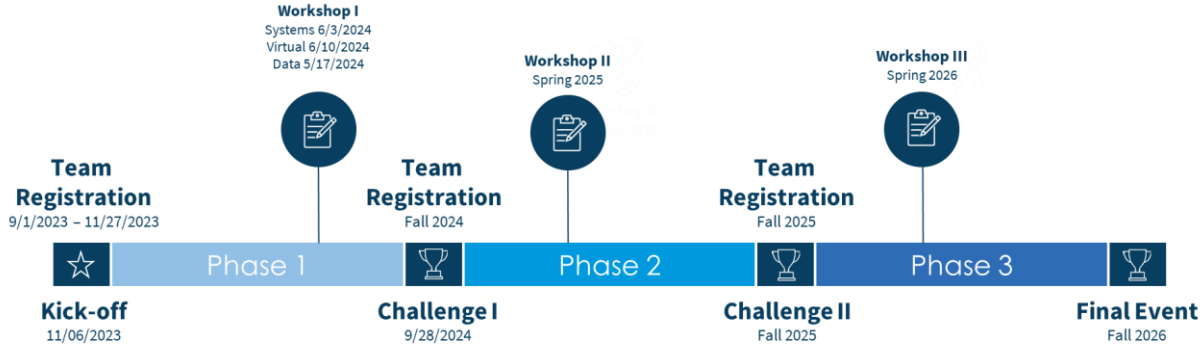


Figure 1: Timeline

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	Spring 2025
Challenge 2 - Month 12 *Evaluations / runs*	In person	7 days	Fall 2025
Challenge 2 - Month 12 *Awards /lessons-learned session*	Hybrid	1 day	Fall 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. 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.

Virtual Competition Prizes and Funding: The Phase 1 and Phase 2 prizes for self-funded Virtual Competition teams will be awarded to the best performing self-funded Virtual Teams. 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.

Data Competition Prizes and Funding: The Phase 1 and Phase 2 prizes for self-funded teams will be awarded to the best performing self-funded Data Teams, provided that the teams finish in the top

5 overall (including DARPA-funded) teams. High-performing Data Competition 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 - 11/15/2024
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	3/10/2025-3/15/2025
Challenge 2	Summer 2025	Fall 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

There are two themes for Challenge 1: a plane crash and a post-battle environment. The three course scenarios in year 1 will focus on these themes. All courses are expected to be located outdoors during daylight where the ground will be pavement, grass 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 8,000sqft to 15,000sqft.

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.

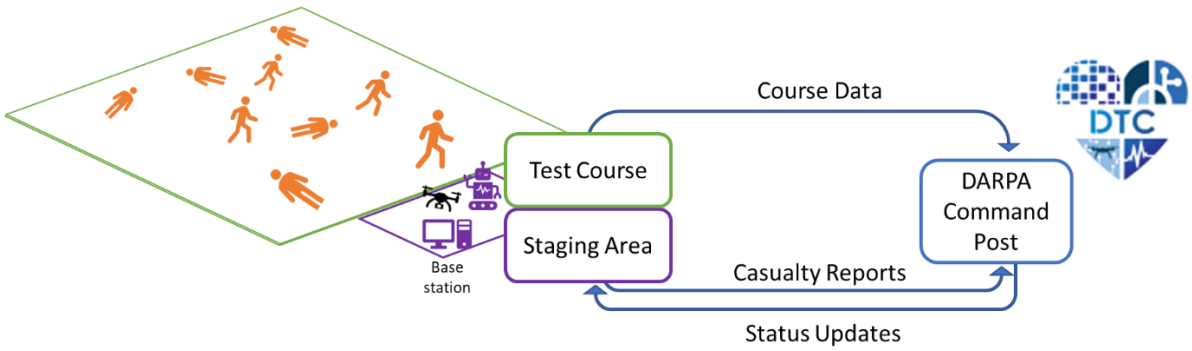


Figure 2 - Course workflow and data transmission

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.

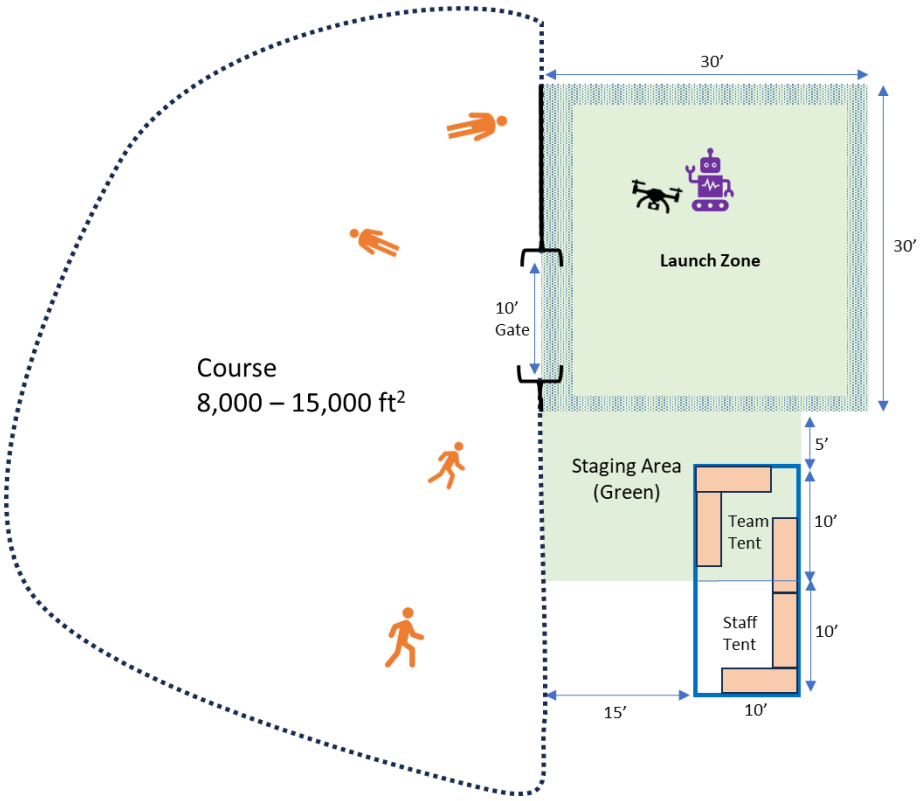
9.4 Systems - Event Operations

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 1. It is anticipated that up to 16 teams may successfully qualify for the event. The event is expected to include three competition days. Qualified teams will be eligible to participate in the event, which will consist of three scored runs 15-30 minutes in duration. The total score for the event will be sum of a team's best two 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 six (6) personnel in the Staging Area; these personnel are designated as the Pit Crew. See section 9.5 for Pit Crew details.



- *Figure 2 - Team Staging Area. Note that the team 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 10 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 six (6) 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. 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 three 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.
- **Operators / pilots** are permitted to communicate with deployed UxS systems, teleoperate deployed UxS systems, activate safety emergency stops, and access Status Data.
- **Human Supervisors** are permitted to communicate with deployed systems, teleoperate deployed systems, activate safety emergency stops, and access Status Data.

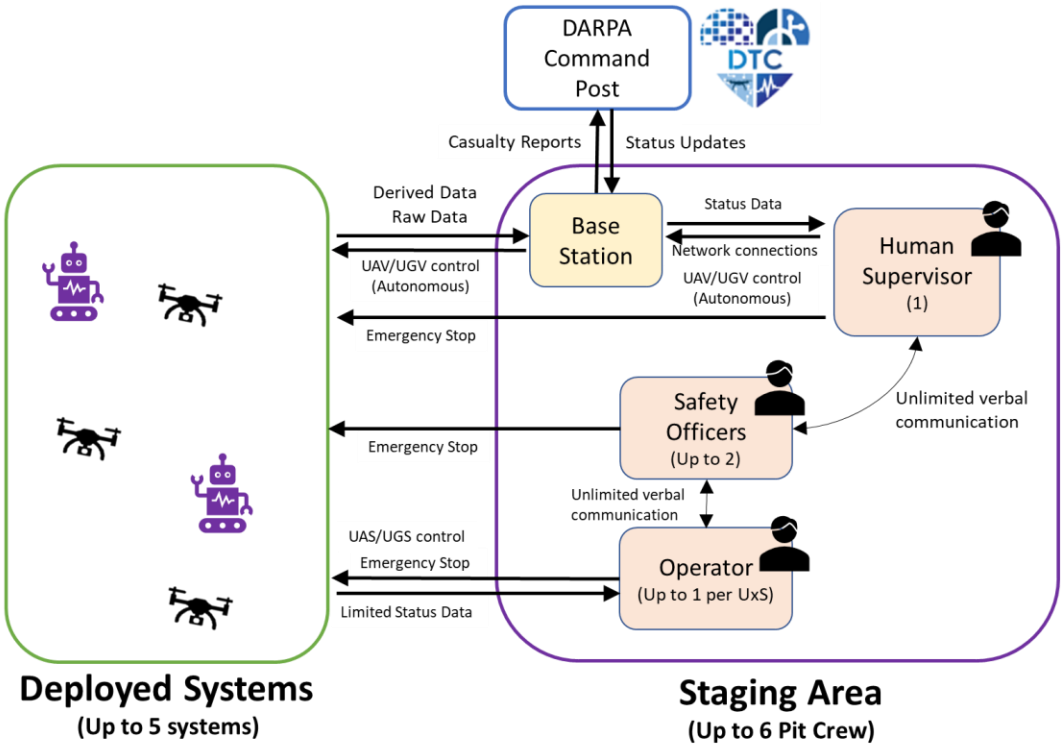


Figure 3 - Data Workflow for the Systems Competition

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 tents, only the designated Pit Crew is permitted to arrive for setup. Other members must remain in the team tent area.

The Pit Crew personnel, including Operators, 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 two Safety Officers in addition to any Operators.

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 or Operator. 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 Operators

The Operator is responsible for managing one UxS during the team's run which includes take-off, landing, safety procedures, and full movement throughout the course. When operating under manual control, each UxS shall have a dedicated operator utilizing a hand controller. Each team is required to have one Operator per UxS, allowing for a maximum of five operators. For autonomous operation, refer to section 9.5.6. Any individual acting as a UAS Operator must hold a valid Part 107 license.

At this time, DARPA plans to allow manual operation only for Challenge Event 1.

9.5.4 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 team, Human Supervisors are required to have valid part 107 license if the team has 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 Status Data but are not permitted to view or access Derived Data or Casualty Reports. 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, Operators, and Pit Crew personnel. Only the Human Supervisor may interact with the base Station.

Responsibilities and Access

Role	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 6)	✓				✓	
Pit Crew: Specialized Roles (each general pit crew teammate permitted up to one specialized role)						
Human Supervisor (1)	✓	✓		✓	✓	✓
Operator (1 per UxS up to 5)	✓			✓	✓	✓
Safety Officer (up to 2)	✓			✓	✓	

Table 5 - Roles and Responsibilities of Pit Crew.

9.5.5 Teleoperation

In Phase 1, competitors will be permitted to teleoperate their deployed systems with up to one Operator per UxS system and one Human Supervisor per team. DARPA expects to place additional limits on teleoperation in later phases. By Phase 3, it is expected that only one Human Supervisor will be permitted to teleoperate all of the deployed systems and will be the only team member permitted to communicate with the deployed systems.

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.

9.5.6 Autonomous Operation

Teams are permitted to pilot their systems autonomously. However, teams must follow all applicable §107 regulations. To run multiple systems autonomously teams must apply for and receive a §107.35 – Operation of Multiple Small UAS waiver. 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 who are tethered to the base station must use visual observers (Safety Officers) to help them maintain the 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 6 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 three 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 of 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.

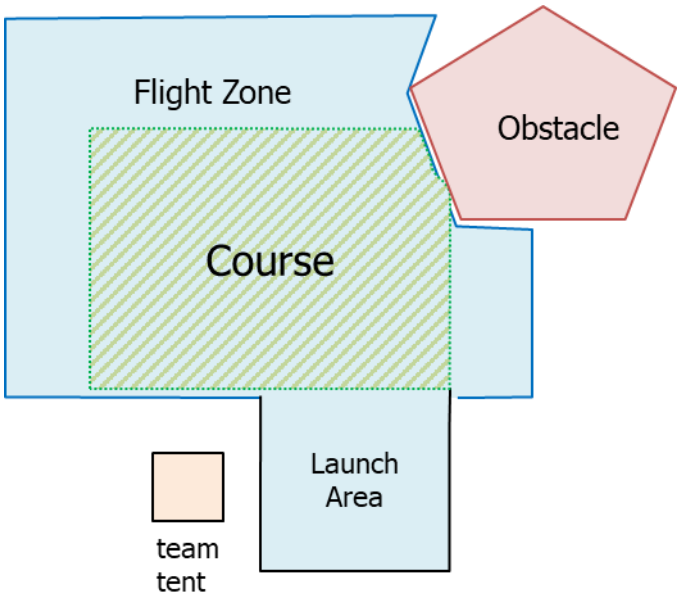


Figure 5: Flight zone of course will be clearly marked and wider than course where possible.

*9.6.1.1 **Human Safety Shelters***

For their safety, all actors will be protected by shelters in the Challenge Event 1.

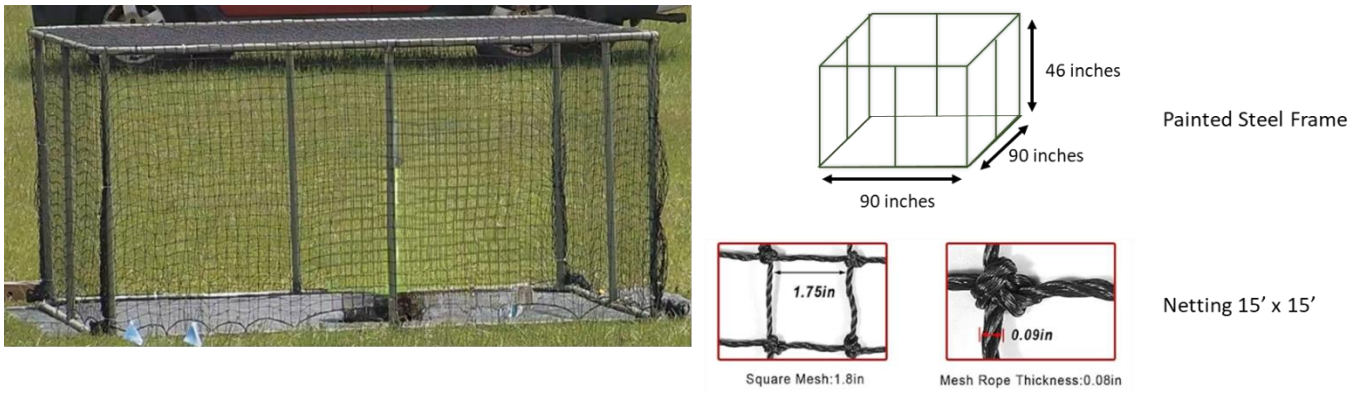


Figure 6: Human Safety Shelter. The shelters consist of a painted galvanized steel frame covered in a 15' x 15' polyethylene netting.

9.6.1.2 AprilTags

Next to each casualty will be an AprilTag cube. The weighted down cube will be labeled on each side with the associated AprilTag.

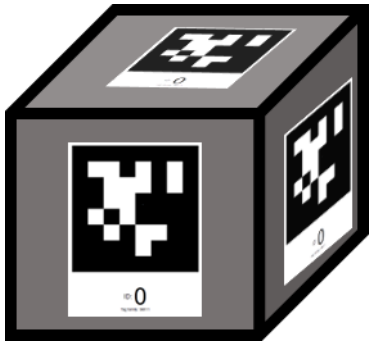


Figure 7: AprilTag Cube

9.6.2 Challenge Event 1 Course Challenge Elements

The scale and complexity of the three competition courses in year 1 is expected to vary. 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 plane crash or post-battle environment. The following subset of challenge elements are anticipated to be present in Year 1.

1. *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).

2. *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.

3. *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.*

Below are excerpts from the (NDAA) 2024 "American Security Drone Act of 2023,"

SEC. 1823. PROHIBITION ON PROCUREMENT OF COVERED UNMANNED AIRCRAFT SYSTEMS FROM COVERED FOREIGN ENTITIES.
(a) IN GENERAL.—Except as provided under subsections (b) through (f), the head of an executive agency may not procure any covered unmanned aircraft system that is manufactured or assembled by a covered foreign entity, which includes associated elements related to the collection and transmission of sensitive information (consisting of communication links and the components that control the unmanned aircraft) that enable the operator to operate the aircraft in the National Airspace System. The Federal Acquisition Security Council, in coordination with the Secretary of Transportation, shall develop and update a list of associated elements.

SEC.1829. GOVERNMENT-WIDE POLICY FOR PROCUREMENT OF UNMANNED AIRCRAFT SYSTEMS
(a) IN GENERAL.—Not later than 180 days after the date of the enactment of this Act, the Director of the Office of Management and Budget, in coordination with the Department of Homeland Security, Department of Transportation, the Department of Justice, and other Departments as determined by the Director of the Office of Management and Budget, and in consultation with the National Institute of Standards and Technology, shall establish a government-wide policy for the procurement of an unmanned aircraft system—

(b) INFORMATION SECURITY.—The policy developed under subsection
(a) shall include the following specifications, which to the extent practicable, shall be based on industry standards and technical guidance from the National Institute of Standards and Technology, to address the risks associated with processing, storing, and transmitting Federal information in an unmanned aircraft system:
(1) Protections to ensure controlled access to an unmanned aircraft system.
(2) Protecting software, firmware, and hardware by ensuring changes to an unmanned aircraft system are properly managed, including by ensuring an unmanned aircraft system can be updated using a secure, controlled, and configurable mechanism.
(3) Cryptographically securing sensitive collected, stored, and transmitted data, including proper handling of privacy data and other controlled unclassified information.
(4) Appropriate safeguards necessary to protect sensitive information, including during and after use of an unmanned aircraft system.
(5) Appropriate data security to ensure that data is not transmitted to or stored in non-approved locations.
(6) The ability to opt out of the uploading, downloading, or transmitting of data that is not required by law or regulation and an ability to choose with whom and where information is shared when it is required.

With the addition of the NDAA 2024 act there are 2 major changes identified so far:

- all data transmission links including Bluetooth 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.

It is possible that additional changes will be identified in the future including the potential for UGSs to be included in phase 2.

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.
- While on course platforms will have a maximum speed of 2m/s.
- Teams with multiple identical systems will need to mark the systems so they are identifiable from a distance. For example, using tape of different colors for system A and system B.

9.7.4 Stand-off Distances

- UGSs minimum stand-off distance = 1 meter
- UASs will have variable minimum stand-off distances based on size
    - Less than 250 g: 1 m
    - Between 250 g and 5 kg: 3 m
    - Greater than 5 kg = 5 m
- UAS maximum altitude = 30 m
- Teams will adequately deconflict altitude when flying multiple UAS

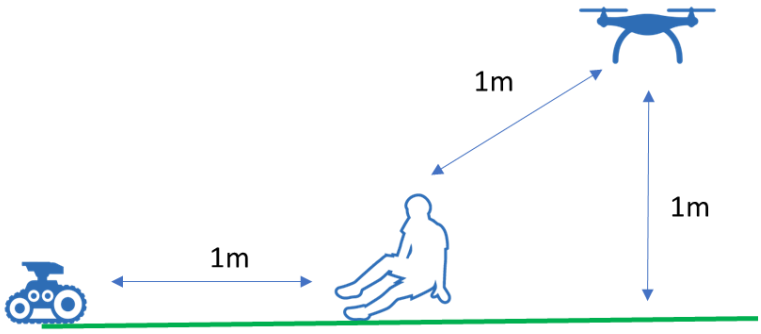


Figure 8a: Standoff Distance. The standoff distance is measured from UxS to ground or nearest body part to nearest UxS part.

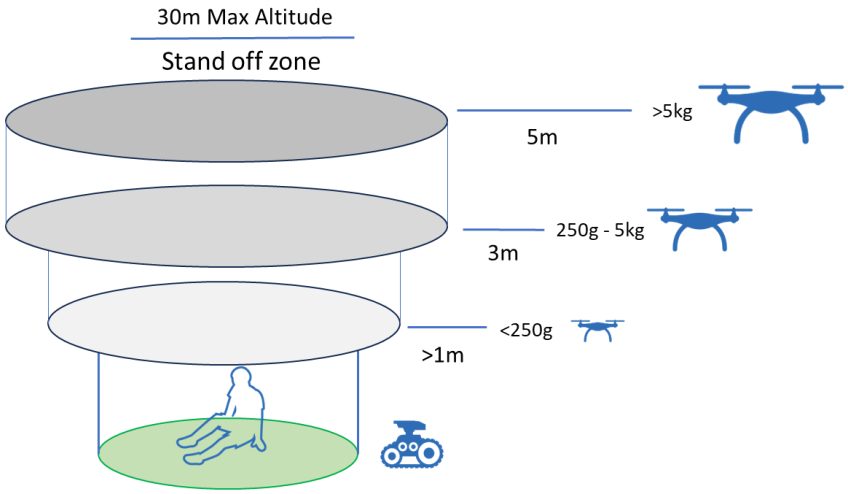


Figure 8b: Size-based standoff distances.

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.

9.7.1 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.

9.7.1.1 Displays

Displays on the base station may not show derived data. Teams must mirror their base station display to the DARPA command post.

For teams that wish to demonstrate their user interface including derived data, there will be an option to send a display from a second device. Once the run starts, the screen from the second device must be covered or otherwise unviewable by the team.

9.7.1.2 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. The human supervisor may only control a single system unless the team is using an autonomous solution and has a part 107.35 waiver. If the human supervisor is using the base station to manually control a system they may not simultaneously use it to monitor other systems.

9.7.2 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.

9.7.3 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 workshop 1. In Challenge 1 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*.

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 1 Workshop qualification requires teams to demonstrate fully functional emergency stopping in compliance with Tier 1 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.

9.7.4 Dropped Components

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

9.7.5 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.

9.7.6 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.

9.7.7 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.

9.7.8 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 tent or make calls on any devices (e.g., cell phone, tablet, radio) during the competition run.

9.7.9 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.

9.7.10 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 Primary Triage challenge (both Systems and Virtual), 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 be varied from run to run.

Upon identifying a casualty status, the deployed system must report its injury diagnosis and relevant 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 conditions are compared against concurrent ground truth data for scoring. After submitting a casualty report, teams will receive a response including confirmation of receipt and status information. The detailed report format, protocol, and example implementation are specified in the ICD available on the DTC website.

9.8.1 Casualty Localization and Identification

For the phase 1 challenge, each casualty in the scene will have a visual identifier (AprilTag) nearby indicating the identity of the casualty. Casualties and their visual identifiers will be positioned such that there is an unambiguous association between the two. The unique casualty identifier will need to be included in the casualty report for scoring, as specified in the ICD. In future years, identification and scoring will require the systems to localize casualties relative to a predetermined origin position. Details will be released in future versions of this document.

9.8.2 Casualty Reports

Reports capture information about clinical condition of casualties relevant for triage decision making including vital signs, indicators of urgent distress, and injury and alertness assessments. Each field in the casualty report is submitted individually to the DARPA Command Post for scoring against concurrent ground truth according to the casualty identifier included in the report and the time of submission, as detailed in the next section.

In future years, reports will include casualty location and may include additional clinical assessment features. The list of clinical features in the casualty report relevant for scoring is shown in Table 6, with definitions provided in Table 7. Complete details on report contents and format can be found in the ICD.

9.8.3 Report Scoring

A valid casualty report earns the team up to 10 points, with up to 5 additional bonus points for early reporting of vitals and time-critical information. Points are determined by comparing submitted report contents to ground truth data from the identified casualty. Additionally, for vitals estimates (Heart Rate and Respiratory Rate), a relative timestamp provided with the report is used to compare submitted vitals against ground truth vitals measured at the same time. Categorical fields in the report are awarded points based on whether they match ground truth; numerical fields in the report (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 incentivize rapid assessment of time-critical information indicating immediate need of medical care, bonus points may be awarded for early casualty reports containing the following fields: Severe Hemorrhage, Respiratory Distress, and vital signs (Heart Rate and Respiratory Rate). 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 half the duration of the run. Teams may receive 2 bonus points each for correct assessment of Severe Hemorrhage and Respiratory Distress, and 1 bonus point for correct assessment of both Heart Rate and Respiratory Rate within the golden window. 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 terms are shown in Table 7 and examples can be found in the provided training data. Details about casualty report format and protocol can be found in the ICD.

Field	Values	Scoring Criteria
Severe Hemorrhage[1]	[Present, Absent]	2 if match ground truth (GT) 0 otherwise
Respiratory Distress[1]	[Present, Absent]	2 if match GT 0 otherwise
Heart Rate[2]	Integer	1 if within *n* of GT 0 otherwise
Respiratory Rate[2]	Integer	1 if within *m* of GT 0 otherwise
Trauma	**Head:** [Wound, Normal] **Torso:** [Wound, Normal] **Upper Ext.:** [Wound, Amputation, Normal] **Lower Ext.:** [Wound, Amputation, Normal]	2 if all match GT 1 if at least two match GT 0 otherwise
Alertness	**Ocular:** [Open, Closed, Not Testable (NT)] **Verbal:** [Normal, Abnormal, Absent, NT] **Motor:** [Normal, Abnormal, Absent, NT]	2 if all match GT 1 if at least two match GT 0 otherwise

Table 6 Preliminary casualty report clinical assessment with scoring criteria

[1] Response receives +2 bonus points if correctly reported within "golden window".

[2] Vitals responses receive +1 bonus point if both are correctly reported within "golden window".

Term	Definition and Indicators in Simulation
Heart Rate	*(Actors only)* Visual/thermal signals
Respiratory Rate	Chest-wall movement; *(Actors only)* Visual/thermal signals
Severe Hemorrhage	Indications of severe hemorrhage beyond presence of injury. Any of the following: active bleeding external to the body (e.g., oozing, squirting, pooling), >50% body with blood present on clothes or exposed skin
Respiratory Distress	Indications of respiratory distress beyond Respiratory Rate. Any of the following: tripod position or abnormal head/neck position indicating distress, unequal chest-wall movement, arrhythmic chest movement, gasping sounds with open mouth NOTE: indicated as *Absent* if respiratory rate is 0
Head	Body region including neck and head
Torso	Body region bounded by hips, shoulders, and below neck
Upper Ext.	Body region including arms below shoulders
Lower Ext.	Body region including legs below hips
Trauma – Wound	Any of the following: non-amputation wound (burn, hemorrhage, abrasion, laceration) using makeup/moulage, blood-soaked clothing, hands pressing on wound site
Trauma – Amputation	Traumatic removal of body part with severe hemorrhage at/around wound site
Trauma – Normal	Absence of visual indicators of any wound
Ocular – Open	(*Manikins only*) Eyelids continuously open (*Actors only*) Eyelids blinking and moving
Ocular – Closed	Eyelids closed and not moving
Ocular – Not testable	Cannot assess due to injured or occluded eyes
Verbal – Normal	Responsive to speech prompts with coherent speech
Verbal – Abnormal	Any of the following: Non-speech or incoherent vocalization, non-responsive to speech prompts
Verbal – Absent	No vocalization
Verbal – Not Testable	Cannot assess due to injured mouth, jaw, and/or throat
Motor – Normal	(*Actors only*) Purposeful movement of limbs, obeys commands, walking
Motor – Abnormal	Minimal movement or twitching of limbs
Motor – Absent	No movement
Motor – Not Testable	Cannot assess due to sedation or external immobilization

Table 7 – Definitions for fields in the casualty report.

Vital sign	Collar
Heart rate	Accuracy within ±5 BPM, as calculated from preceding 10 second window
Respiration rate	Accuracy within ±3 BrPM, as calculated from preceding 60 second window

Table 8 Accuracy collars for heart rate and respiration rate.

9.8.4 Time

Scoring will be based off the time a report is received by the DARPA Command Post. Bonuses will be awarded according to whether the report time is within the "golden window" at the beginning of a run. For vitals estimates (Respiratory Rate and Heart Rate), a relative timestamp provided in the report by the deployed system will indicate the age of the estimate(s) for comparing against appropriate ground truth relative to the report time. After each 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.

9.8.5 Report Limits

To discourage guessing and preserve system bandwidth, the DARPA Command Post will limit the total number of scored reports. Any further reports beyond this limit are rejected and do not impact the score. In Phase 1 it is expected that each run will have 10-12 casualties and the total number of allowed triage reports for each run will be the number of casualties +5. Limits will apply separately to each field in the report, and teams will be able to get status during the run with counts of remaining reports for each field (see ICD).

Multiple triage reports will be permitted for a single identified casualty; however, each report will count against the total number of allowed reports. In the event that multiple reports are submitted for the same casualty and the same report field within the same run, only the last report received will contribute to the team's score, including award of any bonus points.

9.8.6 Final Ranking

For the Primary Triage Systems Competition, the final ranking will be determined based on the average of the top two scores of the team's three scored runs. In the event that multiple teams have an identical score, the team with the earlier non-zero scoring casualty report will be ranked higher.

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.