First Responder

UAS Wireless Data Gatherer Challenge

Official Rules for the

First Responder UAS Wireless Data Gatherer (a.k.a. UAS 6.0)

Hosted by

NIST | PUBLIC SAFETY COMMUNICATIONS RESEARCH

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Introduction

Join us for the sixth prize challenge in our Uncrewed Aircraft Systems (UAS) competition series! **The First Responder UAS Wireless Data Gatherer Challenge (UAS 6.0**) seeks innovators with applicable expertise across and beyond the UAS ecosystem. For public safety and the greater good, contestants can contribute invaluable knowledge and ingenuity in artificial intelligence (AI), radio communications and mapping, Internet of Things (IoT), cybersecurity, and more. Challenge results will support the public safety community and its partners to improve real-time situational awareness and save lives while operating in potentially dangerous radio-complex outdoor environments without fixed communications infrastructure or satellite communications. You can make a difference!

There are a wide variety of situations where public safety personnel need information from ground sensors (for the purposes of this competition, we will often refer to these as "Target Objects of Interest"), where there is little to no existing communications infrastructure, where there is insufficient power to access satellites, and where the radio environment is challenging yet may not require high bandwidth or low latency. Examples of such ground sensors include IoT sensors dropped ahead of a fire in mountainous terrain or the cell phones near survivors of a natural disaster. There is great potential for first responders to be able to leverage UAVs[1] to collect as much up-to-date information as possible from these ground sensors, including both data transmitted over radio and visual imagery, convey it to a mission commander, and keep the information up to date throughout a response. Such information can help the mission commander to plan the early and ongoing phases of the response, detect changes as early as possible to maintain situational awareness, and improve overall safety by reducing the need for people to approach dangerous situations to perform sensing or maintain communications.

To push UAS innovation to address such a need, the National Institute of Standards and Technology (NIST) Public Safety Communications Research (PSCR) Division is hosting this three-stage challenge with prize awards totaling up to $730,000. There are no entry fees required to participate in UAS 6.0.

Contestants with promising component technologies, regardless of whether currently a part of the UAS ecosystem, are encouraged to enter in Stage 1: Call for Papers – Components. Contestants with the most outstanding Stage 1 submissions will receive prizes that may assist them in participating in Stage 2: Measurement of Capabilities – Whole System. Stage 2: Measurement of Capabilities – Whole System is also open to the same eligible contestants as Stage 1 is not a prerequisite for entry to Stage 2. In addition to the broad range of contestants encouraged to enter Stage 1, those contestants with narrower technological competencies or UAS experience are also encouraged to enter Stage 2 because of the offered Best-in-Class awards. Contestants with the best Stage 2 submissions will win an invitation to participate in Stage 3: Live In-Person Event — Scenario Testing.

- **To join in Stage 1:** submit your entry via the challenge website contestant portal starting May 28, 2024, with a deadline of July 26, 2024.

[1] UAV are also referred to as drones. However, in this document, we will use more specific terminology and distinguish Uncrewed Aerial Vehicle (UAV), which refers to the aerial vehicle itself, from Uncrewed Aircraft System (UAS), which refers to the UAV plus the equipment and infrastructure that directly supports its operation, such as ground control stations, communications equipment, software, collaboration tools, and cloud systems.

- **To join in Stage 2**: submit your entry via the challenge website contestant portal starting November 4, 2024, with a deadline of December 13, 2024.

Challenge Background

NIST PSCR has established the UAS Portfolio to spearhead research both internally and externally through prize challenges and other stakeholder engagement activities. Such efforts support industry's and academia's technology development, and facilitate deployments that engage with and foster further technology advancements for public safety. This UAS challenge is supported by congressional funding to push innovation for public safety. For more information about NIST PSCR's UAS Portfolio, please visit: https://www.nist.gov/ctl/pscr/research-portfolios/uncrewed-aircraft-systems.

Challenge Goals and Objectives

The challenge's objective is to foster the development, and integration into UAS, of new technologies that will drive capabilities using next generation, intelligent, connected UAS for public safety, with appropriate risk management, particularly with regard to cybersecurity and AI. Specifically, the challenge goal is to design, test, and build a UAS that can autonomously survey and inspect designated ground sensors within specific geographic limits, with the capability for emergency intervention and sustained operation.

The challenge comprises three stages, with Stages 1 and 2 building toward the ultimate goal in Stage 3 of contestants fielding systems consisting of a single, battery-powered, sub-55 lb. UAS, equipped with hardware, software, and a ground control station that can perform the following high-level tasks:

- Allow for geographic bounds and controls that can terminate the mission in the event of unexpected dangerous behavior.
- Perform a radio survey of the environment, locating and inspecting ground sensors that it finds in a complex environment.
- Periodically communicate with and inspect the ground sensors for a predefined mission duration (expected to be well over one battery life for a multirotor helicopter).

Successful solutions should also be easy to operate, durable, and affordable. PSCR expects contestants to demonstrate their understanding of how solutions for UAS in Public Safety need to manage Cybersecurity and AI risk, and their entries shall appropriately manage risk by design. The outcome of this challenge is to develop UAS solutions capable of performing at or above Stage 3 Specifications and Metrics.

Table A – Challenge Stages

Stage	Stage Description	Review Criteria Summary	Number of Contestants Eligible to Compete
1	Call for Papers — Components	Description of the applied research in related fields that have the potential to improve the described use case, including characterization of associated risks. Feasibility of immediate-term	Open to all eligible contestants.

Stage	Stage Description	Review Criteria Summary	Number of Contestants Eligible to Compete
		implementation on a UAS. Clarity of presentation.	
2	Measurement of Capabilities — Whole System	Measurement of relevant capabilities through self-administered, video recorded, communally attested tests.	Open to all eligible contestants.
3	Live In-Person Event — Scenario Testing	UAS specification and safety verification; live measurement of UAS solution in application scenarios.	Up to 10 contestants selected and invited from Stage 2.

Table B – Awards and Funding

PSCR is hosting a three-stage challenge with prize awards listed in the following table.

Stage	Award Name	Number of Awards	Award Value
Stage 1: Call for Papers — Components	Components Paper Awards	Up to 10	$15,000 (each), up to $150,000 total
Stage 2: Measurement of Capabilities – Whole System	Mid-Stage Progress Review Awards	Up to 20	$2,000 (each), up to $40,000 total
	Whole System Awards	Up to 10	$20,000 (each), up to $200,000 total $5,000 (each) in travel prize to attend Stage 3, up to $50,000 total
	Best-in-Class Awards	Up to 3	$5,000 (each), up to $15,000 total
Stage 3: Live In-Person Event — Scenario Testing	1st Place	1	$100,000
	2nd Place	1	$75,000
	3rd Place	1	$50,000

Stage	Award Name	Number of Awards	Award Value
	Best-in-Class Awards	Up to 8	$10,000 (each), up to $80,000 total
			Total Challenge Award = $760,000

NOTE: This table only describes cash prize awards. NIST reserves the right to decline to make awards or make fewer awards than anticipated. Throughout the challenge, any prize funds available in one stage but not awarded to any contestants during that stage may be moved forward and awarded in subsequent stages. If needed, prior to the start of the subsequent stage, a rules modification will occur to indicate the new prize amounts. NIST also reserves the right to award Stage 3 invitations to additional Stage 2 contestants beyond the Stage 2 Whole System Award Winners and Best-in-Class award winners. These additional Stage 3 invitation awards will not include cash awards.

Table C – Summary of Important Dates

Date	Event
May 28, 2024	Challenge open for Stage 1 submissions through the website; begin Stage 1.
July 26, 2024	Stage 1 submission period ends.
August 19, 2024	Stage 1 winners announced; begin Stage 2; teams may begin building solutions.
September 6, 2024	Stage 2 submission period opens; peer review and evaluation via leaderboard begins.
December 2, 2024	Mid-stage progress review submission period ends (optional).
December 13, 2024	Mid-stage progress review award winners announced.
January 10, 2025	Stage 2 submission period ends.
January 31, 2025	Stage 2 winners announced; begin Stage 3.
April 7 - 11, 2025	Stage 3 is a live, in-person competition for scored capability demonstrations through scenario testing.
April 30, 2025	Stage 3 winners announced.

NOTE: NIST reserves the right to revise the dates at any time.

Summary of Stages

The following is a summary of each competition stage. For more information, please review each stage's instructions provided throughout this document.

STAGE 1: Call for Papers – Components

- In this stage, all eligible contestants can enter by submitting a research paper. A panel of subject matter experts (SMEs) and judges will review each contestant's submission, and judges will make selections based on the relevance of the work in advancing component capabilities pertinent to the challenge goals and objectives, the feasibility of transitioning the technology to the UAS application, and the clarity and presentation of the paper.
- Note that Stage 1 is only a research paper. A goal of Stage 1 is to solicit the participation of contestants from outside the UAS community but who have technologies that may be directly applicable to UAS in this application. Therefore, Stage 1 contestants need not demonstrate their technology on a working UAS prior to Stage 1 submission. Stage 1 winners will receive a prize award that may be used to develop their UAS solution for the Stage 2 submission.
- Up to 10 contestants will receive cash prize awards.

STAGE 2: Measurement of Capabilities – Whole System

- In this stage, all eligible contestants can enter. Participation in Stage 1 is not a prerequisite. Each contestant will need to purchase, build, or adapt an existing UAS capable of flight, sensing, and with radio hardware necessary to satisfy the Required Specifications.
- Contestants will build specified test method apparatuses to run/fly, record attestation videos, and measure the performance of their system. They will submit their measurements and corresponding attestation videos to a contest leaderboard for review by a panel of SMEs and judges. Contestants may update their test method(s) measurements and accompanying attestation video at any time prior to the closing date. Additionally, contestants' entries will be subject to an informal peer review whereby other contestants may choose to informally review the entry and provide insightful feedback that does not impact final ranking.
- Contestants may elect to submit by a mid-stage deadline to be considered for the mid-stage progress review awards. Contestants who elect to enter the mid-stage progress review will receive feedback from competition organizers (i.e., NIST PSCR and supporting staff) and, based on submission completeness and performance, may be awarded a small cash award from the judges.
- Up to 10 contestants will be selected based on their final leaderboard ranking by a panel of SMEs and judges first verifying contestants' measurements; then, judges will award verified top 10 contestants cash prizes and invitations to participate in Stage 3: Live Final. Additionally, up to 3 contestants may win Best-in-Class Awards. Other contestants may win a non-cash prize invitation to Stage 3.

STAGE 3: Live In-Person Event – Scenario Testing

This stage will consist of the live competition (location to be announced). Stage 2 winners will travel to the Live In-Person Event site to compete in Stage 3. All contestants will be required to complete a UAS safety check and compliance review prior to demonstrating their solution's capabilities. Contestants who pass the safety check and compliance review will be evaluated based on their performance across test methods and mission trials within operational scenario mockups. They will be evaluated by a panel of SMEs and judges, and based on those scores, may

receive cash prize awards from judges. Additionally, up to 8 contestants may win Best-in-Class Awards.

Operational Use Case (for reference only)

As a first responder, the need to investigate accidents, as well as prepare for and adapt during a rescue, requires collecting various types of data about the potentially dangerous environment. In radio-complex outdoor environments, where communications infrastructure may be non-existent, the ability of a UAS to collect information, via visual inspection and radio communication, from devices in the field, could be imperative to gaining situational awareness and deploying critical resources to achieve the mission objective.

Three illustrative examples of current and emerging public safety scenarios that have these characteristics are:

- Ahead of a wildfire in a remote, mountainous area, a large number of IoT sensors are dropped in strategic areas that monitor ground and air temperature and humidity, fuel load, presence of embers, and other information such as fire progression or wind direction. Public safety personnel need to maintain periodic communication with these sensors. This keeps their simulation of the wildfire up to date so they can predict how it may evolve. The remote and mountainous nature of the environment means that there is no existing communications infrastructure, and makes it impossible to maintain communication with them using a reasonable amount of temporary communications infrastructure.
- A hydroelectric power plant is equipped with many IoT sensors and cameras that normally feed the plant operator's "Digital Twin", ensuring the plant's safe operation. An accident, cyber-attack, or disaster has disabled the normal monitoring of the sensors, however the sensors themselves are still operational. Prior to sending in public safety personnel, the incident commander wishes to obtain regular data updates from these sensors to keep the plant operator's Digital Twin of the plant up to date. This helps ensure that no dangerous situations emerge that may require public safety to take precautions, such as evacuating neighboring areas. The metallic structures around the plant, its location in complex terrain, and uncertainties about which areas are currently safe make it difficult or impossible to set up enough temporary antennas to regain connectivity with the sensors.
- An earthquake, storm, or other disaster has caused widespread damage in an urban environment, including multiple collapsed buildings, resulting in a mass casualty event. In the first hours following the disaster, the public safety incident commander wishes to locate, connect to, and visually inspect the area around all of the active cell phones to locate survivors and determine their condition. They must also periodically re-connect to and re-inspect the area around the cell phones as the rescue operation progresses to monitor the survivors' conditions.

This competition is designed to encourage the development of UAS that answers this application in a way that is:

- Effective
- Affordable
- Easy to deploy and use
- Appropriately risk managed, particularly in terms of Cybersecurity and AI risk.

Official Contact Information

Official Challenge Website

Contestants can receive official challenge information and the latest news at the official challenge website at https://firstresponderuas.org/.

Program Email Address

Questions about the challenge should be directed to psprizes@nist.gov.

Challenge Stages

This section outlines the stages of the First Responder UAS Wireless Data Gatherer Challenge. Note that, to enhance contestant understanding and performance, competition organizers will make available supplemental resources for all participants throughout the competition that will elaborate on, but not alter, specific topics discussed in this rules document.

STAGE 1: Call for Papers – Components

Introduction

NIST PSCR invites all eligible contestants to complete a research paper on component technologies that are relevant to the stated application (refer to the Terms and Conditions for eligibility requirements). A panel of SMEs and judges will review all eligible papers from which judges will select winners to receive prize awards. Prizes for this stage include cash prizes as outlined in Table B – Awards and Funding and are encouraged to enter Stage 2: Measurement of Capabilities – Whole System.

How to Participate in Stage 1:

- Visit Challenge.gov to review all challenge stages.
- Register for the contestant portal for entry, which includes reviewing and accepting the terms and conditions of participation.
- Complete the submission requirements for the Stage 1, and submit the required Components Paper via the challenge website contestant portal.
- Additional information on how to complete a contestant entry is available on the challenge website.
- Up to 10 contestants will receive cash prize awards.

Important Dates

See Table C – Summary of Important Dates for all important challenge dates.

Components Paper Submission

The Components Paper entry will be created and submitted via the contestant portal.

Section	Word/Page Limit	Description
Cover Page and Abstract	Form Fields & 1,000 words	Form fields include the following: ● Contestant name (individual, team, organization, company) ● Application title

Section	Word/Page Limit	Description
		• Technical and business points of contact (name, phone, address, email address) Contestant abstracts shall describe succinctly (1,000-word MAXIMUM): • The proposed technology contribution. • How it can improve performance in the stated application.
Research Paper	10 pages (IEEE 2-column format)	Contestants shall describe their proposed technology contribution and how it can contribute to the stated Operational Use Case applications. Competition organizers will provide an example Call for Papers at the outset of the stage.
Summary Slide	1 page	Contestants shall provide a single slide (text no smaller than 10 point) in PDF format summarizing the proposed project. A quad chart layout is recommended.

NOTE: Submission(s) must not use NIST's logo or official seal and must not claim NIST endorsement.

Evaluation Criteria and Judging

The panel of SMEs and judges will review each contestant entry in Stage 1. The panel makes an independent assessment of each Components Paper based on the scoring criteria outlined below. As these papers may be released publicly, do not include sensitive materials in the paper (e.g., personally identifiable information, social security numbers, business-sensitive information, tax id numbers).

Criterion 1: Technical Alignment (50%)

The extent to which the proposed research aligns with the needs and open problems within the stated domain; the responsiveness to the public safety scenarios; the likelihood that successful implementation of the proposed solution will have a significant real-world impact; and the feasibility of implementation of the technology on a UAS, at a reasonable cost, in the immediate term.

Criterion 2: Risk Management Understanding (20%)

The extent to which the contestants demonstrate an understanding of the benefits and risks of implementations of their research, and how it fits into the risk management of public safety end users, particularly with regard to Cybersecurity and Artificial Intelligence (AI) risks.

Criterion 3: Presentation and Clarity (30%)

The quality of presentation and clarity, including the appropriate use of language, ease with which the contributions of the research can be understood, and the likelihood that an appropriately knowledgeable researcher can recreate, verify, and build on this work.

Contestants whose entry meets competition eligibility requirements and whose submission meets Stage 1 submission requirements will be included in the Stage 1 review. Specific scores will not be released

publicly or provided to the contestant. Contestants selected by the judges panel will be awarded cash prizes as outlined in Table B – Awards and Funding.

STAGE 2: Measurement of Capabilities – Whole System

Introduction

NIST PSCR invites all eligible contestants, including but not limited to all Stage 1 participants, to demonstrate their technical ability to solve the overall challenge problem. They will do this by measuring different aspects of their solution's performance through self-administered, video-attested test methods at their home location or location of their choosing. Each test measures one metric. Contestants will submit the attestation videos and self-evaluated measurements of these metrics to a leaderboard. The leaderboard will be accessible to all registered challenge contestants and will remain open for unlimited resubmissions until the stage deadline. For each metric, the best measurement of the team's final submission will be used as the final score for each criterion. The top 10 contestants with the highest combined scores across all metrics will be awarded cash prizes and invitations to participate in Stage 3: Live Final. Additionally, up to 3 contestants may win Best-in-Class Awards. Other contestants may win a non-cash prize invitation to Stage 3.

Performance Measurement

Contestants will be provided with detailed instructions to construct their own test method apparatuses, along with procedures to follow for measuring their UAS' performance and recording videos that attest to these measurements. Contestants are free to run the tests, measure their own performance, and submit their results and videos as many times as they wish. The team's last submission will be counted for their final score. The test methods are designed so that the properly recorded video can be used to prove that the test was correctly constructed and run, and that the reported test method(s) measurements are accurate.

UAV Configuration

As the test methods represent a decomposition of the tasks performed during a mission, all of the test results that a team wishes to count towards their Stage 2 score must be achieved with the same UAV configuration. If the UAV configuration changes, the team shall report that this has occurred, and all previous results will be invalidated. Organizations with several different UAV configurations are invited to enter the challenge with a new team, one submission per unique UAV configuration, where there are no overlapping team members.

A change of any part in the UAV that is not a like-for-like replacement is considered a configuration change. Examples of changes that **are** considered configuration changes include:

- Changing or adjusting landing gear (unless the adjustment is done purely by the UAV's own actuation).
- Replacing the battery with a larger or smaller capacity unit.
- Replacing the propellers with ones that are different in size, pitch, or other specification.
- Changing the camera for one that has a different specification.
- Changing the antenna or radio with one that has a different physical or electrical specification.

Examples of changes that are **not** considered configuration changes include:

- Changing a battery for one that is of identical specification (disregard age differences).

- Replacing broken propellers with new ones of the same specification, as long as all tests are started with propellers that are new or have minimal wear.
- Changing the software or firmware on components of the UAV (as this could conceivably be done over the air without physical contact with the UAV).

Contestants should consult with the competition organizers if there is any doubt that a repair or other change to the UAV constitutes a new configuration.

This restriction only covers the UAV (the flying vehicle itself). Parts of the UAS (e.g., the ground control station) that remain in the physical vicinity of the team members during the mission may be changed between tests.

Leaderboard Evaluation and Informal Peer Review

All measurements submitted in Stage 2 will be publicly viewable by all other contestants at the time of upload. Competition organizers reserve the right to release all measurements and videos to the general public at the end of the competition. Contestants will ensure that no sensitive information is present in the videos.

When the Stage 2 submission period opens, contestants are allowed to submit their test method(s) measurements and attestation video early for peer review by other contestants via the leaderboard. Once the leaderboard is open to submissions, eligible contestants can view and provide feedback on contestants' videos through the competition portal.

Contestants may continually submit test method(s) measurements and attestation videos up until the Stage 2 submission deadline to correct non-compliant videos or if they achieve better measurements in later testing. Note that any changes to the UAV configuration, such as improvements to the UAV itself, will require contestants to resubmit all test measurements and videos with the new configuration. The final leaderboard ranking will be evaluated by the competition organizers to confirm the ranking. Any videos of tests found to be non-compliant will be discarded so teams are highly encouraged to submit early and make use of peer review.

Mid-Stage Submission for Progress Review Awards (optional)

An optional mid-stage submission deadline will give contestants the option to submit test method measurements and attestation videos in order to compete for mid-stage cash prize awards and receive feedback from the competition organizers before the final submission. Contestants failing to pass Criterion 1 and/or meet the minimum requirements will be ineligible to compete in this Mid-Stage Progress Review. Competition organizers will provide feedback and judges will award cash prizes for up to 20 submissions as noted in Table B – Awards and Funding based on passing Criterion 1: Required Specifications and ranking in performance demonstrated through submission materials. Following the mid-stage submission deadline, contestants may continue to submit additional test measurements and attestation videos until the final submission deadline.

How to Participate in Stage 2

- Register for and participate in the Stage 2 webinar.

- If new to the competition, register for the contestant portal for entry, which includes reviewing and accepting the terms and conditions of participation.
- Provide proof of drone (liability) insurance or demonstrate financial responsibility with a minimum coverage of $1M at the time of initial video submission to the Leaderboard (see Terms and Conditions, Liability and Insurance).
- Submit attestation videos and test method(s) measurements using the test methods to be provided by the competition organizers at the start of this stage, following instructions detailed in this section.
- Submit Team Statement and Bill of Materials (templates provided by competition organizers); additional supporting materials may be submitted as well.
- Note the optional mid-stage submission deadline for the opportunity to win a mid-stage cash prize award and receive feedback from competition organizers.

Important Dates

See Table C – Summary of Important Dates for all important challenge dates.

Test Method(s) Measurements and Attestation Video Submissions

For a series of operational and technical tests, contestants will build their own copy of the required, low-cost and easy-to-build test method apparatuses deployed in their own space (e.g., at a campus, stadium, flying club), which will include several ground sensors and a ground control station. Contestants will fly and record videos of their UAS completing tests according to instructions provided by NIST directly following the Stage 2 webinar.

All registered contestants will record test method(s) measurements and attestation video themselves and provide their test method(s) measurements and attestation video to NIST via the contestant portal for review and verification prior to leaderboard upload and prior to the contest closing date. Detailed instructions on video content will be provided at Stage 2 launch.

This section lists the various Stage 2 specifications. See the Glossary for specific definitions of terms used. Competition organizers will also provide additional resources at the outset of the stage to assist in the interpretation of these specifications.

Required Specifications

	Requirement Title	Requirement Definition	Required Materials
1	Part 107 Compliant	Contestants shall comply with the requirements for operating their UAS under FAA Part 107 Regulations, in Class G airspace, during the day, over an unpopulated area, without needing any additional authorizations or exemptions.	Team Statement and Supporting Documentation
2	Battery Powered	UAS, including the UAV, ground control station, and associated equipment, shall be powered only by batteries.	Team Statement and Bill of Materials
3	Ground	Provide a ground control station that, in the hands of a Part	Team Statement

	Control Station	107 certified person and in a location where they can observe the entire flight area, satisfies the requirements of the Remote Pilot in Command according to FAA Part 107, up to a distance of 300 feet, with no additional exemptions or authorizations.	and Supporting Documentation
4	Positive Aircraft Control using the ground control station	Demonstrate positive aircraft control of the UAV using the ground control station by performing the Inspect Maneuver (MAN[2]) test of the Open Test Lane: ● Using a scale of S = 6 m (20 ft). ● Using 10 cm (4 in) buckets. ● The test procedure shall take no more than 10 minutes. ● Achieving at least partial alignment with each bucket.	Test Method(s) Measurements and Attestation Video
5	Lost Communications Behavior	If the UAV loses communication with the ground control station, it shall stop its mission and land safely. Before doing so, it may optionally: ● Pause for no more than 1 minute. ● Ascend to no more than 300 feet AGL. ● Fly safely towards its takeoff point. ● Fly safely towards the ground control station.	Team Statement and Documentation
6	Low Battery Behavior	If the UAV enters a low battery state, apart from during the Endurance test, it shall stop its mission and land safely. Before doing so, it may optionally: ● Pause for no more than 1 minute. ● Ascend to no more than 300 feet AGL. ● Fly safely towards its takeoff point. ● Fly safely towards the Supervisory Controller. The UAV shall enter a low battery state while it still has enough battery power to perform all of the following. ● Fly a total horizontal distance of at least 200 m (660 ft) ● Land in a controlled manner. This will be tested as part of the Endurance test.	Test Method(s) Measurements and Attestation Video
7	Bill of Material (BOM) Total Cost	The total build price of the complete, ready-to-operate system, including all components (vehicles, ground control stations, computers, software, etc.), and any fees (e.g., subscription, license) necessary for operation shall be less than $20,000. If applicable, all fees must include at least six months of access to the subscribed or licensed services in the	BOM Spreadsheet

[2] https://www.nist.gov/el/intelligent-systems-division-73500/standard-test-methods-response-robots/aerial-systems/open-test

		total cost.	
8	Safety Plan specific to the team's UAS	In acknowledgement of the wide variety of UAS types, and associated risks, contestants will submit their Safety Plan. At a minimum, the Safety Plan shall include: ● Procedure for pre-flight inspection of all UAS equipment. ● Procedure for power-on and launch. ● Procedure for landing and power-off. ● Procedure for recovery after an unexpected landing. ● Procedure for charging and other expected maintenance. To meet the requirements in Stage 2, the Safety Plan will only be evaluated based on the above headings with approval by competition organizers.	Team Statement and Documentation

Metrics: Measurement of Capabilities – Whole System (also used for Optional Mid-Stage Progress Review)

Contestants will be evaluated on the basis of the following metrics. Competition organizers will provide additional resources on Open Test Lane and Test Methods at the outset of the stage.

	Measurement	**Description**	**Metric to Maximize**
1	Inspect and Download Data	Perform the 10 minute Inspect Payload test of the Open Test Lane (PAY[3]) while downloading data from the Target Objects of Interest. Transmit collected imagery and data to the Command Server. The Open Test Lane will be set up as follows: ● At the scale of S = 6 m (20 ft). ● Implemented using 10 cm (4 in) buckets. ● Taking no more than 10 minutes. ● Inspect the Landolt-C target in each bucket to the second ring, representing a level of acuity of 3.5 mm (0.138 in).	Maximize the amount of unique data downloaded from the Target Objects of Interest and transferred to the Command Server. There is no advantage to achieving a level of acuity beyond that specified. For every minute (rounded up) that human intervention is required, 10% will be deducted from the test score, up to a maximum of 50%.

[3] https://www.nist.gov/el/intelligent-systems-division-73500/standard-test-methods-response-robots/aerial-systems/open-test

2	Survey Acuity	Perform the 10 minute Embedded Survey Acuity Test while downloading data from the Target Objects of Interest. Transmit collected imagery and data to the Command Server. All Target Objects of Interest must be inspected to a level of detail that will be specified in the procedure, approximately equivalent to the ability to resolve 3.5 mm (0.138 in) features.	Maximize the amount of data downloaded from the Target Objects of Interest and transferred to the Command Server. There is no advantage to achieving a level of acuity beyond that specified. For every minute (rounded up) that human intervention is required, 10% will be deducted from the test score, up to a maximum of 50%.
3	Autonomous Obstacle Avoidance	Autonomously fly between two points, avoiding an obstacle in between them.	Maximize the number of iterations in 10 minutes without hitting the obstacle.
4	Endurance (time)	Perform the Test Method for Endurance, aiming to fly for as long a duration as possible while completing at least one iteration.	Maximize flight time on one battery charge. There is no advantage to completing more than one iteration.
5	Endurance (distance)	Perform the Test Method for Endurance, aiming to fly for as many iterations as possible.	Maximize the number of iterations of the test on one battery charge. The flight time is ignored.

Metrics: Best-in-Class

The best performing contestant in each of the following subsets of the Main Contest tests (some maximized with respect to different metrics) will receive respective Best-in-Class awards. They will also receive an invitation to demonstrate their capabilities in Stage 3 if they are not otherwise selected on the basis of the leaderboard ranking.

The purpose of the Best-in-Class awards is to encourage the participation of contestants who may have a specialization that meets a specific need, even if they do not have the resources to field a system that can compete in all the competition tests. Therefore, NIST PSCR encourages contestants who are only focused on one of the following subsets of tests (in addition to the Required Specifications) to participate.

	Capability	Description
1	Best-in-Class Endurance	Achieve the most iterations in the Endurance (Distance) test over one battery charge.
2	Best-in-Class Inspection and Survey Acuity	Inspect, to the highest level of detail, the largest number of targets across all Target Objects of Interest, across the Inspect and Download Data, and the Survey Acuity tests. Amount of data downloaded and human intervention penalties are ignored.
3	Best-in-Class Radio	Download the most amount of data across all Target Objects of Interest across the Inspect and Download Data, and the Survey Acuity tests. Inspections and human intervention penalties are ignored.

Capability 1 of the Best-in-Class Contest is identical to Measurement 2 of the Main Contest. Each team's latest result for Measurement 2 of the Main Contest is therefore automatically considered for Best-in-Class Capability 1.

While Best-in-Class Capabilities 2 and 3 make use of some of the same Measurements as the Main Contest, contestants may score better by flying in a different manner to the way that they did in the Main Contest. For example, a team may maximize their Best-in-Class Capability 2 score by spending equal time inspecting each Target Object of Interest to their best level of acuity. In contrast, in the Main Contest they might aim to only achieve the required level of acuity and instead focus their time on downloading from Target Objects of Interest that have radio transmitters. Therefore, contestants who wish to be considered for Best-in-Class Capabilities 2 and 3 shall submit separate results and accompanying videos for each of the two Best-in-Class capabilities' tests in each of Best-in-Class contests 2 and 3. These may also be resubmitted as many times as contestants wish, with the latest results being considered.

Note that contestants must use the same UAV, in the same configuration, for their Main Contest and Best-in-Class Contest entries. A team who updates their UAV to a new configuration for one contest must re-submit new measurements.

Evaluation Criteria and Judging

NIST will review each contestant entry for Stage 2. Contestants failing to pass Criterion 1 and/or meet the minimum requirements will be disqualified and will be ineligible to compete in this stage. Following the deadline, qualifying submissions will be evaluated on the leaderboard and scored by a panel of judges to confirm the final leaderboard ranking.

Criteria: Measurement of Capabilities – Whole System (also used for Optional Mid-Stage Progress Review)

Criterion 1: Required Specifications (pass/fail)

Review the contestants' prototype UAS, video, team statement, and bill of materials to ensure that the UAS is compliant with all Required Specifications. Full compliance is required.

Criterion 2: Measured Specifications and Capabilities (Leaderboard Ranking)

This criterion comprises test method(s) measurements verification and attestation video performance for the following metrics:

- Inspect and Download Data (30%)
- Survey Acuity (30%)
- Autonomous Obstacle Avoidance (20%)
- Endurance (Time) (10%)
- Endurance (Distance) (10%)

Criteria: Best-in-Class

Best-in-Class awards recognize contestants achieving the most outstanding metrics in a specific capability that advances the challenge goals. All contestants in Stage 2 who pass Criterion 1: Required Specifications are eligible for the following Best-In-Class awards:

- Best-in-Class Endurance
- Best-in-Class Inspection and Survey Acuity
- Best-in-Class Radio

From the Main Contest, up to the top 10 Stage 2 winners selected by the judge panel will be awarded cash prizes as outlined in Table B – Awards and Funding and receive invitations to Stage 3: Live Evaluation. From the Best-in-Class Contests, the best performing team for each capability will receive respective Best-in-Class awards. NIST reserves the right to award non-cash prize invitations to contestants who are not in the top 10 Stage 2 winners or Best-in-Class Winners, but who pass Criterion 1 and receive a score on Criterion 2 above 30% of the total.

STAGE 3: Live In-Person Event – Scenario Testing

Introduction

The Live Final Contest will take place at a flight-testing facility (specific location will be announced later). All contestants who meet Required Specifications outlined in Stage 2 will complete a series of tests methods and a minimum of one scenario to demonstrate their solution's capabilities. Contestants meeting the minimum requirements will be ranked, evaluated and judged for prize awards as outlined in Table B – Awards and Funding.

How to Participate in Stage 3

- Stage 2 winners will be invited and required to participate in the Stage 3 webinar.
- In addition to their own safety plan, contestants in Stage 3 will be expected to follow the safety plan for the live event venue.
- Stage 3 events will be conducted in an outdoor environment.
- Each UAV will be expected to demonstrate the indicated Required Specifications in a specified area before being permitted to fly in the scenario stations.
- Each event area will be bordered by a safety zone.
- The UAS will need to follow defined operational paths at assigned altitudes, navigate to assigned positions, and activate and deactivate safely.
- Contestants will be assigned a start time to demonstrate their UAS solution's capabilities.

- Prior to and during the stage, competition organizers will also evaluate final team statements, supporting documentation and BOM total cost.
- Simulated outdoor scenarios will be conducted across one or more environments to evaluate system capabilities.

Important Dates

See Table C – Summary of Important Dates for all important challenge dates.

Specifications and Metrics

This section lists the various specifications for the Stage 3 live event. See the Glossary for specific definitions of terms used. Competition organizers will also provide additional resources at the outset of the stage to assist in the interpretation of these specifications.

Required Specifications

Contestants must comply with the same Required Specifications as listed in Stage 2 with the following adjustments.

Positive Aircraft Control using the Ground Control Station

Contestants will be expected to demonstrate this requirement in person at the Stage 3 event before being permitted to fly the Stage 3 scenarios.

Low Battery Behavior

Contestants will be expected to demonstrate this requirement in person at the Stage 3 event before being permitted to fly the Stage 3 scenarios. This may be demonstrated as part of the Endurance test.

Safety Plan

Contestants invited to participate in Stage 3 may be provided with feedback on their safety plan at Stage 2 on aspects that they must address prior to satisfying the requirements for Stage 3.

Measured Specifications and Capabilities

The Stage 3 Contest will see contestants rotate through a test method station and one or more scenario stations. Each station results in a team score, which is normalized to the highest score at that station. The leaderboard is based on the sum of each team's normalized scores across the stations.

At the test method station, contestants will perform the tests they performed for the Stage 2 Metrics: Main Contest, and their score will be computed accordingly. They may perform as many of the tests, as many times as they wish, within the allotted time. The best measurement for each test will count.

At each scenario station, contestants will fly a mission in a scenario that resembles a public safety use case, relevant to the challenge application. For example, the scenario might be a simulated mass casualty event in an urban area, with simulated victims (mannequins) in and among a collapsed structure, cars, and so-on. There will be a number of Target Objects of Interest in the environment, in locations that are operationally relevant, such as next to the simulated victims. Some may be out in the open, some may be in obstructed or confined areas. The radio transmitters at the Target Objects of Interest will include similar capabilities to the ones contestants build for their own testing in Stage 2. They may have additional capabilities for measuring connection quality. Details and sample code for contestants to perform their own testing will be made available prior to the launch of Stage 3.

The scenario may require the UAV to fly beyond line-of-sight and/or radio communications of the ground control station. (The Remote Pilot in Command, with the Supervisory Controller, will be in a separate location where they can maintain communication and visual line-of-sight to the UAV.) Over the course of the allotted time, the team shall maximize the number of target items read/identified, and maximize the amount of data gathered from the Target Objects of Interest and transferred to the Command Server. The scoring formula will incentivize the collection of data from multiple Target Objects of Interest, rather than just focusing on collecting data from one.

Contestants will be allowed five minutes of hands-on time at the start of the mission to set up and launch their system from a stowed state. For every additional minute (rounded up) that human intervention is required during the rest of the mission (meaning any input from any human to the system, via any modality), 10% will be deducted from the measurement for that test before computation of the normalized score, up to a maximum of 50%. Administrative intervention, such as addressing another aircraft that has unexpectedly appeared in the airspace, is exempt from this penalty.

Contestants will visit each station at least once; subsequent attempts will be allowed as scheduling permits. Only their highest score in each station is counted. Each run of a given test station shall be as if it was approached anew; contestants found to have used information gathered prior to the current mission (e.g. during practice, or a previous mission in the same station), such as maps and waypoints, will be disqualified. Competition organizers may take measures, such as adjusting the station periodically while keeping the difficulty level the same, to prevent and detect re-use of previous information.

Evaluation Criteria and Judging

NIST will review each contestant entry in the Live Final contest. A submission that fails to meet the requirements specified in Required Specifications will be disqualified and will be ineligible to compete in this contest. Submissions that pass the UAS Safety Review will be evaluated and scored by a panel of SMEs and judges. Submissions will be judged according to the criteria below:

Criterion 1: Required Specifications (pass/fail)

Examine the contestants' UAS and contest deliverables to ensure that the UAS is compliant with all Required Specifications. Full compliance is required.

Criterion 2: Performance in Testing and Scenario Stations (Max 100/100 points)

Contestants have the performance of their systems measured in each testing station. In one station, the Test Method station, they will replicate the measurements they performed in Stage 2. In the scenario stations, they will measure their performance in operational scenarios. Teams may repeat stations; a team's highest measurement in each station will be counted. All stations are normalized to the highest measurement in that station across all teams to compute each team's score in each station. All stations are weighted equally to yield the total score for each team.

Prize Award Evaluation: First through Third Place

For the First through Third Place awards, contestants will be evaluated using a point system. Contestants who pass Criterion 1: Required Specifications and have the highest aggregate score across the remaining criterion will be ranked; the highest three scoring contestants will receive place awards.

Prize Award Evaluation: Best-in-Class Categories

Special category awards recognize contestants with specific requirements for outstanding achievement or contribution to advancing the challenge goals. All contestants in Stage 3 who pass Criterion 1: Required Specifications are eligible for Special Category awards. Contestants will be evaluated at-large, and up to eight $10,000 prize awards are anticipated to be awarded:

1. **Best Single Scenario Scores (four) –** Awards given, for each scenario station, to the team that achieved the highest score in that scenario station (even if they only succeeded in completing one mission overall). This team has demonstrated a high-water mark in terms of technology, even if their system was not reliable.
2. **Best Affordable Solution –** the best overall scoring team with a total BOM of less than $10,000 USD.
3. **Best Highly Portable Solution –** The best overall scoring team whose UAS system (all components that would be deployed in a real response, including the UAV, ground control station, and all necessary batteries and a single carrying case, with the exception of the ground control station and its batteries) fits within the common U.S. Domestic carry-on baggage size limit of 56 x 36 x 23 cm (22” x 14” x 9”) and weighs no more than the maximum weight for portable equipment as specified in MIL-STD-1472F Section 5.11 of 16 kg (35 lb).
4. **First Responder’s Choice Awards (two) –** The First Responder’s Choice award will be given to the top two contestants who receive the greatest number of votes from all first responders in attendance at the Live In-Person Event.

TERMS AND CONDITIONS

This document outlines the Official Rules for the First Responder UAS Wireless Data Gatherer Challenge. Nothing within this document or in any documents supporting the First Responder UAS Wireless Data Gatherer Challenge shall be construed as obligating the Department of Commerce, NIST or any other Federal agency or instrumentality to any expenditure of appropriated funds, or any obligation or expenditure of funds in excess of or in advance of available appropriations.

Submission Requirements

In order for submissions to be eligible for review, recognition and award, contestants must meet the following requirements:

- Deadline - The submission must be available for evaluation by the end date noted in the "Important Dates" section of these rules.
- Each submission must be original, the work of the contestant, and must not infringe, misappropriate or otherwise violate any intellectual property rights, privacy rights, or any other rights of any person or entity.
- It is an express condition of submission and eligibility that each contestant warrants and represents that the contestant's submission is solely owned by the contestant, that the submission is wholly original with the contestant, and that no other party has any ownership rights or ownership interest in the submission. The contestant must disclose if they are subject to any obligation to assign intellectual property rights to parties other than the contestant, and if the contestant is licensing or, through any other legal instrument, utilizing intellectual property of another party.
- Each contestant further represents and warrants to NIST that the submission, and any use thereof by NIST shall not: (i) be defamatory or libelous in any manner toward any person, (ii) constitute or result in any misappropriation or other violation of any person's publicity rights or right of privacy, or (iii) infringe, misappropriate or otherwise violate any intellectual property rights, privacy rights or any other rights of any person or entity.
- Each submission must be in English.
- Eligible formats must be in commonly accessible forms such as: Word/PDF, PowerPoint, Excel, Movie (.mov file), Audio (.mp3 file), or link to an online platform (youtube, vimeo, google play store, website, etc.) so long as the content is made freely accessible to NIST for evaluation and judging.

Submissions containing any matter which, in the sole discretion of NIST, is indecent, obscene, defamatory, libelous, in bad taste, which demonstrates a lack of respect for public morals or conduct, which promotes discrimination in any form, which shows unlawful acts being performed, which is slanderous, or which adversely affects the reputation of NIST, will not be accepted, and will not be evaluated or considered for an award. NIST shall have the right to remove any content from the challenge website in its sole discretion at any time and for any reason, including, but not limited to, any online comment or posting related to the challenge.

If NIST, in its sole discretion, finds any submission to be unacceptable, then such submission shall be deemed disqualified.

No Endorsement

You agree that nothing in these rules grants you a right or license to use any names or logos of NIST or the Department of Commerce, or any other intellectual property or proprietary rights of NIST or the Department of Commerce or their employees or contractors.

Judging Panel

The submissions will be judged by a panel of qualified expert(s) selected as judges by the Director of NIST. The panel consists of Department of Commerce, National Institute of Standards and Technology and non-Department of Commerce, non-National Institute of Standards and Technology experts who will judge the submissions according to the judging criteria identified above in order to select winners. Judges will not (A) have personal or financial interests in, or be an employee, officer, director, or agent of any entity that is a registered contestant in a challenge; or (B) have a familial or financial relationship with an individual who is a registered contestant. Prior to evaluation by the judging panel, the submissions will be evaluated by a team of SMEs who are not considered part of the judging panel.

The decisions of the Judging panel for the challenge will be announced in accordance with the dates noted in these rules. NIST PSCR will not make contestants' evaluation results from the judging panel available to other contestants or the public.

Tie Breaking

In the event of a tie between contestants, the judges will review the evaluations of the contestant submissions to assess if there is a means based on the evaluation data to differentiate the submissions to break the tie. If the submissions cannot be differentiated to break the tie based on the evaluation data, the contestants shall split equally the combined prize amounts of the tie (for example, a tie for 1st place, where the 1st place prize is $30,000 and the 2nd place prize is $20,000, will result in the two contestants each being awarded $25,000 (equaling ($30,000 + $20,000)/2)). If this tie-breaking provision is applied, the tied contestants will share the highest-placed prize and the next lower-placed prize will be "skipped" (for example, 1st, 1st, 3rd, etc.). This tie-breaking provision will be applied to all ties involving two or more contestants. In resolving all ties, the total cumulative value of prizes awarded will not change.

In the event of a tie between contestants for the Best-in-Class awards, the judges will review the evaluations of the contestant submissions to assess if there is a means based on the evaluation data to differentiate the submissions to break the tie. If the submissions cannot be differentiated to break the tie based on the evaluation data, the contestants shall split equally the prize amount of the tie (for example, where the Best-in-Class prize is $5,000, will result in the two contestants each being awarded $2,500 (equaling $5,000)). If this tie-breaking provision is applied, the tied contestants will share the prize award. This tie-breaking provision will be applied to all ties involving two or more contestants. In resolving all ties, the total cumulative value of prizes awarded will not change.

Notification & Verification of Potential Winners

ALL POTENTIAL CHALLENGE WINNERS WILL BE SUBJECT TO VERIFICATION OF IDENTITY, QUALIFICATIONS AND ROLE IN THE CREATION OF THE SUBMISSION BY THE DEPARTMENT OF COMMERCE, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.

Contestants must comply with all terms and conditions of the Official Rules. Winning a prize is contingent upon fulfilling all requirements contained herein. The potential winners will be notified by

email, telephone, or mail after the date of winning results. Each potential winner of a monetary or non-monetary award will be required to sign and return to the Department of Commerce, National Institute of Standards and Technology, within ten (10) calendar days of the date the notice is sent, an ACH Vendor/Miscellaneous Enrollment Form (OMB NO. 1510-0056) and a Contestant Eligibility Verification form in order to claim the prize.

In the sole discretion of the Department of Commerce, National Institute of Standards and Technology, a potential winner will be deemed ineligible to win if: (i) the person/entity cannot be contacted; (ii) the person/entity fails to sign and return an ACH Vendor/Miscellaneous Enrollment Form (OMB NO. 1510-0056) and a Contestant Eligibility Verification form within the required time period; (iii) the prize or prize notification is returned as undeliverable; or (iv) the submission or person/entity is disqualified for any other reason. In the event that a potential or announced winner is found to be ineligible or is disqualified for any reason, the Department of Commerce, National Institute of Standards and Technology, in their sole discretion, may award the prize to another contestant.

Winners Not Eligible for Cash Prizes

Winners who are found to be ineligible for cash prizes may still be publicly recognized. In the event that the prize award normally allotted to the place or rank of an ineligible winner occurs, the cash prize will be awarded to the next eligible winner in the series or ranking. Throughout the challenge, winners who are ineligible for cash prizes will continue to have opportunities to have their work viewed and appreciated by stakeholders from industry, government and academic communities.

Eligibility Requirements

A contestant (whether an individual, private entity, or team ("contestant" herein)) must have registered to participate and complied with all of the requirements under Section 105 of the America COMPETES Reauthorization Act of 2010 (Pub. L. No. 111-358), as amended by Section 401 of the American Innovation and Competitiveness Act of 2016 (Pub. L. No. 114-329) and codified in 15 U.S.C. §3719 (hereinafter "America COMPETES Act" or "15 U.S.C. §3719) as contained herein.

A contestant who registers or submits an entry (whether an individual, private entity, or team or anyone acting on behalf of a private entity or team) to participate in this challenge represents that they have read, understood and agree to all terms and conditions of the Official Rules.

To be eligible to win a cash prize, a contestant must register as an individual, private entity, or team as defined below:

- Individual: a person age 18 or older at time of entry and a U.S. citizen or permanent resident of the United States or its territories.
- Private Entity: a company, institution, or other organization that is incorporated in and maintains a primary place of business in the United States or its territories.
- Team: a group of individuals or a group of private entities, with at least one member of the team meeting the definition for either Individual or Private Entity.
- Contestants not eligible for cash prizes: a contestant that enters the challenge without the ability to claim a cash prize based on the eligibility requirements above. Contestants not eligible for cash prizes must be 18 years or older at time of entry and cannot be individuals on the denied persons list nor from entities or countries sanctioned by the United States Government.

For all contestants, general eligibility requirements include:

- Contestants may not be a Federal entity or Federal employee acting within the scope of their employment.
- Contestants may not be a NIST employee.
- Non-NIST Federal employees acting in their personal capacities should consult with their respective agency ethics officials to determine whether their participation in this challenge is permissible. A contestant shall not be deemed ineligible because the individual or entity used Federal facilities or consulted with Federal employees during this challenge if the Federal employees and facilities are made available to all contestants on an equitable basis.
- Contestants may not be a NIST contractor or associate, or private entity providing services to NIST acting within the scope of their contract, employment, or funding or acquisition agreement with NIST which would involve the use of NIST funding to support a contestant's participation in the challenge.
- Contestants may not be working with NIST as a CRADA collaborator if the statement of work of the CRADA includes the subject matter of the challenge or if the CRADA provides the contestant with a competitive advantage.
- Contestants may not be individuals or private entities which provide program support services to NIST including strategic planning, project / program management, communications, reporting, program evaluation, or other similar services to NIST.
- Individuals who are former NIST Federal employees or NIST associates are not eligible to enter as an individual or member of a team for 365 days from their last date of paid employment or association with NIST with the exception of individuals in a student internship, experiential learning, or similar temporary employment status.
- Any individuals (including an individual's parent, spouse, or child) or private entities involved with the design, production, execution, distribution or evaluation of the challenge are not eligible to enter as an individual or member of a team.
- Employees of any official co-sponsoring entities are not eligible to enter.
- A contestant (whether participating as an individual, private entity, or member of a team) must not have been convicted of a felony criminal violation under any Federal law within the preceding 24 months and must not have any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.
- Contestants must not be suspended, debarred, or otherwise excluded from doing business with the Federal Government.
- Individuals currently receiving NIST funding through a grant or cooperative agreement are eligible to compete but may not utilize the NIST funding for competing in this challenge.
- Previous and current PSCR prize challenge contestants are eligible to enter.

All Contestants must designate an Official Representative

At the time of entry, all contestants must designate one individual to serve as their Official Representative, and one individual to serve as an alternate to assume the role and requirements of the Official Representative if, and only if, the first individual has resigned from their role as Official Representative or has failed to respond to NIST communications for a period of 30 consecutive days. The Official Representative will be the only individual with the authority to officially interact and communicate with NIST regarding the contestant-created materials, completion of tasks as part of the

challenge, signing official documentation related to the challenge, providing information to process prize payments, and any other administrative requests related to the challenge.

The eligibility of a contestant is determined by the contestant's registration status (individual, private entity or team) as defined above—the Official Representative does not determine the contestant's eligibility.

- For individual contestants, by default the Official Representative must be the individual.
- For private entity contestants, the Official Representative can be any individual designated by the private entity.
- For a team contestant:
    - If the team is composed of individuals, the Official Representative must be a team member who individually meets the eligibility requirements of an individual contestant.
    - If the team is composed of private entities, the Official Representative can be any individual designated by the private entity leading the team.
    - If the team is composed of a mix of individuals and private entities, the Official Representative, designated by the team, can be any qualified individual meeting the requirements of an individual or member of a private entity.

The Official Representative will be authorized to interact with NIST and be responsible for meeting all entry, evaluation, and administrative requirements of the challenge.

If in the event a contestant decides to withdraw their submission from consideration, the Official Representative must notify NIST in writing of their decision.

If a contestant (whether an individual, private entity, or team) is selected as a prize winner, NIST will award a single dollar amount to the account named in the standard form 3881 (ACH Vendor/Miscellaneous Payment Enrollment Form) by the Official Representative. The named account must belong to an individual or private entity as defined above in the eligibility requirements for individual or private entity.

On behalf of the team as defined above, the Official Representative shall be solely responsible for allocating any prize amount among the members of the team. NIST will not arbitrate, intervene, advise on, or resolve any matters between team members.

Submission Rights

Any applicable intellectual property rights to a submission will remain with the contestant. The contestant is not granting any rights in any patents, pending patent applications, or copyrights related to the technology described in the entry. However, by submitting a challenge submission, the contestant is granting the Department of Commerce, National Institute of Standards and Technology certain limited rights as set forth herein.

- The contestant grants to the Department of Commerce, National Institute of Standards and Technology the right to review the submission, to describe the submission in any materials created in connection with this challenge, and to screen and evaluate the submission, and to have the judges, challenge administrators, and the designees of any of them, review the submission. The Department of Commerce, National Institute of Standards and Technology, and any challenge co-sponsors, will also have the right to publicize contestant's name and, as applicable, the names of

contestant's team members and/or organization which participated in the submission following the conclusion of the challenge.

- The contestant grant to NIST, and any parties acting on NIST's behalf, the right to include your name and your company or institution name and logo (if the entry is from a company or institution) as a participant on the challenge website and in materials from NIST, and any parties acting on NIST's behalf, announcing winners, finalists or participants in the challenge. Other than these uses or as otherwise set forth herein, the contestant is not granting NIST any rights to your trademarks.
- The contestant grants the Department of Commerce, National Institute of Standards and Technology, a royalty-free, non-exclusive, irrevocable, worldwide license to display publicly and use for promotional purposes the contestant's entry ("demonstration license"). This demonstration license includes posting or linking to the contestant's entry on the Department of Commerce, National Institute of Standards and Technology websites, including the challenge website and inclusion of the contestant's submission in any other media, worldwide.
- Any data generated in the evaluation of contestant submissions is the property of the Department of Commerce, National Institute of Standards and Technology. The contestants, reviewers, and judges involved in the evaluation acknowledge and agree that NIST will own this evaluation data, and that the evaluation data created can be used in future research and development activities. To the extent that NIST is able to, NIST will anonymize for research purposes, whether it is used internally or published, any such data and will not include any contestant's, reviewer's, or judge's personally identifiable information. The contestant acknowledges and agrees that the data generated through evaluation of submissions may be used by NIST for future research related to the challenge.

Warranties

Each contestant represents and warrants that the contestant is the sole author and copyright owner of the submission; that the submission is an original work of the contestant and that the contestant has acquired sufficient rights to use and to authorize others, including the Department of Commerce, National Institute of Standards and Technology, to use the submission, as specified throughout the Official Rules, that the submission does not infringe upon any copyright or upon any other third party rights of which the contestant is aware; and that the submission is free of malware.

The contestant represents and warrants that all information submitted is true and complete to the best of the contestant's knowledge, that the contestant has the right and authority to submit the entry on the contestant's own behalf or on behalf of the persons and entities that the contestant specifies within the entry, and that the entry (both the information and materials submitted in the entry and the underlying technology/method/idea/treatment protocol/solution described in the entry):

- Is the contestant's own original work, or is submitted by permission with full and proper credit given within the entry;
- Does not contain proprietary or confidential information or trade secrets (the contestant's or anyone else's);
- Does not knowingly violate or infringe upon the patent rights, industrial design rights, copyrights, trademarks, rights in technical data, rights of privacy, publicity or other intellectual property or other rights of any person or entity;

- Does not contain malicious code, such as viruses, malware, timebombs, cancelbots, worms, Trojan horses or other potentially harmful programs or other material or information;
- Does not and will not violate any applicable law, statute, ordinance, rule or regulation, including, without limitation, United States export laws and regulations, including but not limited to, the International Traffic in Arms Regulations and the Department of Commerce Export Regulations; and
- Does not trigger any reporting or royalty or other obligation to any third party.

No Confidential Information

Each contestant agrees and warrants that no part of its submission includes any trade secret information, ideas or products, including but not limited to information, ideas or products within the scope of the Trade Secrets Act, 18 U.S.C. § 1905. All submissions to this prize challenge are deemed non-proprietary. Since NIST does not wish to receive or hold any submitted materials "in confidence" it is agreed that, with respect to the contestant's entry, no confidential or fiduciary relationship or obligation of secrecy is established between NIST and the contestant, the contestant's team, or the company or institution the contestant represents when submitting an entry, or any other person or entity associated with any part of the contestant's entry.

Challenge Subject to Applicable Law

All challenge phases are subject to all applicable Federal laws and regulations. Participation constitutes each contestant's full and unconditional agreement to these Official Rules and administrative decisions, which are final and binding in all matters related to the challenge. Eligibility for a prize award is contingent upon fulfilling all requirements set forth herein. This notice is not an obligation of funds; the final award of prizes is contingent upon the availability of appropriations.

Participation is subject to all U.S. Federal, state and local laws and regulations. Contestants are responsible for checking applicable laws and regulations in their jurisdiction(s) before participating in the prize competition to ensure that their participation is legal. The Department of Commerce, National Institute of Standards and Technology shall not, by virtue of conducting this prize challenge, be responsible for compliance by contestants in the prize challenge with Federal law including licensing, export control, and nonproliferation laws, and related regulations. Individuals entering on behalf of or representing a company, institution or other legal entity are responsible for confirming that their entry does not violate any policies of that company, institution or legal entity.

Resolution of Disputes

The Department of Commerce, National Institute of Standards and Technology is solely responsible for administrative decisions, which are final and binding in all matters related to the challenge.

In the event of a dispute as to any registration, the authorized account holder of the email address used to register will be deemed to be the contestant. The "authorized account holder" is the natural person or legal entity assigned an email address by an Internet access provider, online service provider or other organization responsible for assigning email addresses for the domain associated with the submitted address. Contestants and potential winners may be required to show proof of being the authorized account holder.

Publicity

The winners of these prizes (collectively, "Winners") will be featured on the Department of Commerce, National Institute of Standards and Technology website, newsletters, social media, and other outreach materials.

Except where prohibited, participation in the challenge constitutes each winner's consent to the Department of Commerce, National Institute of Standards and Technology's, its agents', and any challenge co-sponsors' use of each winner's name, likeness, photograph, voice, opinions, and/or hometown and state information for promotional purposes through any form of media, worldwide, without further permission, payment or consideration.

Payments

The prize competition winners will be paid prizes directly from the Department of Commerce, National Institute of Standards and Technology. Prior to payment, winners will be required to verify eligibility. The verification process with the agency includes providing the full legal name, tax identification number or social security number, routing number and banking account to which the prize money can be deposited directly.

All cash prizes awarded to contestants by the Department of Commerce, National Institute of Standards and Technology are subject to tax liabilities, and no withholding will be assessed by the Department of Commerce National Institute of Standards and Technology on behalf of the contestant claiming a cash prize.

Liability and Insurance

Any and all information provided by or obtained from the Federal Government is without any warranty or representation whatsoever, including but not limited to its suitability for any particular purpose. Upon registration, all contestants agree to assume and, thereby, have assumed any and all risks of injury or loss in connection with or in any way arising from participation in this challenge, development of any application or the use of any application by the contestants or any third-party. Upon registration, except in the case of willful misconduct, all contestants agree to and, thereby, do waive and release any and all claims or causes of action against the Federal Government and its officers, employees and agents for any and all injury, death, damage, or loss of property, revenue, or profits of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential and whether foreseeable or not), arising from their participation in the challenge, whether the claim or cause of action arises under contract, tort, or loss through negligence or otherwise. Upon registration, all contestants agree to and, thereby, shall indemnify and hold harmless the Federal Government and its officers, employees and agents for any and all injury, death, and damage of any nature and against third party claims for damages arising from or related to challenge activities.

Contestants are not required to obtain liability insurance for Stage 1 of the challenge. Contestants in Stage 2 and Stage 3 of the challenge are required to demonstrate UAS (liability) insurance or demonstrate financial responsibility with a minimum coverage of $1M prior to conducting any flights outside of an enclosed test facility for claims by a third party for death, bodily injury, or property damage, or loss resulting from an activity carried out in connection with participation in this challenge and for claims by the Federal Government for damage or loss to government property resulting from such an activity. The Federal Government shall be named as an additional insured under the

contestant's insurance policy. Depending on the site for Stage 3 of the challenge, the flight-testing facility may also be a required named additional insured under the contestant's insurance policy.

Records Retention and FOIA

All materials submitted to the Department of Commerce, National Institute of Standards and Technology as part of a submission become official records and cannot be returned. Submitters will be notified of any Freedom of Information Act requests for their submissions in accordance with 29 C.F.R. § 70.26.

Privacy Advisory

The Capital Consulting Corporation website is hosted by a private entity and is not a service of NIST. The solicitation and collection of your personal or individually identifiable information is subject to the host's privacy and security policies and will not be shared with NIST unless you win the Challenge. Challenge winners' personally identifiable information must be made available to NIST in order to collect an award.

508 Compliance

Contestants should keep in mind that the Department of Commerce, National Institute of Standards and Technology considers universal accessibility to information a priority for all individuals, including individuals with disabilities. The Department is strongly committed to meeting its compliance obligations under Section 508 of the Rehabilitation Act of 1973, as amended, to ensure the accessibility of its programs and activities to individuals with disabilities. This obligation includes acquiring accessible electronic and information technology. When evaluating submissions for this challenge, the extent to which a submission complies with the requirements for accessible technology required by Section 508 will be considered.

General Conditions

All challenge and prize competitions shall be performed in accordance with the America COMPETES Act.

The Department of Commerce, National Institute of Standards and Technology reserves the right to cancel, suspend, and/or modify the challenge, or any part of it, if any fraud, technical failures, or any other factor beyond the Department of Commerce, National Institute of Standards and Technology's reasonable control impairs the integrity or proper functioning of the challenge, as determined by the Department of Commerce, National Institute of Standards and Technology in its sole discretion. The Department of Commerce, National Institute of Standards and Technology is not responsible for, nor is it required to count, incomplete, late, misdirected, damaged, unlawful, or illicit votes, including those secured through payment or achieved through automated means.

NIST reserves the right in its sole discretion to extend or modify the dates of the challenge, and to change the terms set forth herein governing any phases taking place after the effective date of any such change. By entering, you agree to the terms set forth herein and to all decisions of NIST and/or all of their respective agents, which are final and binding in all respects.

ALL DECISIONS BY THE DEPARTMENT OF COMMERCE, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CHALLENGE.

Glossary

Command Area: The location for the Ground Control Station, Command Server, Takeoff and Landing Zone, and members of the team who are involved in the scored mission (excluding the Remote Pilot in Command). It may be assumed that devices within the Command Area (including the UAV while it is in the Landing Zone) will have unobstructed radio communications with each other. For Stage 3 the Command Area may be in a location without Visual Line of Sight and/or radio communications with parts of the flight area.

Command Server: A device, provided by the competition organizers, consisting of an Wi-Fi access point operating in the 2.4 GHz and/or 5.8 GHz bands, and servers as described elsewhere in this document. During the scored mission, the team's UAS will connect to the Command Server and provide information that the UAV has gathered. It is up to the team if the UAV directly connects to the Command Server, or if the UAV connects to the Ground Control Station, which then relays the information to the Command Server.

Ground Control Station: A stand-alone device, optionally but not necessarily hand-held, provided by the team. In a real response situation and in the presence of the appropriate Certificates of Authorizations or waivers, this would be the main/only controller for the UAS. During the Stage 3 competition, an FAA Part 107 Remote Pilot in Command shall hand over control to the Ground Control Station to begin the scored mission, during which time the team will interact with, and obtain scored data from, the UAS through the Ground Control Station.

Measurement: The actual number or numbers for the metric(s) that result from a test method. For example, the measurement of the Time metric in the Endurance test for a particular system configuration might be 20 minutes.

Metric: The name of the measurement that is generated by a test method. A test method may generate more than one metric. For example, the Endurance test generates two metrics, Iterations and Time.

Subject matter expert (SME): an expert in their respective field, either from NIST or from a collaborating entity. SMEs will conduct independent reviews of the submissions received from the challenge. SMEs are not members of the judging panel and, as such, will provide recommendations based on the evaluation criteria to the judging panel and will not make any award determinations.

NIST PSCR will select members from the public safety industry, first responders, and PSCR to test and evaluate the submissions for the challenge. The judging panel will take SMEs' recommendations into consideration when evaluating contestants' submissions. The judging panel will make the final determination of awards for the challenge.

Target Object of Interest: The Stage 2 tests of Inspect and Download Data and Survey Acuity, and the Stage 3 Scenarios, involve the UAV inspecting and/or downloading data from ground sensors referred to in this competition as Target Objects of Interest. These represent objects from which the UAV is seeking and need to observe and download data. These consist of an apparatus that the UAV should inspect with its camera and a co-located radio transmitter from which the UAV should connect to and download data.

Test Method (test): The specification for apparatus, procedure, and metrics that evaluate a particular capability, to some known or estimated level of statistical significance.

Uncrewed Aircraft System (UAS): The UAV and associated team-provided equipment, including the Ground Control Station, Supervisory Controller, and support equipment.

Uncrewed Aerial Vehicle (UAV): The singular, flying, uncrewed aircraft, including only the portions that are airborne. This may be a multi-rotor vehicle, a fixed-wing vehicle, or any other format that is compatible with FAA Part 107 regulations, as long as it satisfies the other requirements in this document.