Official Rules for First Responder UAS Indoor Challenge (a.k.a. UAS 4.0)

INTRODUCTION

Join us for this exciting Unmanned Aircraft System (UAS) prize competition using your ingenuity and hardware or software build expertise to create a concept for a UAS prototype. The results of the First Responder UAS Indoor Challenge will support the public safety community and its stakeholders to improve situational awareness and to save lives while operating in potentially dangerous environments. You can make a difference!

Operating UAS indoors in a constrained environment (e.g., limited lighting, compromised structural integrity, lack of global positioning system, or GPS-denied environment) presents many challenges for first responders who may be responding to an ongoing incident. Before inserting first responders into an unfamiliar environment, assessing the risks and obtaining better situational awareness could be critical to mission success and the safety of victims, survivors, bystanders, and first responders. While there are UAS solutions available in the market, these solutions typically cost more than what a local public safety agency might be able to afford. Additionally, it may be too difficult to operate a UAS in a small room or building without visual line of sight (VLOS), autonomous capabilities, and additional sensors. Also, information provided to incident command may not have sufficient fidelity or interpretability to be actionable. The objective of this challenge is to provide user-friendly, affordable solutions for first responders to accomplish their missions involving indoor environments.

The National Institute of Standards and Technology (NIST) Public Safety Communications Research (PSCR) division is hosting this three-stage challenge with prize awards up to $685,000. There are no fees to participate in this prize challenge. The most outstanding Stage 1 solution concepts will be eligible to participate in the remaining stages and compete in a live event.

To enter Stage 1, submit your entry via the challenge website contestant portal starting April 27, 2022, with a deadline of July 15, 2022. To enter as a Walk-on Contestant later in Stage 2.2, submit your entry by February 17, 2023.

Challenge Background

NIST PSCR division has established the Innovation Accelerator (IA) to spearhead the research that supports the development and deployment of the Nationwide Public Safety Broadband Network (NPSBN). PSCR's Open Innovation team engages public safety entities, government, academia, and industry to identify innovation opportunities and foster technology advancements for public safety communications through prize competitions and challenges.

Challenge Use Case

Search and rescue (SAR) operations that occur in unfamiliar environments may present danger to first responders where they would benefit from situational awareness. For example, SAR operations that take place in an indoor, constrained environment, such as a partial building collapse, require reliable tools to assess the risks to first responders and other SAR resources. Certain scenarios can be life-threatening if humans are sent in first to assess the environment and provide information back to incident command before deploying other first responders on-site. Based on our current research, cost-effective UAS solutions do not exist that gather information and promote safer initial response efforts while providing valuable intelligence.

Challenge Goals and Objectives

The goal of this challenge is for contestants to design, build, and fly a cost-effective UAS solution that helps a SAR team locate missing person(s) and life-threatening obstacles in an indoor, low-light, and GPS-denied environment. This UAS must be easy to control, highly durable, and provide first responders with a high-quality video signal needed to detect human life and assess hazards in the environment.

The following are the challenge's primary objectives:

- Design, build, test, and demonstrate UAS solutions that address the primary need associated with flying a UAS in an indoor and constrained environment.
- Develop innovative solutions that further enhance the first responder's ability to gain situational awareness of the indoor environment.
- Develop a product at an affordable price that meets the budget of a public safety agency.

The outcome of this challenge is to develop UAS solutions that are capable of performing at or above the UAS design specifications as outlined below in Table D - UAS Design Specification. In addition to developing a solution to solve the use case described, it is expected that the UAS solution will also help solve issues related to the following use cases:

- Collapsed buildings
- Operations under dense canopies
- Indoor barricaded suspect
- Indoor hostage situations
- Indoor active shooters
- Structure fires
- Partially flooded buildings

The advancement of UAS research achieved through this challenge will help support the development and operation of UAS that are intended to improve communications that may, in turn, enhance situational awareness for public safety missions.

Table A - UAS Challenge Stages

Stage	Contest Description	Review Criteria Summary	Number Of Contestants Eligible To Compete
1	Solution Description	Clarity, feasibility, plausibility using Solution Description, resume and summary slide	Open to all eligible contestants
2	Design, Prototype Build & Safety Evaluation		
2.1	Design Review	A comprehensive design of a working solution and draft Bill of Materials (BOM)	Up to 20 contestants selected and invited from Stage 1
2.2	Prototype Build & Safety Evaluation	Clarity, feasibility, and plausibility of the Design, with video proof of a working solution and validation of BOM Walk-on Contestants evaluated for entry	Up to 20 contestants selected and invited from Stage 2.1 Walk-on's open to all eligible contestants
3	Live Test & Evaluation	UAS specification and safety verification Live evaluation and demonstration of UAS	Up to 15 contestants selected and invited from Stage 2.2

Table B - Awards and Funding

NIST's PSCR program is hosting a three-stage challenge, with travel awards and prize awards listed in the following table.

Award Ranking	Number of Awards	Award Value
Stage 1	Up to 20	$5,000 (each), up to $100,000 total
Stage 2.1	Up to 15* *Up to 5 additional teams will be awarded an invite to Stage 2.2 but not a cash award.	$7,500 (each), up to $112,500 total
Stage 2.2	Up to 15	$7,500 (each), up to $112,500 total in travel awards and invited to compete in Stage 3
Stage 3		
Grand Prize	1	$100,000
Second Place	1	$70,000
Third Place	1	$45,000
Fourth Place	1	$30,000
Fifth Place	1	$25,000
Best-In-Class Awards	Up to 6	$15,000 (each), up to $90,000 total
		Total Challenge Award = $685,000

NOTE: This table only describes cash prize awards and travel awards; additional contestants may be awarded invitations to participate in challenge stages but not receive cash prize awards. All Stage 3 Contestants are eligible to compete for all Stage 3 prizes.

Program Email Address

Questions about the challenge should be directed to uaschallenge4.0@capconcorp.com.

Table C - Summary of Important Dates

Date	Event
April 27, 2022	The challenge is open for Stage 1 proposal submissions through the website; begin Stage 1.
July 15, 2022	The challenge is closed for Stage 1 proposal submissions.
August 19, 2022	Stage 1 winners announced; begin Stage 2.
October 7, 2022	Stage 2.1 submissions closed.
November 14, 2022	Stage 2.1 winners announced; begin Stage 2.2 (for Stage 2.1 winners and Walk-on Contestants).
February 17, 2023	Stage 2.2 submissions closed.
March 17, 2023	Stage 2.2 winners announced; begin Stage 3.
May 1-3, 2023	Stage 3: The Live Test and Evaluation Contest is a live, in-person competition to include scored capability demonstrations.
June 2, 2023	Stage 3 Final winners announced.

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

OFFICIAL RULES

This document outlines the official rules for the First Responder UAS Indoor Challenge. Nothing within this document or in any supporting documents 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.

Summary of Challenge

The following is a summary of each contest stage. For more information, please review the full terms and conditions for each contest as provided throughout this document.

STAGE 1: Solution Description

The Solution Description stage invites all eligible contestants to complete Solution Description submission requirements. Contestants' solutions will be reviewed by a panel of subject matter experts (SMEs) and judges who will make their selections based on the clarity of the submission, the feasibility of the solution, and how well the submission addresses the Challenge Use Case and UAS Design Specifications.

- Up to 20 contestants will receive awards including invitations to advance to Stage 2: Design, Prototype Build & Safety Evaluation and/or cash prize awards.

STAGE 2: Design, Prototype Build & Safety Evaluation

This stage has two milestones for contestants to demonstrate progression in the design of their solutions, development of a working prototype, and compliance with the safety requirements.

STAGE 2.1: Design Review

In this stage, contestants will develop their designs to build their prototype UAS solutions according to the specifications and required safety standards. They will submit design review materials.

- Up to 15 contestants will receive cash prize awards and an invitation to advance Stage 2.2. Five additional contestants may win an invitation to continue to Stage 2.2.

STAGE 2.2: Prototype Build & Safety Evaluation

In this stage, contestants will purchase and/or create the hardware necessary to implement the design approach outlined within their Solution Description and refined in the design. Contestants may take part in a series of design reviews to demonstrate progress towards achieving the teams' proposed designs, culminating in the final video evaluation.

Walk-on Evaluation

As part of Stage 2.2, Walk-on Contestant entries will be evaluated with an opportunity to advance to Stage 3.

- Up to 15 contestants (which may include Stage 2.1 Winners and/or Walk-on Contestants) will be selected to receive cash prize awards, and invitations to participate in the Stage 3: Live Test & Evaluation.

STAGE 3: Live Test & Evaluation

The Live Test & Evaluation Contest is the final stage of the challenge and consists of the live competition (location will be announced later). Stage 2 winners will travel to the Live Event site to compete in Stage 3. All contestants will be required to complete a UAS safety check prior to demonstrating their prototype UAS capabilities. Contestants who pass the initial compliance review will be evaluated and scored by a panel of judges, and based on those scores, may receive cash prize awards.

Official Rules of Stage 1: Solution Description

NIST invites all eligible contestants to complete a Solution Description outlining their knowledge, skills, capabilities, and approach for this challenge. Contestants' Solution Descriptions will be reviewed by a panel of judges who will select those contestants to be awarded prizes. Prizes for this stage include cash prizes as outlined in Table B – Awards and Funding and up to 20 contestants will be awarded invitations to Stage 2: Design, Prototype Build & Safety Evaluation Contest.

How to Enter Stage 1

Visit the challenge website to review the stages in the First Responder UAS Indoor Challenge.

- Visit Challenge.gov to review the series of stages in the challenge.
- Complete the submission requirements for the Solution Description Contest and submit the required Solution Description and summary slide via the challenge website contestant portal.
- Additional information on how to complete a contestant entry is available on the challenge website.

Operational Use Case (for reference only)

Imagine you are a firefighter on a search and rescue team, and you get a call that there was an explosion at a large residential building with visible smoke and possible occupants trapped inside. You arrive on scene and Incident Command tells you that the explosion came from the "Bravo/Charlie" side of the building which has partially collapsed in some areas, limiting rescue teams access inside. To assess structural safety of the building, identify possible ingress and

egress routes, and locate occupants in the building, you deploy a UAS that has been purpose-built for this situation.

This durable, cost effective, and easy-to-fly UAS provides real-time high definition (HD) video critical to situational awareness for not only the operator but also to Incident Command. This purpose-built UAS is also capable of operating in limited lighting and constrained environments and can potentially communicate with trapped occupants.

The innovative design your team develops is the key to your success, and below are several UAS design features that need to be considered in support of public safety agencies:

- The UAS needs to be easy to fly indoors.
- The system needs to be cost effective to fit a first responder's budget.
- The UAS needs to be durable enough to operate in confined indoor spaces and withstand physical impacts or be easily repaired/replaced in such an event.
- The system needs to provide the UAS operator and Incident Command with live HD video.
- The UAS may include some audio capability that allows first responders to communicate through the UAS.

Design Approach Overview (for reference only)

The following aspects of UAS prototype development are anticipated:

- A methodical, systems engineering approach that identifies the requirements, a conceptual design that meets those requirements, and successful tests confirming that the actual system meets the requirements in practice.
- An elegant and efficiently designed solution, supported by an appropriate depth of analysis.
- Innovation in the approach that solves the engineering, logistics, and other challenges.
- An appreciation for the practical design constraints and development of sound design principles that are essential for a successful, robust, and reliable prototype (e.g., adequate strength and stiffness of key structural components; consideration to maintenance; ease of repair in the field; modular design for integration of future capacities; intuitive design, interface, and controls).
- Good planning and teamwork; organizing the team to divide up roles and responsibilities. Good communication and planning will be essential to achieve a successful, competitive entry that meets the timeline of the challenge with a UAS that is properly tested prior to flight demonstrations.

Contestant designs shall adhere to the UAS Design Specification (see below).

UAS Design Specification

UAS prototypes entered in this challenge will be subject to the requirements and limitations defined in the UAS Design Specification (outlined below in Table D - UAS Design Specification). The UAS must not be a completely unaltered commercial off-the-shelf UAS as the intent of the challenge is to design a UAS that is purpose-built to the objectives and requirements of the challenge. The following table describes the design requirements for the First Responder UAS Indoor Challenge. The "Requirement Title" is the nomenclature used to refer to the Requirement. The "Requirement Definition" describes the meaning of the specific requirement. The "Minimum Capability" represents mandatory capabilities of the UAS and minimum acceptable values for the specific requirement. The "Preferred Capability" provides guidance where higher standards are sought and expected. Each Minimum or Preferred Capability applies to all stages of the challenge unless a deviation is noted below in Table D - UAS Design Specification.

Table D - UAS Design Specification

Requirement Title	Requirement Definition	Minimum Capability	Preferred Capability
UAS Manufacturer Suggested Retail Price (MSRP)	The price that UAS would sell for in a store. Includes the cost of formal flight training if required. Includes cost of licensed frequency if required.	MSRP of $7,500 or less.	MSRP of $5,000 or less.
Real Time Red, Green, Blue (RGB) Video	Real-time video is the ability to provide full motion video to the ground control station during anticipated mission operations. The video link needs to be able to maintain quality transmission through multiple indoor obstructions made of various building materials	The UAS shall provide real time full motion video to the ground control station at a minimum resolution of 1280 X 720 pixels at 30 frames per second.	Maximize resolution and frame rate. Encrypted solution.
Local (Onboard) Recording	Data recording of onboard UAS sensors/payloads that can be reviewed post flight.	The UAS shall provide recorded video that is stored on UAS or on storage device that can be viewed post flight. Must be a minimum resolution of 1280 X 720 pixels at 30 frames per second.	Maximize resolution and frame rate. Ability to record sensor/payload data from the UAS controller. Ability to record audio if equipped. Ability to record flight telemetry data.

Requirement Title	Requirement Definition	Minimum Capability	Preferred Capability
Flight Time	The amount of time that the UAS can fly on one fully charged battery.	The UAS shall be able to fly a minimum of 15 minutes.	The UAS can fly greater than 30 minutes, which is considered the industry standard.
Flyability (Ease of Control)	The ease in which the pilot/operator is able to control the UAS in the flight environment. This includes the ability to maintain a constant position when the remote pilot in command (RPIC) is not providing any control input (hands off) and the ability to easily navigate and maneuver in a GPS-denied environment. Various levels of autonomy may be incorporated.	During the live flight event, the UAS can be operated in the challenge live event by someone with formal flight training specific to the UAS.	Incorporated sensors that will assist the operator in the overall control of the UAS in dark and constrained spaces. Can be operated without formal flight training by someone with little to no experience in the challenge environment.
Ease of Operation	The ease in which the UAS can be operated. This includes the amount of personnel it takes to operate and how portable the UAS is.	The UAS shall be able to be operated by 1 person. The UAS shall also be portable enough that 2 people can carry and unload.	The UAS shall be able to be operated by 1 person. The UAS can also be portable enough that 1 person can carry and unload.
Power Source	The type of power that is used to operate the UAS.	The UAS shall be battery operated only.	N/A
Ground Station Control (GCS)	The device used to control the UAS. This includes the command and control (C2) link. The C2 link needs to be able to maintain control of UAS through multiple indoor obstructions made of various building materials	Ability to provide command and control through multiple indoor obstructions.	Frequency Hopping Spread Spectrum (FHSS). Encrypted C2 link.

Requirement Title	Requirement Definition	Minimum Capability	Preferred Capability
Flight Termination System (FTS)	The FTS is a subsystem that can immediately cut power to all UAS motors at once when activated or initiates an inverted dive for a horizontal flight aircraft. Activation shall be possible for any one of the following: 1. If the UAS passes a geofence set by the contestant. 2. If the UAS is disconnected from the flight controller for a set amount of time. 3. To allow for a "kill" command to be sent to the UAS via the controller.	The UAS shall be equipped with an FTS (i.e., a Kill Switch) that when activated cuts power to all motors.	N/A
Deployment Time	The amount of time it takes to deploy the aircraft from a packed carrying case to taking off for flight.	Deployable in 10 minutes.	Deployable in 3 minutes or less.
Additional Preferred Capabilities (No minimum)			
Thermal (Infrared)	Sensors that enable UAS operators to see invisible temperature data.	N/A	Capable of displaying thermal data and detecting hotspots.
Night Vision	Camera that enables the UAS operator to see into dark rooms/spaces.	N/A	Capable of displaying night vision on GCS in place of the standard RGB video stream.
Audio	Capability that the operator can use to communicate via the UAS with someone, or the operator can listen to what is happening on the UAS side.	N/A	1-way Operator to UAS, 1-way UAS to Operator, 2-way Both.
Auto-flip (Turtle)	Capability of the UAS to right itself after it has landed in an abnormal orientation.	N/A	Demonstrated capability
Battery Swappable	The UAS battery can be swapped out for a fully charged battery.	N/A	Demonstrated capability
Perching	The UAS can land on an uneven surface and maintain a level attitude by intermittently using motors.	N/A	Demonstrated capability

Safety Specific Requirements

- All flights shall comply with local, state, and Federal laws and regulations.
- All flights shall occur at authorized UAS flying areas.
- All UAS competing in the challenge must follow Federal Aviation Administration (FAA) rules and regulations.
- All UAS competing in the challenge must follow Federal Communications Commission (FCC) rules and regulations. Unlicensed and licensed frequencies are authorized. If using a licensed frequency, challenge participants must present an FCC license for the frequency.
- Any design that is deemed to pose a significant risk may be disqualified or not selected to advance.

Solution Description Requirements

The Solution Description entry will be created and submitted by all registered users using an online form available through the contestant portal.

Section	Word/Page Limit	Description
Cover Page and Abstract (required)	Form Fields & 300 words	Form fields include the following: ● Contestant name (individual, team, organization, company)* ● Application title* ● Technical and business points of contact (Name, phone, address, email address)* ● Contestant's Suggested Retail Price of Solution UAS (USD $)* ● Projected flight time (in minutes)* ● Projected deployment time (in minutes)* ● UAS weight (in pounds) ● UAS size dimensions (in US inches – L x W x H) Additional Preferred Capabilities: ● Thermal (Infrared) – (Yes/No/Unknown) ● Night Vision – (Yes/No/Unknown) ● Audio – (Yes/No/Unknown) ● Auto-Flip (Turtle) – (Yes/No/Unknown) ● Battery swappable – (Yes/No/Unknown) ● Perching – (Yes/No/Unknown) *required Describe succinctly (300-word MAXIMUM): ● Conceptual Description of the UAS ● The unique aspects of the contestant's approach and the potential impact that the proposed approach could have in achieving the goals of the challenge.
Solution Description (required)	Form Fields & 1,000 words	Addressing the requirements should be your primary objective; therefore, create your Solution Description narrative to address the evaluation criteria. Below are a few options to consider:

Section	Word/Page Limit	Description
		● The competitive advantage offered by the contestant's approach or solution. ● The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, costs, and challenges, and how the proposed project will overcome the shortcomings, limitations, and challenges relevant to the goals of the challenge. ● High-level vision for performance metrics. Describe what will be produced, when it will be produced, and how it will be verified. Start by defining the baseline capability and end project performance metric in quantifiable and verifiable terms. Include interim performance metrics which will be closely reviewed for flight feasibility and endurance. Technical Performance Measures (TPM) should reflect estimates of key requirements for the contestants' system and should include: ● Real Time RGB Video capability ● Local (onboard) Recording capability ● Flight time (minutes) ● Flyability (Ease of Control) ● Ease of Operation ● Power Source ● Ground Station Control ● Flight Termination System ● Deployment time TPM can also include any of the Additional Preferred Capabilities described in Table D.
Resume Information for Key Team Members (required)	1,000 words	The key team members and why they are well suited to accomplish the project, with resume information to support their qualifications.
Summary Slide (required)	1 page uploaded	Contestants shall provide a single slide summarizing the proposed project. This can be a presentation slide or PDF summary of the proposal.

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

Evaluation Criteria and Judging

NIST will review each contestant entry in the Solution Description. A submission that fails to meet the minimum capability criteria in Table D – UAS Design Specification and completion of the Solution Description Requirements will be disqualified and will be ineligible to compete in this stage. Submissions that pass the initial compliance review will be evaluated and scored by a panel of judges. NIST makes an independent assessment of each concept paper based on the scoring criteria outlined below. Do not include sensitive materials in the concept paper, such as

personally identifiable information (e.g., social security numbers or business sensitive information, tax id numbers, etc.).

Criterion 1: Strategic Alignment & Technical Outcome (60%)

This criterion involves consideration of the following factors:

- **Strategic Alignment** – The extent to which the proposed approach meets the objectives listed in the goals of the challenge; 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 price of the solution being within target.
- **Technical Outcome** – The extent to which the proposed approach will result in significant improvement in commercially available technology and will potentially result in a technical outcome which enables considerable progress toward the challenge goals. Contestants will be evaluated on their ability to satisfy the UAS Design Specification, outlined above in Table D - UAS Design Specification.

Criterion 2: Feasibility & Team (40%)

This criterion involves consideration of the following factors:

- **Team** – The extent to which the capability of the contestant(s) can address all aspects of the proposed project with a high chance of success, including, but not limited to, qualifications, relevant expertise, and time commitment of the contestants. Reviewers will evaluate: (a) the relevance of the qualifications and experience of the key staff, leadership, and technical experts and (b) the extent of the contestants' prior experience and the quality of the results achieved in leading programs similar in nature to the purpose, scope, etc.
- **Plan** – Contestant(s) plan to manage the limited schedule, resources, project risks, and other challenges, and produce high quality project outcomes, in pursuit of the challenge goals.

Solution Descriptions will be evaluated based on Criteria 1 and 2 above. Each Solution Description will be assigned a score on a scale of 1 to 10 for each criterion based on the merit and potential of success of the proposal. The judges will determine the winners based on these scores. The specific scores will not be released publicly or provided to the contestant.

Official Rules of Stage 2: Design, Prototype Build & Safety Evaluation

Introduction

In this stage of the contest, the contestants will implement the approach outlined within their Solution Description by completing the detailed design and estimating Technical Performance Measures (TPM) to demonstrate compliance with the requirements. Contestants will then implement their designs to build the system. Contestants will purchase or create (e.g., using 3D printing or machining) the hardware or parts necessary to build their prototype UAS to meet the UAS Design Specification and Safety Specific Requirements.

Contestants will take part in two in-stage reviews (Stages 2.1 and 2.2) to demonstrate progress toward achieving the team's proposed design. During the in-stage reviews, contestants will

present information about their solution design and status of their design toward the goals defined in the Solution Description. Prior to each review, contestants will participate in a mandatory check-in meeting to provide an update on their progress. The Design Review (Stage 2.1) is where contestants will present details of the planned design, TPM estimates, estimated BOM, and a status of the project schedule. Contestants selected by the judge panel will be awarded cash prizes and invitations to the second in-stage review. During the Prototype Build and Safety Review (Stage 2.2), contestants will present the implemented design, actual values for key TPMs, and updated estimates for any remaining TPMs, actual estimates for the BOM, a status of the project schedule, and, where applicable, the status of any component or system level testing. Contestants will consider "part scarcity" when scheduling projects and include potential mitigation strategies or alternate materials. Walk-on Contestants whose entries meet certain requirements will be included in the Stage 2.2 review (see Walk-on Contestant requirements below). Contestants selected by the judge panel will be awarded cash prizes, travel prizes, and invitations to participate in the Stage 3: Live Test and Evaluation.

STAGE 2.1 Design Review

In this stage, contestants will present information about the status of their design toward the goals defined in their Solution Description.

Important Dates

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

UAS Design Specification

See Table D - UAS Design Specification for all UAS design requirements.

How to Enter Stage 2.1

- Once Solution Description Contest Winners are awarded their invitations to Stage 2, they will be required to participate in an introduction and Stage 2 challenge webinar.
- Contestants will review the terms and conditions of participation and accept the terms and conditions for entry.
- Contestants will complete their preliminary design, prototype build, and safety compliance progress and participate in one check-in meeting with the NIST Challenge Team to report on progress (see below for additional information).
- Contestants will create and submit a BOM to ensure compliance (see below for additional information).
- Reporting requirements are similar to a build list, acquisition list, or BOM. A challenge staff member will review and verify the contestants' BOMs to ensure that system cost is within the maximum budget allowed for each contestant. This hardware budget is in place to ensure that all contestants have the same resources to enable their creativity. Contestants who violate this critical requirement will be removed from the competition and no longer be eligible for future contests as part of this challenge.

Check-in Meeting

The check-in meeting is a virtual meeting between the NIST Challenge Team and contestants to demonstrate their progress toward achieving their proposed design. This phase of Stage 2 is limited to those contestants invited from Stage 1. During the meeting, contestants will present information about the status of their UAS solution. Contestants will present the details of the planned design, estimated or actual BOM, an actual implemented subsystem, and a status of the project schedule.

For the check-in meeting, do not include proprietary or sensitive information. The meeting will be scheduled for all eligible contestants using an online scheduling portal. The check-in meeting is a brief presentation with content that shall include the following:

- Information about deviations from the Solution Description submitted in Stage 1.
- Details of the planned system design:
    - Flyability (Plans to make the solution easy to control)
    - Durability (Summarize strength of aircraft design)
    - Sensors (Video or other on-board sensors)
- Details of the logistics of the project:
    - Status of ordered parts, components, or subsystems
    - Updated estimate of total cost of the system
    - Status of the project schedule
- Any other details deemed meaningful by team.

BOM Requirements

Contestants must keep records of all hardware and software purchased or created for the prototype to function in the form of a BOM to ensure their entry is compliant. The BOM must show that all components included in the system are acquired appropriately, accounted for, and reported correctly to ensure the team stays below the maximum system cost allowed for their system. The BOM shall include:

- Each item in the system with its part number, internet link or URL that identifies where to procure the item, unit cost, quantity, and total cost.
- Custom items, or items fabricated by the contestant, shall have the unit cost estimated, their fabrication source defined, material, and material volume estimated.
- Contestants must account for at least 20% markup on the overall BOM cost to create MSRP. Any deviation shall be justified in the submission.

2.1 Design Review Content Requirements

Design Review content must conform to the following requirements. Do not include proprietary or sensitive information in the Design Review. The Design briefing will be created and submitted by all registered users using an online form available through the contestant portal.

Section	Page Limit	Description
Cover Page (required)	1 Slide	Includes: ● Contestant (Individual, Team, Organization, Company) name ● Application title ● Technical and business points of contact ● Conceptual Description of the UAS
Project Description (required)	10 Slides	How the design will fulfill the requirements is the objective of the Design Review. Below are a few options to consider: ● Overview or conceptual description of the system with callouts indicating the key components, estimated endurance, and energy source. ● Details of key components; how they enable the contestants to achieve the requirements in the design specification. ● Schematics or drawings Technical Performance Measures (TPM) should reflect estimates of key requirements for the contestant's system and should include: ● Real Time RGB Video capability ● Local (onboard) Recording capability ● Flight time (minutes) ● Flyability (Ease of Control) ● Ease of Operation ● Power Source ● Ground Station Control ● Flight Termination System ● Deployment time
Bill of Materials (required)	1-2 Worksheets	● Reviews shall include a Bill of Materials (BOM) that estimates the entire design. ● The BOM can be a separate document delivered with the review slides. ● Items that are not fully defined can be estimated (note, estimated elements of the design should not include key components in the propulsion or power systems).
Technical Performance Measure Calculation (required)	1-2 Worksheets	● Submissions should include the estimation process used to establish estimates for TPMs.

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

Evaluation Criteria and Judging:

NIST will review each contestant entry in the Design Reviews. A submission that fails to meet the minimum capability criteria in Table D - UAS Design Specification and completion of the Design Review Content Requirements (including BOM and TPM) will be disqualified and will be ineligible to compete in this contest. Submissions that pass the initial compliance review will be evaluated and scored by a panel of judges. An evaluation of a submission by a panel of judges

does not constitute NIST's final determination of contestant or submission eligibility. Submissions will be judged according to the criteria below:

Criterion 1: Strategic Alignment (75%)

This criterion involves consideration of the Strategic Alignment—the extent to which the proposed approach demonstrates the potential to meet the preferred capabilities in Table D - UAS Design Specification. Points will be given for demonstrating the potential for each preferred capability met from Table D - UAS Design Specification for this stage, and additional points will be given for each preferred capability that is exceeded.

Criterion 2: Plan (25%)

This criterion involves the contestant's plan to manage schedule, resources, and other challenges associated with developing the capability in pursuit of the challenge goals.

Stage 2.1 Design Review entries will be evaluated based on Criteria 1 and 2 above using a point system. Contestants with the highest aggregate score across all the criteria in the Design Review will be awarded prizes. The judges will award up to 15 contestants with cash prize awards and an invitation to advance to Stage 2.2. Five additional contestants may win an invitation to continue to Stage 2.2. The specific scores will not be released publicly or provided to the contestant.

STAGE 2.2 Prototype Build & Safety Review

In this stage of the contest, contestants will be required to finalize the build of their aircraft system. Once the system is complete, contestants will conduct a series of tests to demonstrate minimum capabilities and safety compliance. The test flights are designed to ensure the contestants complete minimum requirements for safety, hardware configuration, flight time, and live streaming video/audio with their prototype UAS. Contestants will be evaluated on the performance of their system with respect to Table D - UAS Design Specification. Walk-on Contestants whose entries meet certain requirements will be included in the Stage 2.2 review (see Walk-on Contestant requirements below).

How to Enter Stage 2.2

- Contestants who are winners in Stage 2.1 will be required to participate in the Stage 2.2 challenge webinar.
- Contestants will review the terms and conditions of participation and accept the terms and conditions for entry.
- Contestants who are winners in Stage 2.1 shall be required to provide proof of drone (liability) insurance or demonstrate financial responsibility with a minimum coverage of $1M at the time of the Stage 2.2 challenge webinar (See Additional Terms and Conditions, Liability and Insurance). Contestants who are winners in Stage 2.1 that do not meet the insurance requirements at the time of the Stage 2.2 challenge webinar will

be disqualified from the competition. (Walk-on Contestant insurance requirements, including timing, is stated in Walk-on Contestant section below.)

- Contestants will complete their design, prototype build, and safety compliance progress and be invited to hold one check-in meeting with the NIST Challenge Team to report on progress (see below for more information).
- Contestants must keep records of all hardware and software purchased or created for the prototype in the form of a BOM to ensure their entry is compliant. The BOM must show that all components included in the build are acquired appropriately, accounted for, and reported correctly for review. The BOM shall include:
    - Each item in the system, a part number, link or URL of where to procure the item, unit cost, quantity, and total cost.
    - Custom items, or items fabricated by the contestant, shall have the unit cost estimated, their fabrication source defined, material, and material volume estimated.
- Contestants will complete a series of video recorded flights. Each flight will begin with a safety check which meets challenge safety check standards. Then, the contestants will place the UAS in a safe test flight location. The contestants will complete a series of flight maneuvers.
- Contestants will provide their test flight video for review and verification of flight.

Check-in Meeting

The check-in meeting is a virtual meeting between the NIST Challenge Team and contestants to demonstrate their progress toward building their proposed design. This phase of Stage 2 is limited to those contestants invited from Stage 2.1. (Walk-on Contestants are not required to participate in the Check-in Meeting.) During the meeting, contestants will present information about the status of their UAS solution. Contestants will present the details of the design implementation, estimated or actual BOM, and a status of the project schedule.

For the check-in meeting, do not include proprietary or sensitive information. The meeting will be scheduled for all eligible contestants using an online scheduling portal. The check meeting is a brief presentation with content that shall include the following:

- Information about deviations from the design submitted in Stage 2.1.
- Details of the planned system implementation:
    - Flyability (Progress toward making the solution easy to control)
    - Durability (Progress toward strengthening the aircraft)
    - Sensors (Video or other on-board sensors)
- Details of the logistics of the project:
    - Status of ordered parts, components, or subsystems
    - Updated estimate of total cost of the system
    - Status of the project schedule
- Any other details deemed meaningful by team.

UAS Safety Requirements

All aircraft and ground-based equipment will undergo rigorous safety evaluations leading up to the Live Event. Physical inspections will take place before each flight that occurs as part of the Stage 2.2 video and Stage 3 Live Test and Evaluation competitions. These inspections must be passed before the aircraft will be permitted to fly. All decisions by NIST in relation to airworthiness are final. Safety inspections will include (but not be limited to) the following:

- Structural verification of the aircraft to ensure structural integrity including:
    - Components adequately secured and fasteners tightened
    - Propeller structure and attachment integrity
    - General inspection of electronic wiring
    - Payload general integrity
- UAS autonomous flight mode manual override (only if the UAS has autonomous modes)
- Radio spectrum frequency compliance
- Radio range checks with motor off and on
- Flight termination system or "kill switch" test
- Power source: must be battery powered
- Video evidence and flight logs of previous flight tests demonstrating safe operations
- Proficiency of team members with respect to operation of UAS software and equipment, communications and procedures

2.2 Video Content Requirements

The Video content will be created and submitted by all registered contestants using an online form available on the challenge website.

All contestants will provide their test flight video to NIST via secure file transfer for review and verification prior to the contest closing date. The test flight video should include the view of the UAS in the air from the moment of take-off to the moment of landing, a view from a camera onboard the UAS looking straight down, a view of the controller(s) for the UAS, and a view of a clock with at least a one second resolution. The four views should be clearly visible in the same video image simultaneously. This may be accomplished by strategically positioning the video camera relative to the UAS, controller(s), and clock such that these three components are visible to the camera; or by feeding live video from several cameras pointed at the UAS, controller(s), and clock, respectively, into a video Multiview processor that can combine multiple inputs into one video output (which will be provided at a later date) to ensure the UAS can be safely operated and achieve basic performance requirements. The video shall clearly depict all components of the UAS when in flight. The video submission should be recorded in no less than 1280 x 720 pixel resolution and shall include all content listed below:

Section	Time Limit	Description
System Overview	10 minutes	Video overview of all major components of system design with narration (system in powered off state): ● View of UAS from multiple angles ● View of the Real Time RGB Video on GCS ● Power Source

System Operation	30 minutes	Video of contestant conducting:
		● System set-up and preflight checks
		● System safety checks
		● Flight termination system test (while on ground)
		● Manual flight. Steps to be followed:
		  ● Take off
		  ● Fly UAS within a small area for approximately a 5-minute flight over the take off point.
		  ● Land UAS
		  ● Disarm UAS motors
		  ● Prepare UAS for next flight
		  ● System safety checks
		● Test flights. Steps to be followed:
		  ● Take off
		  ● Fly for approximately 10 minutes.
		  ● Land UAS
		  ● Disarm UAS motors
		  ● Prepare UAS for next flight (e.g., swap batteries)
		  ● System safety checks
		● Indoor flight. Steps to be followed:
		  ● Take off
		  ● Demonstrate the ability to navigate indoors in a constrained environment for approximately 15 minutes.
		  ● Land UAS
		  ● Disarm UAS motors
		● Video complete

Evaluation Criteria and Judging

NIST will review each contestant entry into the Prototype Build & Safety Evaluation Contest. A submission that fails to meet the minimum capability criteria in Table D - UAS Design Specification, a completed BOM and completion of the Video Content Requirements will be provided with a list of items to be addressed and a re-evaluation date. On the re-evaluation date, contestants shall submit the new video using an online form available on the challenge website. Contestants failing to meet the minimum capability criteria during the re-evaluation will be disqualified and will be ineligible to compete in this contest. Submissions that pass the initial compliance review will be evaluated and scored by a panel of judges. An evaluation of a submission by a panel of judges does not constitute NIST's final determination of contestant or submission eligibility. Submissions will be judged according to the criteria below:

Criterion 1: UAS Safety Review (pass/fail)

Review the contestants' prototype UAS, video, and contest deliverables to ensure that the UAS is compliant with the UAS Design Specification and Safety Specific Requirements. Full compliance is required.

Criterion 2: Strategic Alignment (75%)

This criterion involves consideration of the Strategic Alignment—the extent to which the proposed approach demonstrates the potential to meet the preferred capabilities listed in Table D - UAS Design Specification, BOM and Video Content Requirements. Points will be given for each preferred capability met from Table D - UAS Design Specification for this stage, and additional points will be given for each preferred capability that is exceeded.

Criterion 3: Plan (25%)

This criterion involves the contestant's plan to manage schedule, resources, and other challenges associated with developing the capability in pursuit of the challenge goals.

Stage 2.2 contestants that receive a "pass" on Criterion 1 will be evaluated using a point system to evaluate Criteria 2 and 3 (note: specific scores will not be announced or provided to contestants). Contestants with the highest aggregate score across all the criteria will be awarded cash prizes, travel prizes, and invitations to compete in Stage 3.

Official Rules for Walk-on Contestants: Prototype Build & Safety Review

Walk-on Contestants are contestants in Stage 2.2 who meet all eligibility requirements defined for Stages 1 and 2.1, and have a fully compliant system with the minimum capability criteria in Table D – UAS Design Specification, a completed BOM and completion of the Video Content Requirements. Walk-on Contestants shall register and submit all materials required for 2.2 Prototype Build & Safety Evaluation stage. Walk-on Contestant submissions will be evaluated to determine if they meet all eligibility requirements defined for Stages 1 and 2.1 and if they meet the insurance requirements. Walk-on Contestants who meet these requirements will be invited to compete in Stage 2.2. Upon invitation to compete in Stage 2.2, Walk-on Contestants will be treated the same as Stage 2.1 Winners for Stage 2.2 Evaluation Criteria and Judging (including for review of meeting the minimum capability criteria in Table D – UAS Design Specification, a completed BOM and completion of the Video Content Requirements).

Important Dates

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

UAS Design Specification

See Table D - UAS Design Specification for all UAS design requirements.

How to Enter as a Walk-on Contestant

- Visit the challenge website to review the stages of the challenge.
- Visit Challenge.gov to review the series of stages of the challenge.
- Contestants will review the terms and conditions of participation and accept the terms and conditions for entry.
- Walk-on Contestants shall be required to provide proof of drone (liability) insurance or demonstrate financial responsibility with a minimum coverage of $1M at the time of the Stage 2.2 submission (See Additional Terms and Conditions, Liability and Insurance). Walk-on Contestants that do not meet the insurance requirements at the time of the Stage 2.2 submission will be disqualified from the competition.
- Complete the official entry form that will include information on key team members and their ability to accomplish the project.
- Submit all required materials as instructed in Stage 2 - Design, Prototype Build & Safety Evaluation as described in the Official Rules and challenge website. See Stage 2.2 submission requirements for BOM and for the series of video recorded flights included the Stage 2.2 How to Enter section and 2.2 Video Content Requirements section.

Evaluation Criteria and Judging

NIST will review each Walk-on Contestant entry into the Prototype Build & Safety Evaluation Contest. A submission that fails to meet the eligibility requirements defined for Stages 1 and 2.1 or fails to meet the insurance requirements will be disqualified and will be ineligible to compete in this contest. Submissions that pass this eligibility and insurance review will be invited to compete in Stage 2.2. Upon joining the competition for Stage 2.2, the Walk-on Contestants will be treated the same as Stage 2.1 Winners for Stage 2.2 Evaluation Criteria and Judging (including for review of meeting the minimum capability criteria in Table D – UAS Design Specification, a completed BOM and completion of the Video Content Requirements).

Official Rules of Stage 3: Live Test & Evaluation Contest

Introduction

The Live Test & Evaluation Contest is the final contest of the series. The event will take place at a flight-testing facility (specific location will be announced at a later date). All contestants who pass the UAS Safety Review will complete a series of static tests and live test flights to demonstrate their prototype's capabilities. Contestants meeting at least the minimum standards will be ranked and, based on those rankings, may be awarded a prize.

Important Dates

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

UAS Design Specification

See Table D - UAS Design Specification for all UAS design requirements.

How to Enter

- Stage 2 Winners (all invited contestants from Stage 2.2, whether originally a Stage 2.1 Winner or Walk-on contestant, are considered "Stage 2 Winners") will be required to complete UAS safety checks prior to any contest flights.
- Stage 2 Winners will be required to participate in the Stage 3 webinar.
- Contest flights will be conducted in an indoor environment. Each contestant will be assigned a flight area to complete their preflight safety checks and full test flight. Each flight area will be bordered by a safety zone. The UAS will need to follow defined flight paths at assigned altitudes, navigate to assigned positions, and take off and land safely.
- Contestants will be assigned a start time to demonstrate their prototype UAS capabilities in a series of static tests and live test flights.
- Static checks will evaluate fixed attributes of the system such as power source, MSRP and battery swap capability.
- Technical flights will evaluate system capabilities and fundamental flight performance, such as different flight modes, ability to hold position in a GPS-denied environment, and other requirements in a series of structured flights.
- Operational flights will evaluate the usability and additional system capabilities in a simulated operational flight.

Evaluation Criteria and Judging

NIST will review each contestant entry in the Live Test & Evaluation Contest. A submission that fails to meet the criteria specified in Criterion 1: UAS Safety Review 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 judges. An evaluation of a submission by a panel of judges does not constitute the NIST's final determination of contestant or submission eligibility. Submissions will be judged according to the criteria below:

Criterion 1: UAS Safety Review (pass/fail)

Review the contestants' prototype UAS to ensure it is compliant with the features required and that contestants properly complete safety checks. Full compliance is required.

Criterion 2: Static Tests and Evaluations (Max 30/120 points)

Evaluation of the fixed attributes of the UAS: Systems will be measured and awarded points based upon the specific attributes associated with the requirements listed in the UAS Design Specification. These include (but are not limited to) the following:

- UAS Manufacturer Suggested Retail Price (MSRP)
- Real Time Red, Green, Blue (RGB) Video
- Local (Onboard) Recording

For each assessment, points will be awarded based upon a scale where one point equals the minimum (e.g., achieved the minimum capability of the UAS Requirement); the score increases as the level of the "Minimum Capability" is exceeded to a maximum of 10 points.

Criterion 3: Technical Flight Evaluations (Max 30/120 points)

Evaluation of technical attributes of the UAS during flight: Contestants will be provided with a series of flight maneuvers and will fly a defined route and complete a series of tasks. During the flight, the system will be evaluated and awarded points based upon performance associated with the requirements listed in the UAS Design Specification. These include (but are not limited to) the following:

- Deployment Time
- Flyability (Ease of Control)
- Ground Control Station

For each assessment, points will be awarded based upon a scale where one point equals the minimum (e.g., achieved the minimum capability of the UAS Requirement); the score increases as the level of the "Minimum Capability" is exceeded to a maximum of 10 points.

Criterion 4: Simulated Indoor Mission Evaluations (Max 60/120 points)

During the simulated indoor mission, contestants will put their system into operation from a stored, packaged state and fly their UAS into a simulated indoor mission. During the simulated indoor mission, contestants and the system will be evaluated and awarded points based upon performance associated with the requirements listed in the UAS Design Specification. These include (but are not limited to) the following:

- Deployment Time
- Ease of Operation
- Real Time RGB Video
- Flyability (Ease of Control)
- Flight Time
- Ground Control Station

For each assessment, points will be awarded based upon a scale where 1 point equals the minimum (e.g., achieved the minimum capability of the UAS Requirement); the score increases as the level of the "Minimum Capability" is exceeded to a maximum of 10 points.

Criterion 5: Additional Preferred Capabilities Evaluation (Max 30 extra credit points)
In the operational environment, situational awareness is critical. However, additional capabilities add costs and increase weight. Contestants will be awarded extra credit points by demonstrating any additional capabilities within their UAS design. UAS solutions will be measured and awarded points based upon the specific attributes associated with the requirements listed in the UAS Design Specification. These include (but are not limited to) the following:

- Thermal (Infrared)
- Night Vision
- Audio
- Auto-Flip (Turtle)

- Battery Swappable
- Perching

For each assessment, points will be awarded based upon a scale where each capability can receive a maximum of 5 points.

Final Prize Award Evaluation

For the First through Fifth Place awards, contestants will be evaluated using a point system (note: specific scores will not be announced or provided to contestants). Contestants who pass Criterion 1: UAS Safety Review and have the highest aggregate score across Criteria 2 through 5 will be ranked; the highest five scoring contestants will receive place awards.

Best-In-Class Award Evaluations

Best-in-Class awards recognize contestants in specific requirements for outstanding achievement or contribution to advancing the challenge goals. All contestants in Stage 3 who pass Criterion 1: UAS Safety Review are eligible for Best-In-Class awards. Contestants will be evaluated at-large and up to six $15,000 prize awards are anticipated to be awarded. All Stage 3 Contestants are eligible to win Best-In-Class award(s).

Each award is based on one of the requirements (e.g., performance metrics) outlined in Stage 3's Criteria 2 through 5. The contestant is not required to obtain a score in all of Stage 3's Criteria 2 through 5 to be eligible for the Best-In-Class awards. Specifically, the judge panel will vote on all eligible contestants and use a simple majority to select a winner for each Best-In-Class award.

All contestants are eligible for the following Best-In-Class awards:

1. Best in Class Ease of Operation
2. Best in Class Flyability (Ease of Control)
3. Best in Class Additional Preferred Capabilities
4. Best in Class Price
5. First Responder's Choice (2 awards)

For the Best-In-Class awards, contestants will be evaluated by a judge panel, each of whom will cast a vote (note: specific vote counts will not be announced or provided to contestants). The First Responder's Choice award will be given to the contestant who receives the greatest number of votes from all first responders in attendance at the Live Test & Evaluation. The number of awards may vary; NIST reserves the right to decline to make awards or make fewer awards than anticipated.

TERMS AND CONDITIONS

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, 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.

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 libelous, 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, 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.

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 contestants or the public.

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 place 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.

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 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 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 competition, 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 competition.
- You 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 your entry is from a company or institution) as a contestant on the challenge website and in materials from NIST, and any parties acting on NIST's behalf, announcing winners, finalists or contestants in the challenge. Other than these uses or as otherwise set forth herein, you are 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 competition 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 created data 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 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 competition 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.

Additional Terms and Conditions

This document outlines the Official Rules for the First Responder UAS Indoor Challenge. Nothing within this document or in any documents supporting the First Responder UAS Indoor 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.

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 competition, be responsible for compliance by contestants in the prize competition 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 and damage 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 Stages 1 and 2.1 of the challenge. Contestants in Stages 2.2 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. Any confidential commercial information contained in a submission should be designated at the time of submission. 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

This prize competition shall be performed in accordance with the America COMPETES Reauthorization Act of 2010, Pub. Law 111-358, title I, § 105(a), Jan. 4, 2011, codified at 15 U.S.C. § 3719 and amended by the American Innovation and Competitiveness Act of 2016 (Pub. L. No. 114-329) (hereinafter "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

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.