UAS 3D MAPPING CHALLENGE
FIRST RESPONDER

Contestant Webinar

First Responder UAS
3D Mapping Challenge
(UAS 5.0)

16 May 2023

#NIST #PSCR #FirstResponders #3DMappingChallenge

UAS Challenge Team

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#NIST #PSCR #FirstResponders #3DMappingChallenge

Agenda

1. PSCR Overview and Mission
2. Challenge Goal
3. Requirements and Objectives
4. Roadmap and Timeline
5. Prizes
6. Resources
7. Questions

NIST Organizational Overview

NIST
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

CTL
Communications Technology Laboratory

Public Safety Communications Research

EL
Engineering Laboratory

Emergency Response Robots Projects

NIST PSCR Mission

Serving as an objective technical advisor and laboratory, PSCR is driven towards **advancing public safety communications technologies by accelerating their development, adoption, and implementation** so that the public safety community can more effectively carry out their mission to protect lives and property.

Uncrewed Aircraft Systems Portfolio

- Mission -

To advance the capabilities of uncrewed aircraft systems and provide safe, effective, and reliable solutions to first responder in their crucial missions by conducting cutting-edge research for emergency response operations

PUBLIC SAFETY NEED

Feedback from first responders is critical to reach the program goals

ADVANCE UAS TECHNOLOGY

Influence industry standards to include public safety needs

PROGRAM PARTNERSHIPS

Collaborating with first responders, academic institutions, industry, and government agencies

GRANTS & PRIZE CHALLENGES

Solve research problems by crowdsourcing external researchers

UAS 5.0 Video

View the video here.
UAS 3D MAPPING
CHALLENGE
FIRST RESPONDER

Challenge Goal

To advance UAS technologies by designing, building and operating affordable drone prototypes in support of NIST PSCR's research to provide an accurate, high-quality 3D map in real-time to support First Responders' indoor operations prior to entry.

Indoor Situational Awareness

Indoor disaster response with no GPS and 3D Mapping

First Responders need to conduct an effective response for rescue efforts indoors while operating with limited or no GPS signal.

Operationally Sound

Safety / Portable
Durable / Low-light

To improve both safety and mission outcome, they would benefit from a UAS that could maneuver in close space and provide accurate information.

Easy to Use

Affordable / Easy-to-Use
Blue or Green UAS Capable

Develop a low cost, Blue/Green UAS capable platform that offers semi or fully autonomous operation

Challenge Requirements and Objectives

Table D: UAS Design Specifications

'Minimum Capability' represents **mandatory** capabilities & **minimum acceptable** values for the specific requirement

'Preferred Capability' provides **guidance** where higher standards are **desired**

Requirement Title	Minimum Capability	Preferred Capability
Uncrewed Vehicle (UV)	1 aerial UV	1 aerial UV + additional aerial/ground UVs
Autonomy	≤ 2 UAS operators/support personnel	Automated route planning and navigation
Bill of Material Total Cost	≤ $20K	≤ $10K
Indoor 3D Map Deliverable	• 3D map in an open or common format on portable media storage • Minimize the size of surface area gaps • Minimize relative dim. Error • Minimize # of undetected obj. • No or limited post-processing time	• 3D map in an open or common format on portable media storage • No surface area gap ≥ 1 ft^2 • Relative dimensional error ≤ 5% • Detect objects ≥ 64 in^3 or 16 in^2 • Real-Time map acquisition
3D Map Progress Rendering	Near real-time 3D rendering with ≤ 10 sec latency	Real-time 3D rendering
Map Data Acquisition Speed	Average ≥ 2 ft/sec	Average ≥ 4 ft/sec
Human Detection	Manual detection via real-time video feed / verbal location description	Autonomous detection/location tagging within real-time rendering or video feed
Real-Time Video	≥ 640 X 480 pixels at 10 frames/sec	Maximize resolution; 2-3 axis gimbal; onboarding recording; RGB (color) video; Thermal (Infrared); Night Vision (low lux); encrypted link

Challenge Requirements and Objectives

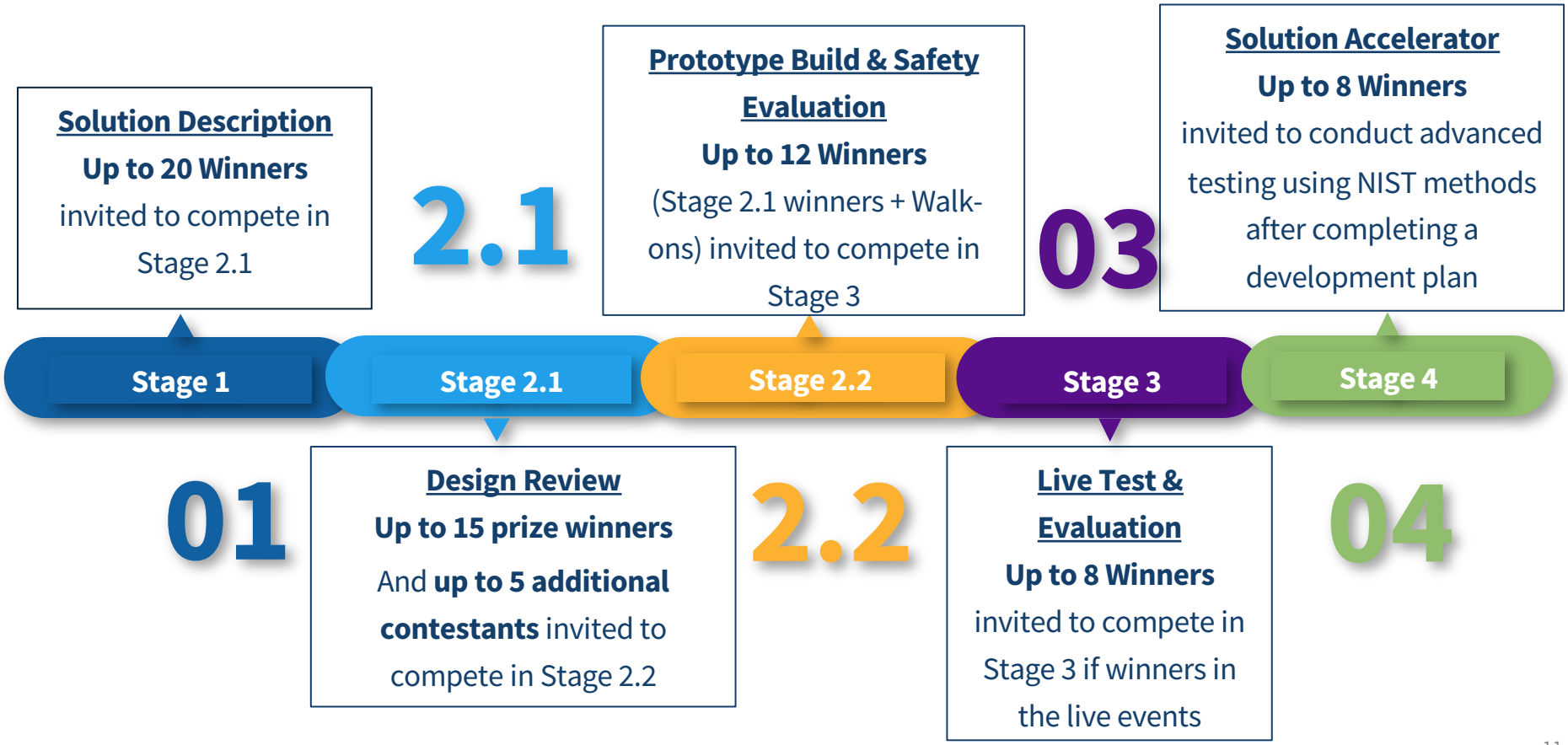
Table D Cont.

‘Minimum Capability’ represents **mandatory** capabilities & **minimum acceptable** values for the specific requirement

‘Preferred Capability’ provides **guidance** where higher standards are **desired**

Requirement Title	Minimum Capability	Preferred Capability
Additional Preferred Capabilities (No minimum)		
Real-Time Audio	N/A	Demonstrated Capability
Auto-Flip (Turtle)	N/A	Demonstrated Capability
Blue or Green UAS Capable	N/A	Demonstration of Flight Controller, Operating Software, and Ground Control Station capable of achieving Blue or Green UAS compliance per the policy. Maximize the remaining six critical components outlined in the NDAA Section 848 or the AUVSI adaptation of NDAA Section 848.

Challenge Summary



Challenge Summary

01

<u>1. Solution Description</u> **Up to 20 Winners** invited to compete in Stage 2.1	• Prepare a Solution Description including knowledge, skills, capabilities, and approach that meets the minimum capability criteria in Table D - UAS Design Specifications • Submit a solution summary slide ***(see challenge rules for details)***

Challenge Summary

2.1

<u>2.1 Design Review</u> **Up to 15 prize winners** And **up to 5 additional contestants** invited to compete in Stage 2.2	• Prepare a detailed design and estimate using Technical Performance Measure (TPM) and Bill of Materials (BOM) for compliance • Present a Design Review of the planned design, TPM & BOM estimates, status ***(see challenge rules for details)***

Challenge Summary

2.2

2.2 Prototype Build & Safety Evaluation **Up to 12 Winners** (Stage 2.1 winners + Walk-ons) invited to compete in Stage 3	• Present the implemented design, actual and estimates of TPM and BOM • Develop or configure a technological mapping method to meet design specifications and safety. • Build the prototype, perform test flights, and submit flight videos to include 3D map rendering ***(see challenge rules for details)***

Challenge Summary

03

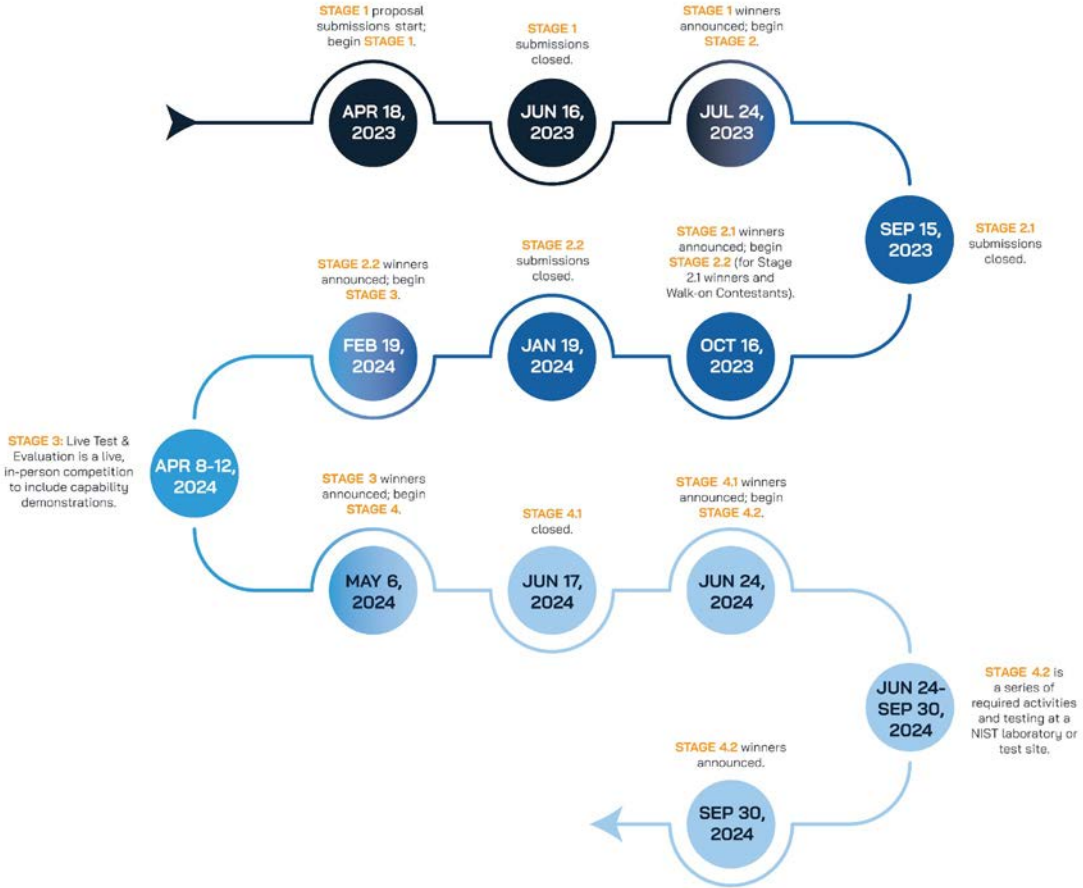
<u>3. Live Test & Evaluation</u> **Up to 8 Winners** invited to compete in Stage 3 if winners in the live events	Live event at a flight-testing facility conducted in an indoor environment • Once the UAS Safety Review is passed, complete a series of static tests • Live tests will be a series of structured operational flights using 3D mapping in a simulated indoor mission. ***(see challenge rules for details)***

Challenge Summary

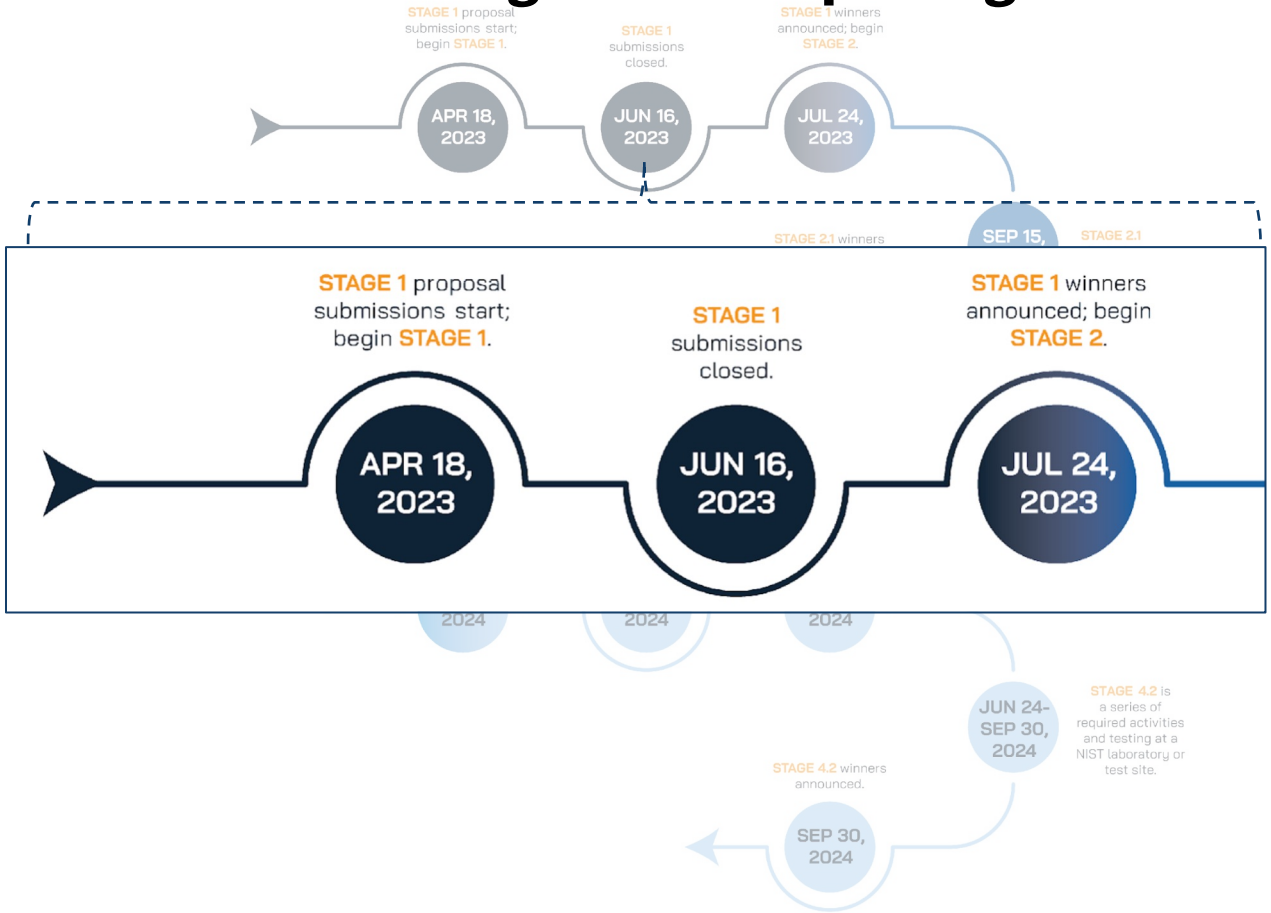
04

4. Solution Accelerator **Up to 8 Winners** invited to conduct advanced testing using NIST methods after completing a development plan	4.1 • Prepare a Solution Accelerator Plan for a commercial application -or- research goal • Letter of Partnership with Public Safety agency (see challenge rules for details) 4.2 • Meet with a UAS Consultant • Participate in Resource Webinars • Present completed Solution Plan • Test UAS using NIST test methods ***(see challenge rules for details)***

Challenge Roadmap



Challenge Roadmap: Stage 1



Challenge Prizes: Up to $987.5K Total

Stage 1 Up to 20 — $7.5K each, Up to $150K total

Stage 2.1 Up to 15 — $12.5K each, Up to $187.5K total
(Up to 5 additional teams will be awarded an invite to Stage 2.2 but not a cash award)

Stage 2.2 Up to 12 — $10K each, Up to $120K total and invited to compete in Stage 3
$5K each in travel prize to attend Stage 3, Up to $60K total

Stage 3

x 1	x 1	x 1	Up to 5
Grand Prize	*2nd Place*	*3rd Place*	*Best-In-Class Awards*
$100K	$50K	$30K	$10K each, Up to $50K total

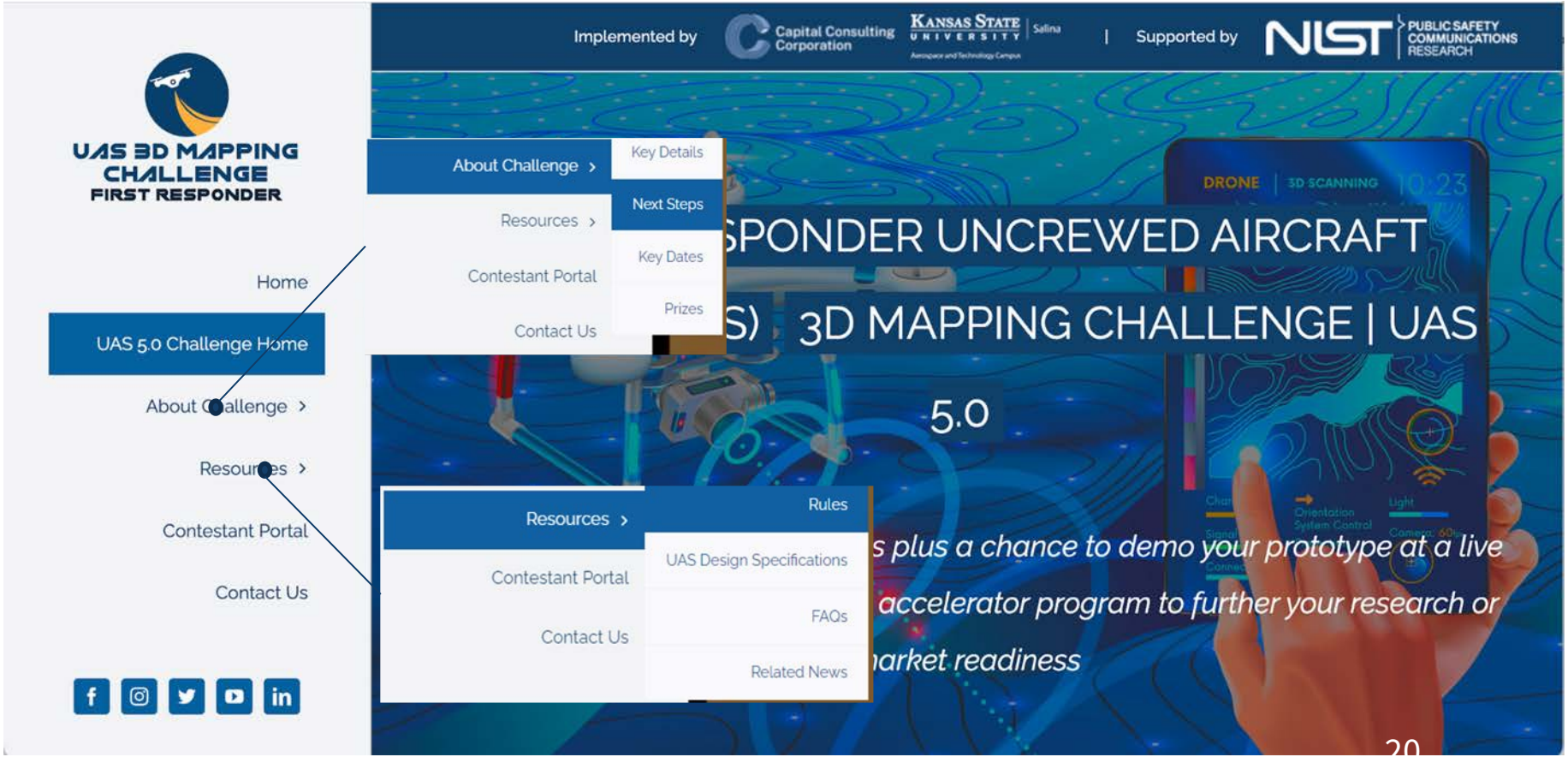
(Up to 8 teams will be awarded an invite to Stage 4)

Stage 4.1 Up to 8 — $10K each, Up to $80K total

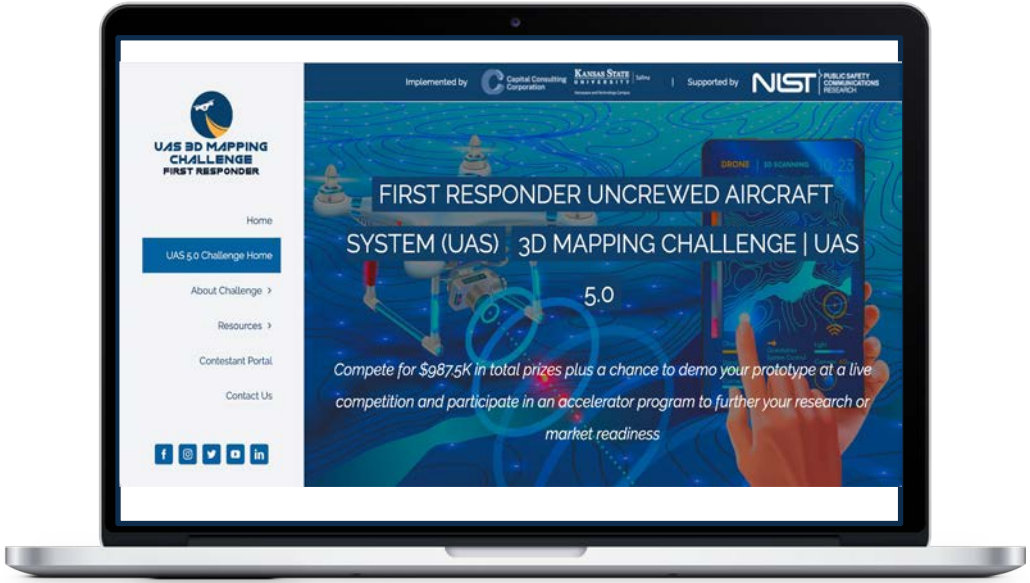
Stage 4.2 Up to 8 — $20K each*, Up to $160K total

*This prize requires contestants to attend the final event at the NIST laboratory or test site.

Challenge Website



Resources/Get Connected



MAILING LIST

Sign up on the challenge website to receive updates

WEBSITE

Go to the **Challenge Website** for next steps , including how to use the Contestant Portal

GET CONNECTED

Recruit team members on UAS Challenge Facebook **page**

facebook.com/uaschallenges

https://twitter.com/uaschallenges

https://www.linkedin.com/company/uaschallenges/

Questions?
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