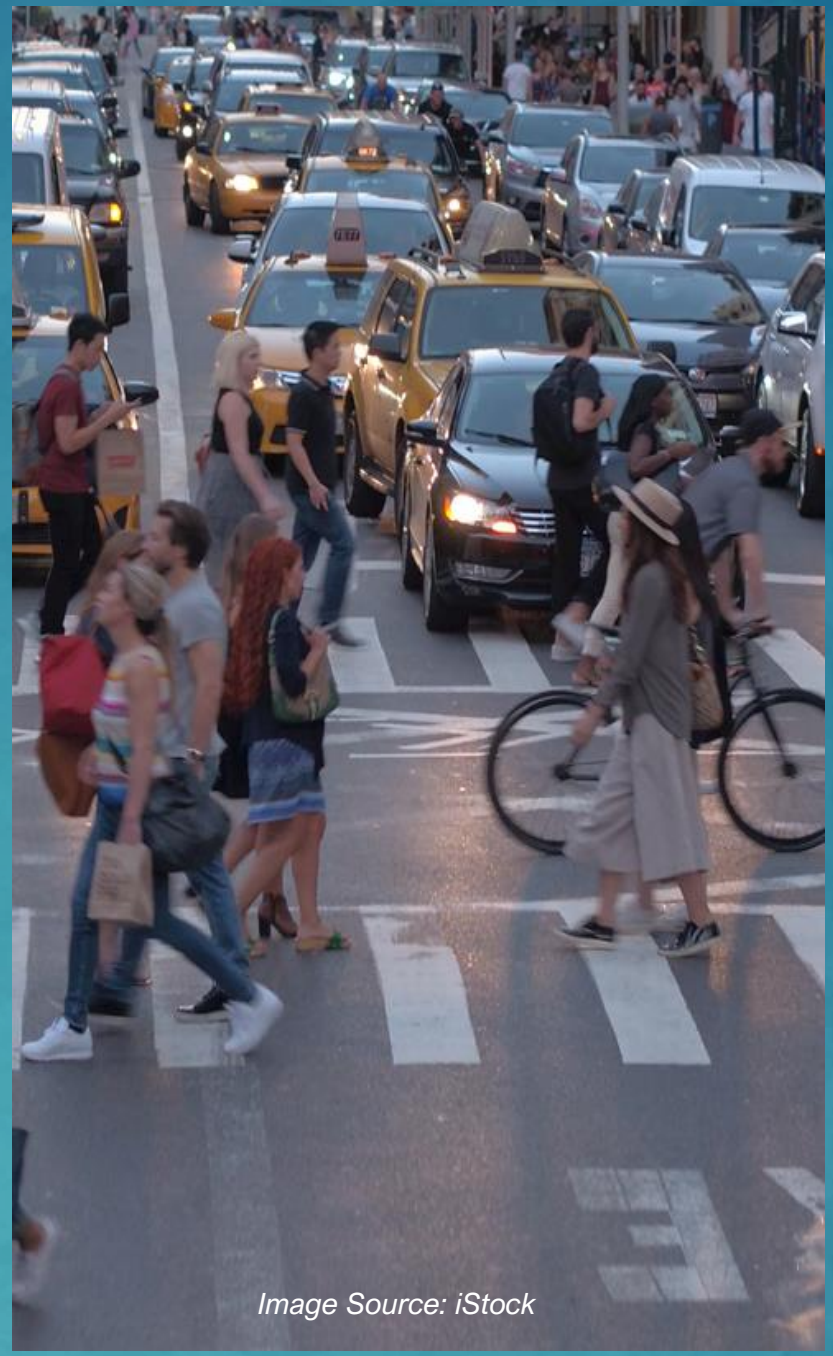

Image Source: iStock

INTERSECTION SAFETY CHALLENGE

PRIZE COMPETITION

U.S. Department of Transportation

MAY 22, 2023

U.S. Department of Transportation

WEBINAR PROTOCOL

- Please mute your audio (phone or laptop audio) during the entire webinar.
- You are welcome to ask questions via the Question and Answer (Q&A) Chat Pod during the Q&A Section.
- The webinar recording and the presentation material will be posted on the Intelligent Transportation Systems (ITS) Joint Program Office (JPO) Intersection Safety Challenge website: https://its.dot.gov/isc/.

DISCLAIMER

- Except for any statutes or regulations cited, the contents of this presentation do not have the force and effect of law and are not meant to bind the public in any way. This presentation is intended only to provide information regarding existing requirements under the law or agency policies.

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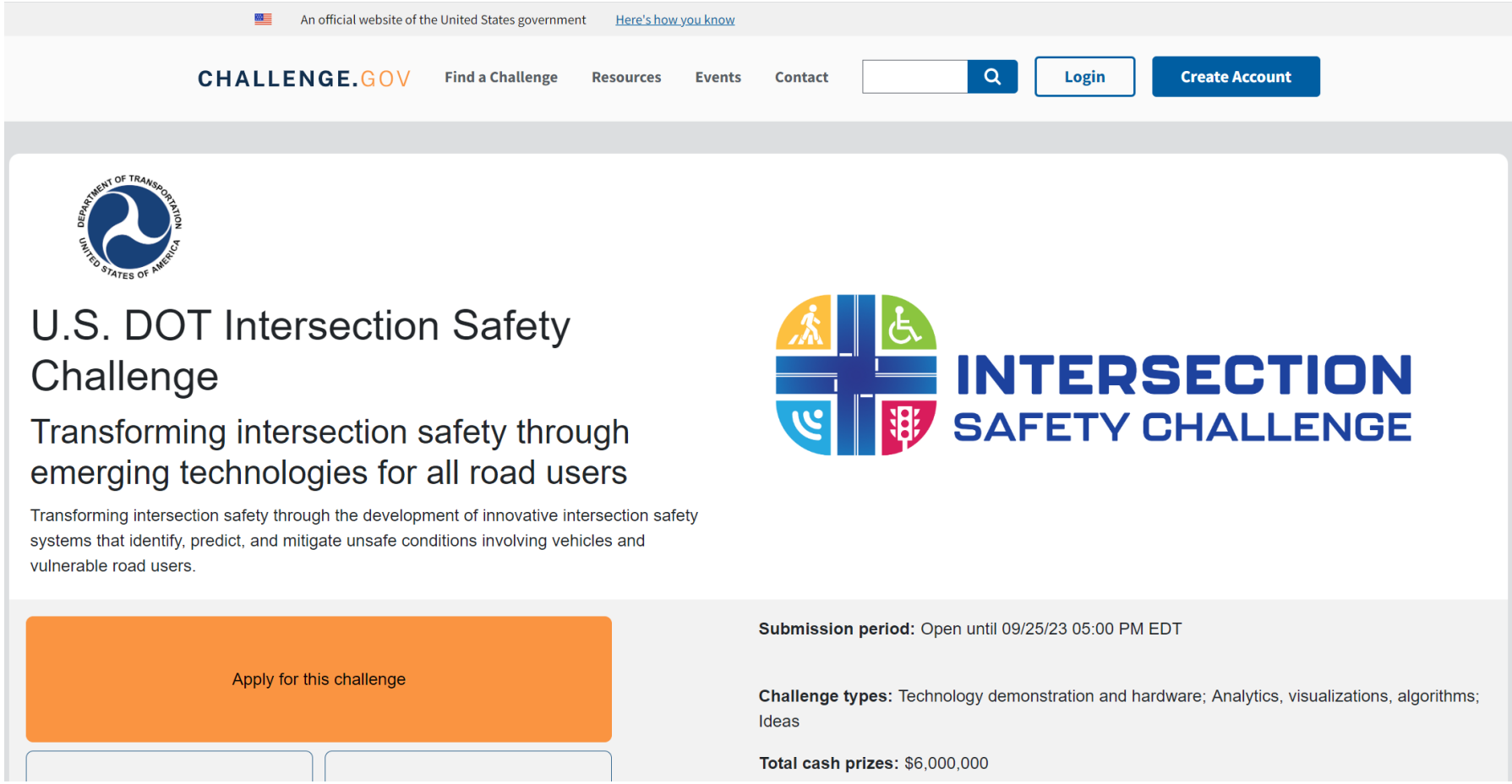
PURPOSE OF THIS WEBINAR

https://www.challenge.gov/?challenge=us-dot-intersection-safety-challenge



AGENDA

- Webinar Emcee
  - **Dr. Rachel James**, Transportation Operations Engineer, Office of Policy, Federal Highway Administration (FHWA).
- Introduction
  - **Mr. Egan Smith**, Managing Director, Intelligent Transportation Systems (ITS) Joint Program Office (JPO).
- Intersection Safety Challenge Program Overview
  - **Dr. Govind Vadakpat**, Program Manager, Smart Infrastructure, ITS JPO.
- Stage 1A: Concept Assessment
  - **Dr. Chris Atkinson**, Deputy Director of Technology, Advanced Research Projects Agency – Infrastructure (ARPA-I), U.S. Department of Transportation (DOT)
  - **Mr. Brian Cronin**, Director, Office of Safety and Operations Research and Development, FHWA.
  - **Dr. Jesse Eisert**, Research Psychologist, Office of Safety and Operations Research and Development, FHWA.
- Q&A

INTRODUCTION

Mr. Egan Smith, Managing Director, ITS JPO

INTERSECTION SAFETY IS A GROWING ISSUE, ESPECIALLY FOR VULNERABLE ROAD USERS

Intersection Crashes

Each year, roughly one-quarter of traffic fatalities and about one-half of all traffic injuries in the United States are attributed to intersections.[1]

Rising Vulnerable Road User Deaths

Vulnerable road user fatalities are on the rise with pedestrian fatalities up 13% and pedalcyclist fatalities up 2% in 2021 compared to 2020.[2]

[1] https://highways.dot.gov/safety/intersection-safety/about

[2] https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813435

INTERSECTION SAFETY CHALLENGE PROGRAM

- **VISION: Transform intersection safety** through the innovative application of emerging technologies including machine vision, sensor fusion, and real-time decision-making to identify and mitigate unsafe conditions involving vehicles and vulnerable road users.
- **PRIZE COMPETITION:** Encourage teams of innovators and end-users to develop and test their intersection safety systems to compete for prizes.
- **ALIGNMENT WITH DOT PRIORITIES:**
  - The concept aligns with the **National Roadway Safety Strategy (NRSS)** and supplements current and existing U.S. DOT **safety** and **equity** efforts (e.g., FHWA Complete Streets, Proven Safety Countermeasures, etc.).

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INTERSECTION SAFETY CHALLENGE PROGRAM OVERVIEW

Dr. Govind Vadakpat, Program Manager, Smart Infrastructure, ITS JPO

PROPOSED SOLUTION:

LEVERAGE EMERGING TECHNOLOGIES TO IMPROVE INTERSECTION SAFETY AT SCALE IN A NEW WAY.

Data Fusion Utilizing Existing and Emerging Sensors

Emerging, low-cost sensors can be deployed at intersections for **improved sensing of vulnerable road users**. Data from these sensors can be fused and used in new ways by AI.

Artificial Intelligence /Machine Learning

AI/ML can fuse data from multiple machine vision sensing modalities rapidly to **improve situational awareness** and **anticipate potential conflicts**.

Low-Cost, High-Value Opportunity for Integration at Scale

These existing technologies have not been deployed together at intersections broadly, offering an opportunity ripe for **innovative collaboration.**

INTERSECTION SAFETY SYSTEM (ISS) CONCEPT

- Emerging, low-cost sensors (e.g., cameras, radar, LiDAR, infrared) deployed at intersections to improve sensing.
- Multi-sensor data fusion/analytics to improve situational awareness and anticipate safety threats.
- System issues warnings or modifies control settings to improve safety.

Concept Illustration: Intersection Safety System

Safety systems informed by data fused from multiple sensors may anticipate unsafe conditions, e.g., a vehicle turning right in potential conflict with pedestrian pushing a stroller (lower right).

Image Source: U.S. DOT.

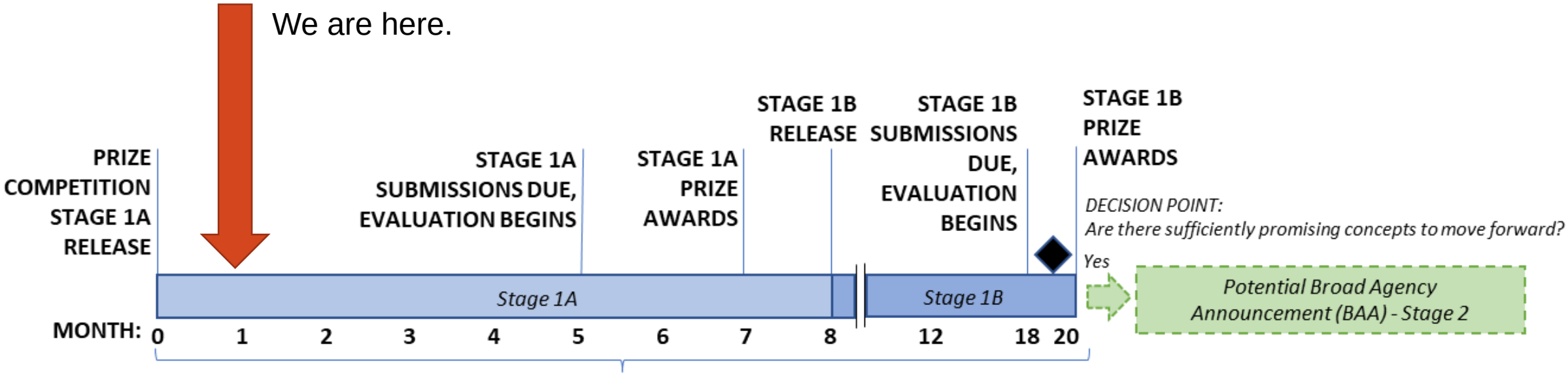
THE INTERSECTION SAFETY SYSTEM (ISS) CONCEPT IN CONTEXT

- A technology-based approach is one of many potentially cost-effective approaches for improving safety at intersections.
  - Cost-effective approaches are *critical* to support equity and accessibility considerations.
- Intersection Safety System (ISS) research would augment (but does not substitute for) a comprehensive suite of intersection safety considerations.
  - Data from an ISS can support designing tailored improvements to intersection geometry and local intersection safety policy.
- An ISS would support current and future U.S. DOT safety and equity efforts.

CHECK OUT THESE RESOURCES TO LEARN MORE

- **Intersection Safety Challenge Website**
  - https://its.dot.gov/isc/
- **Enhancing the Safety of Vulnerable Road Users at Intersections:**
  - **Request for Information (RFI)** (released September 16, 2022): Link on the Federal Register.
  - **RFI Summary Report** (February 2023): FHWA-JPO-23-986.
  - **Webinar** (March 17, 2023): presentation material and recording.

PRELIMINARY STRUCTURE & SCHEDULE



Stage 1 Prize Competition (Up to $6,000,000 in total prizes)

Note: Dates are subject to change with any changes being posted on the DOT's Challenge website accordingly.

PRIZE COMPETITION OVERVIEW

- ***Stage 1A: Concept Assessment***
  - Develop an ISS Concept Paper.
  - Up to ten prizes may be awarded (up to $100,000 each).
  - The total value of all Stage 1A prizes will be a maximum of $1,000,000.
  - Winners may advance to Stage 1B.
- ***Stage 1B: System Assessment and Virtual Testing***
  - Develop, train, and improve algorithms for the detection, localization, and classification of vulnerable road users and vehicles using DOT-supplied sensor data collected at a controlled test intersection.
  - The total value of all Stage 1B prizes will be a maximum of $5,000,000.
  - *Additional details to come following Stage 1A awards.*

POTENTIAL PROTOTYPE, FIELD TEST AND DEMONSTRATION (After Stage 1 Prize Competition)

- Potential Broad Agency Announcement (BAA) Solicitation – To develop, test, and demonstrate one or more prototype ISS in a real-world environment.
  - Prototype Test
    - Prototype systems assessed at a controlled environment (DOT facility).
    - Limited field testing based simple use cases at intersections.
  - Field Test and Demonstration
    - Develop, test, and demonstrate Minimum Viable Product (MVP) capability.
    - More complex field testing at site identified test bed(s).
    - Prepare MVP for real-world demo leading to commercialization and deployment.

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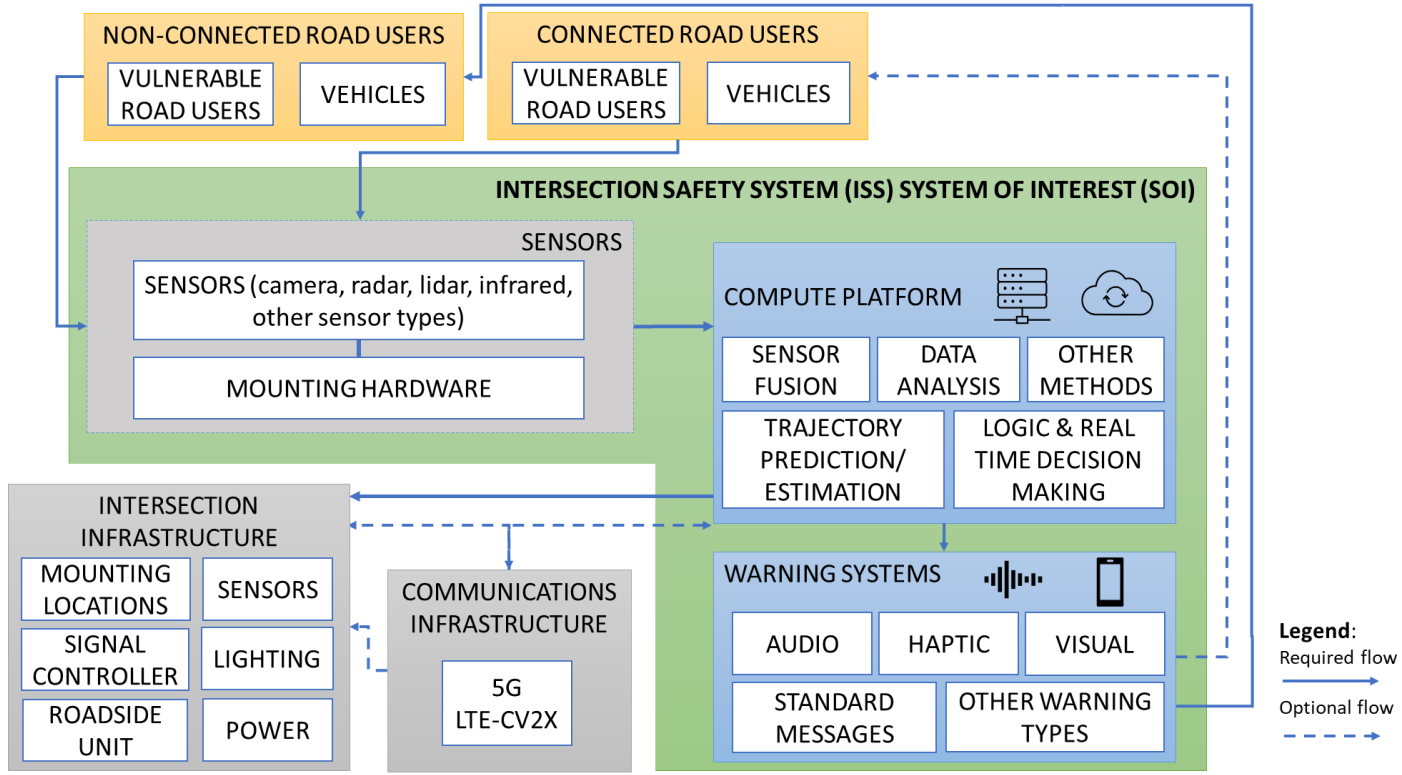
STAGE 1A: CONCEPT ASSESSMENT EXPECTATIONS

Dr. Chris Atkinson, Deputy Director of Technology,
ARPA-I, U.S. DOT

THE INTERSECTION SAFETY SYSTEM (ISS) CONCEPT

- ISS Costs
  - As an overarching goal, the Challenge seeks ISS solutions that utilize core componentry costing in the order of $10,000 (or less) per intersection at scale within 10 years following the end of the competition.
- ISS Deployment Scope
  - The Challenge seeks one or more interoperable ISS solutions that can collectively address a large proportion of our nation's intersections and make a significant improvement in overall road safety.



* CV2X: Cellular Vehicle-to-Everything

Image Source: U.S. DOT.

STAGE 1A OVERVIEW

- **Stage 1A (Concept Assessment):** Participants submit an ISS Concept Paper. Up to ten (10) well-formed, differentiable concepts scoring highest against a set of uniform judging criteria will receive a Challenge prize and may advance to the next part of the Stage 1 Prize Competition.
- **Stage 1A submission period**: Open until 09/25/23 05:00 PM EDT.
  - Up to 10 prizes may be awarded in Stage 1A, with a maximum of one prize awarded per individual or team.
  - Each Stage 1A prize will have a maximum of **$100,000.**
  - The total value of all Stage 1A prizes will be a maximum of **$1,000,000.**

STAGE 1A EXPECTATIONS
Minimum ISS Capabilities (1 of 2)

- Sensing and perception
  - Detect, localize, and classify multiple individual vehicles and vulnerable road users simultaneously in real-time, while maintaining privacy protections.
- Vehicle and road user movement prediction
  - Predict the movements or trajectories of multiple vehicles and vulnerable road users in and near the intersection in real-time.
- Data handling and storage
  - Manage the volume, bandwidth, and variety of data required to enable all minimum capabilities.
- Wireless communications and positioning
  - A roadside unit or other form of infrastructure may be included if the proposed ISS concept utilizes some form of wireless connectivity.
  - Infrastructure-based positioning may support GPS or its equivalent.

STAGE 1A EXPECTATIONS
Minimum ISS Capabilities (2 of 2)

- Intersection control system interaction
  - Should be capable of real-time interconnection with existing modern intersection control systems (assume, at minimum, compliant with prevailing industry standards and protocols).
- Warning system
  - Must feature a real-time vulnerable road user and vehicle warning system (or both vulnerable road user and vehicle warning systems).
- Interoperability and extensibility considerations
  - Interoperability considerations include integration with existing systems at intersections as well as coordination among neighboring intersections with a deployed ISS.
  - Must not degrade the underlying existing safety of any intersection at which it is deployed.
- Event reporting for performance measurement and system improvement
  - Interaction between the ISS and the intersection control system must support recording both crash and near-miss events, including tagging those events to support further safety and operations analysis at the central traffic management system.

STAGE 1A EXPECTATIONS
High-Level Requirements

- Anticipate potentially unsafe conditions.
- Provide warnings to vehicles and vulnerable road users reliably (including those who are not wirelessly connected).
- Maintain consistent and reliable system operation and performance.
- Provide a cost-effective safety solution.
- Have a feasible path to rapid commercialization and deployment within 10 years.
- Allow upgradeability and modularity as well as interoperability and data transfer.
- Monitor performance of the system.

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STAGE 1A: CONCEPT ASSESSMENT

JUDGING CRITERIA

Mr. Brian Cronin, Director, Office of Safety and Operations Research and Development, FHWA

STAGE 1A JUDGING CRITERIA

- Four judging criteria will be used in Stage 1A:
  - **Technical Merit**
  - **Deployment Suitability**
  - **Alignment with Challenge Vision**
  - **Participant Team Organization and Qualifications**

- All criteria have approximately the same weight. Only submissions that meet the eligibility criteria will be evaluated.

STAGE 1A JUDGING CRITERIA: Technical Merit

- Demonstrates a technically feasible and compelling path to prototype testing and development that:
  - Satisfactorily addresses all Minimum ISS Capabilities
  - Meets or exceeds all High-Level ISS Requirements
- Provides a solution for suitably robust detection, localization, and classification of both vehicles and vulnerable road users in real-time.
  - Differentiates sub-categories of vulnerable road users and vehicles.
- Has a technically feasible and compelling approach to both monitor and anticipate individual vehicle and vulnerable road user path, pace, and progress.
- Identifies the most relevant technical risks
  - Provides viable mechanisms for the avoidance, elimination, or mitigation of these risks.

STAGE 1A JUDGING CRITERIA: Deployment Suitability

- Can be readied to initiate physical system prototyping at the time Stage 2 is scheduled to begin.
  - With potential replication and deployment at scale within 10 years.
- Identifies the specific intersection conditions under which the proposed ISS could be cost-effectively deployed, including:
  - Specific types of intersection geometry/configuration, intersection control system and features, built environment and land-use, demand levels, etc.
- Provides a detailed assessment of projected ISS costs of at-scale deployment.
  - Provides evidence that ISS costs per intersection can be reduced to a level compelling enough to encourage broad nationwide deployment at high-risk intersections.
- Provides a compelling approach to interoperable deployment at scale, including:
  - The utilization of existing communication protocols, relevant standards, and a solution for communication and integration among adjacent intersections.

STAGE 1A JUDGING CRITERIA: Alignment with Challenge Vision

- The proposed ISS concept is aligned with the vision of the Challenge:

> *Transform intersection safety through the development of one or more innovative intersection safety systems that identify, predict, and mitigate unsafe conditions involving vehicles and vulnerable road users in real-time.*

STAGE 1A JUDGING CRITERIA: Participant Team Organization and Qualifications

- Team composition and leadership are clearly presented, including:
  - A single overall team leader and point-of-contact.
  - All team members (individuals and organizations).
- Team experience and qualifications with relevant technologies and systems are sufficient to:
  - Advance the concept through virtual testing.
  - Identify, describe, and mitigate ISS technical risk.
  - Accurately assess the timeline for future prototyping and deployment of the candidate ISS.

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STAGE 1A: CONCEPT ASSESSMENT

HOW TO ENTER

Dr. Jesse Eisert, Research Psychologist, Office of Safety and Operations Research and Development, FHWA

HOW TO ENTER STAGE 1A (1 OF 2)

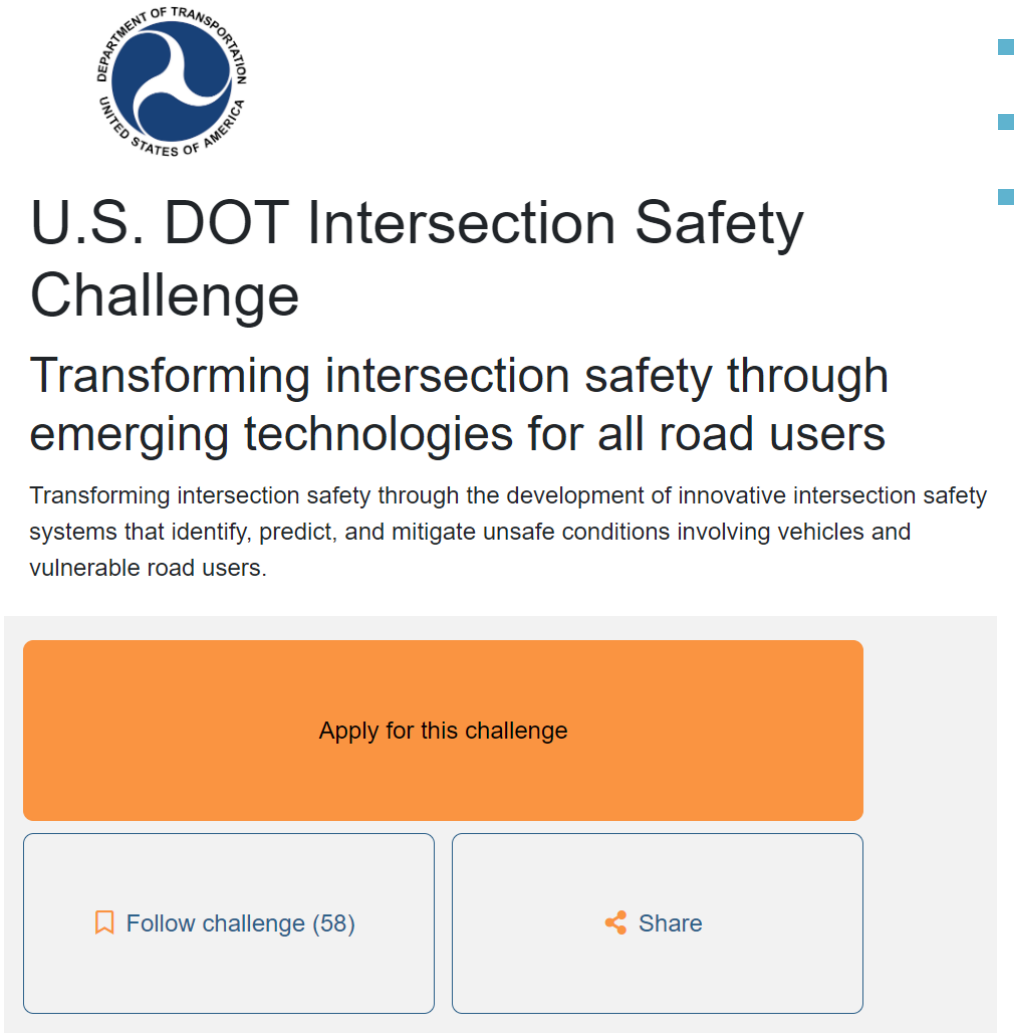
- **Concept Paper**: All submitted materials must be contained in a single PDF file consisting of a maximum of **15 pages** and no larger than **8MB** in total file size.
  - A cover page, if included, will count against the 15-page limit.
  - Submissions over the 15-page limit or in excess of 8MB in total file size will not be accepted and will be ineligible for prizes.
- There is no required format for this submission.
- Text in the Concept Paper may be no smaller than **11-point font** size with **1" margins**.
- Text in tables or graphics of any font size are acceptable provided they are legible.

HOW TO ENTER STAGE 1A (2 OF 2)

- **TIP**: The system times out after 20 minutes of inactivity, so be sure to click "Save Draft" often to save your work. The submission package consists of a single Concept Paper uploaded to https://www.challenge.gov/?challenge=us-dot-intersection-safety-challenge

- Please contact safeintersections@dot.gov if you experience any technical difficulties while submitting your proposal before the deadline.
  - Emails received after 5:00 PM ET may not receive a response until regular business hours resume.

STEPS TO SUBMIT THE CONCEPT PAPER



- Create a Challenge.Gov Account.
- Log in to Challenge.Gov.
- Click the orange "Apply for this Challenge" at the top of the Challenge page.
  - **Provide general submission information.**
    - Title, Brief Description, and Description
  - **Upload your documents.**
    - *Step 1:* Choose File
    - *Step 2:* Rename your file (optional)
    - *Step 3:* Attach File
  - **Complete your submission.**
    - "Acknowledgement of Rules, Terms & Conditions"
    - "Review and Submit"
    - "Submit"

RULES

- Please refer to the “U.S. DOT Intersection Safety Challenge: Stage 1A (Concept Paper) Prize Competition Description for Participants” document on the “Resources” tab of the Challenge.gov page for the following rule categories:
  - Eligibility
  - Liability and Insurance Requirements
  - Payment of the Prize
  - Confidential and Business Information
  - Representation, Warranties, and Indemnification
  - Intellectual Property of Submissions

ELIGIBILITY

- The Challenge is open to individuals and teams from the academic, research, and business communities, as well as state and local agencies[1].
- If any potential prize winner is found to be ineligible for any reason, including for failure to comply with Challenge rules, an alternate winner may be selected.
- Federal funds:
  - Federal grantees or recipients of Federal cooperative agreements may not use Federal funds to develop submissions for this Challenge unless consistent with the purpose of their grant award or cooperative agreement; and
  - Federal contractors may not use Federal funds from a contract to develop prize competition applications or to fund efforts in support of a prize competition submission.

[1] All participants (individuals, private sector entities, and public agencies or organizations) must meet the eligibility requirements in Section VI of the "U.S. DOT Intersection Safety Challenge: Stage 1A (Concept Paper) Prize Competition Description for Participants".

Q&A

Dr. Rachel James

STAY CONNECTED

- Go to the **Intersection Safety Challenge** website for more information:
  - https://its.dot.gov/isc/
- Go to the **Challenge.gov** website to apply for the Intersection Safety Challenge:
  - https://www.challenge.gov/?challenge=us-dot-intersection-safety-challenge
- For more information about the **ITS Joint Program Office (JPO)**, visit:
  - https://www.its.dot.gov/
- Sign up for the ITS JPO email list and/or follow the ITS JPO social media for upcoming events:
  - https://www.its.dot.gov/contacts/mailinglist.htm