

Official Rules of Phase 1: Concept Paper Contest

Introduction:

The Challenge will consist of contestants from 2 groups: Haptic Providers and Haptic Development Teams.

For Haptic Providers

The Concept Paper Contest invites all eligible contestants to submit a concept paper outlining their haptic interface products (types of actuators, sensors, software/platform, etc.) that will be available to the Haptic Development Teams, their proposed level of support, services and approach for the up to 3 Haptic Development Teams, with whom they can team for this challenge. Haptic Providers' concept papers will be reviewed by a panel of subject matter experts; the Judging panel will evaluate and select up to 3 Haptic Providers to be invited to the Challenge Kickoff and Teaming Webinar. Contestants selected by the Judging panel will be eligible to move forward to the Teaming Contest.

For Haptic Development Teams

The Concept Paper Contest invites all eligible contestants to submit a concept paper outlining their proposed team's solution, approach, capabilities, knowledge and skills for this challenge. Haptic Development Teams' concept papers will be reviewed by a panel of subject matter experts; the Judging panel will evaluate and select up to 9 Haptic Development Teams to be invited to the Challenge Kickoff and Teaming Webinar. Contestants selected by the Judging panel will be eligible to move forward to the Teaming Contest.

Important Dates:

Concept Paper: Launch of March 18, 2019 to Papers due April 22, 2019; Notify contestants by May 3, 2019

How to Enter:

Visit Challenge.gov, review the series of contests in the Haptic Interfaces for Public Safety Challenge.

- Review the summary of the PSCR provided 3 virtual environments, included on the Challenge website
- Complete the submission requirements for the Concept Paper Contest; submit the required concept paper as your entry and register as a contestant via Challenge.gov by the required date.
- Additional information on how to complete a contestant entry is available at: <https://www.challenge.gov/how-it-works/>
- Contestants may only submit a concept paper for either the Haptic Provider or the Haptic Development Team within the Concept Paper Contest.

Concept Paper Content Requirements

The Concept Paper must conform to the following content requirements:

SECTION (Start each section on a new page)	PAGE LIMIT	HAPTIC PROVIDER DESCRIPTION	HAPTIC DEVELOPMENT TEAM DESCRIPTION
Cover Page and Abstract (required)	1 page maximum	<p>Please include:</p> <ul style="list-style-type: none"> Contestant's Name (Team, Organization or Company Name) and list of individual team member(s), Contestant's Location (City, State/Region and Country). Official Representative and their preferred contact information. <p>Describe succinctly (500-word MAXIMUM):</p> <ul style="list-style-type: none"> The unique aspects of the contestants' capabilities and the potential impact that the proposed approach could have in achieving the goals of the challenge. Note: Do not include proprietary or sensitive information in this summary. 	<p>Please include:</p> <ul style="list-style-type: none"> Contestant's Name (Team, Organization or Company Name) and list of individual team member(s), Contestant's Location (City, State/Region and Country). Official Representative and their preferred contact information. <p>Describe succinctly (500-word MAXIMUM):</p> <ul style="list-style-type: none"> The unique aspects of the contestants' approach and the potential impact that the proposed approach could have in achieving the goals of the challenge. Note: Do not include proprietary or sensitive information in this summary.
Project Description (required)	4 pages maximum	<p>Addressing the scoring criteria should be your primary objective, therefore, create your concept paper to address the criteria. Below are a few options to consider:</p> <ul style="list-style-type: none"> The contestant's knowledge, skills, and capabilities as they relate to the goals of the challenge. A description of hardware, services and level of support the contestant plans to provide each matched Haptic Development Team per phase 	<p>Addressing the scoring criteria should be your primary objective, therefore, create your concept paper to address the criteria. Below are a few options to consider:</p> <ul style="list-style-type: none"> The contestant's knowledge, skills, and capabilities as they relate to the goals of the challenge. The contestant's proposed solution for meeting the contests' objectives.

SECTION (Start each section on a new page)	PAGE LIMIT	HAPTIC PROVIDER DESCRIPTION	HAPTIC DEVELOPMENT TEAM DESCRIPTION
		<ul style="list-style-type: none"> ● The contestant's proposed solution for meeting the contests' objectives. ● The competitive advantage offered by the contestant's approach or solution. 	<ul style="list-style-type: none"> ● The competitive advantage offered by the contestant's approach or solution.
Resume Information for Key Team Members (required)	3-5 pages	The key team members and why they are well-suited to accomplish the project, with supporting resume information to support their qualifications, skills and capabilities.	The key team members and why they are well-suited to accomplish the project, with supporting resume information to support their qualifications, skills and capabilities.
Informational Sheet or Concept Sketches and/or Mock Up Video (required)	1-3 page(s) 1-2 min	A relevant product information sheet (1-3 pages) in a PDF format for haptic hardware and/or software	A concept sketch (1-3 pages) in a PDF format, and/or a single, 1-2 min, video may be provided through an accessible online link within the application materials.
Letters of Support (optional)	1 page max. per Letter of Support	You may attach up to 3 letters of support from public safety entities (1-page maximum per letter). Multi-page Letters of Support are not allowed, any extra pages will not be reviewed.	You may attach up to 3 letters of support from public safety entities (1-page maximum per letter). Multi-page Letters of Support are not allowed, any extra pages will not be reviewed.

NIST makes an independent assessment of each Concept Paper based on the evaluation criteria. NIST will not review or consider incomplete Concept Papers. During the review, each subject matter expert and Judging panel member will review entire concept papers to which they are assigned. The review is not done in sections with different reviewers responsible for different assigned sections. Therefore, it is not necessary to repeat information in every part of the concept paper. Do not include sensitive materials in the concept paper, for example personally identifiable information like social security numbers, business sensitive information like tax id numbers, etc.

Concept Paper Evaluation Criteria

Haptic Providers' Concept Papers are evaluated based on the following criteria:

Criterion 1: Strategic Alignment & Technical Outcome (50%)

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 how they propose to support the Haptic Development Teams; the likelihood that successful implementation of the proposed solution will have a significant real-world impact.
- Technical Outcome – 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.

Criterion 2: Feasibility & Team (50%)

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. (b) The extent of the applicants' prior experience and the quality of the results achieved in leading programs similar in nature to the purpose, scope, etc.
- Products – Contestant(s)'s planned offering of haptic interface products (types of actuators, sensors, software/platform) to the Haptic Development Teams and how the products align with the challenge goals.
- Approach – Contestant(s)'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.

Haptic Development Teams' Concept Papers are evaluated based on the following criteria:

Criterion 1: Strategic Alignment & Technical Outcome (50%)

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 firefighter, EMS and law enforcement scenarios; the likelihood that successful implementation of the proposed solution will have a significant real-world impact.
- Technical Outcome – 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.

Criterion 2: Feasibility & Team (50%)

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. (b) The extent of the applicants' prior experience and the quality of the results achieved in leading programs similar in nature to the purpose, scope, etc.
- Approach – 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.

Both groups of Concept Papers will be evaluated based on the criteria above. Each Concept Paper will be reviewed by at least two subject matter expert reviewers and the Judging panel members and be assigned a score for each criterion, 0-10 for each criterion. Scores will not be provided to the contestants. In the case of a tie, the judging panel will make a determination on the winners invited to compete in Phase 2.

Scoring for Concept Papers

10	Contestant has strong potential to aid in the achievement of the goals of the challenge
1-9	Varying degrees of certainty the contestant may have the potential to aid in the achievement of the goals of the challenge
0	Contestant does not have the potential to aid in the achievement of the goals of the challenge

Weighting of Criteria for Concept Papers

Criterion 1: Strategic Alignment & Technical Outcome	50%
Criterion 2: Feasibility & Team	50%

Official Rules of Phase 2: Teaming Contest

Introduction:

The Teaming Contest will be open to the winners of the Concept Paper Contest, up to 3 Haptic Providers and up to 9 Haptic Development Teams. During the Challenge Kick-off and Teaming Webinar, each of the Haptic Providers will present their haptic interface products, proposed level of support, services and approach to the Haptic Development Teams. The Haptic Development Teams will present their concept, team composition, and background. The contestants will then have two weeks to sign teaming agreements between the Haptic Development Teams and Haptic Providers; agreements will be reviewed for completeness by the judge panel. A Haptic Provider that does not successfully team with at least one Haptic Development Team will not be eligible to advance in the competition.

Alternatively, a Haptic Development Team may decide not to team with a Haptic Provider. They will not be eligible for the \$15,000 of combined support awarded through the Haptic Provider during Phase 2 and Phase 4 of the challenge. Haptic Development Team(s) deciding to go solo must submit a letter documenting how they will proceed without Haptic Provider support. Successful contestants selected by the judge panel will be eligible to move forward to the next contest, Demonstration of Haptic Interface Prototypes in Virtual Reality. Additionally, up to 3 Haptic Providers will advance in the competition and will

receive prize awards of \$7,500 per matched Haptic Development Team; up to 9 Haptic Development Teams will advance in the competition and each will receive \$2,500 for prototype development.

The teaming agreements will be reviewed for completeness by the Judging panel. Successful contestants will be eligible to move forward to the next contest, Demonstration of Haptic Interface Prototypes in Virtual Reality.

Important Dates:

Challenge Kickoff and Teaming Webinar May 7, 2019; Submit Teaming Agreements by May 17, 2019; Notify contestants by May 23, 2019

How to Enter:

- Invited contestants will receive an email with information on how to access the prize challenge platform.
- Invited contestants will also receive an email with instructions on the topics that should be covered in their submitted Teaming Agreement.
- Document the agreed upon teaming arrangement between the Haptic Development Team and Haptic Provider or document the Haptic Development Team's decision to move forward through the contest without teaming.
- Contestants invited to this phase will be required to register for a NIST secure file transfer account. Information on this account and how it works can be accessed here: <https://nfiles.nist.gov>.
- Teams must submit their signed finalized teaming agreement documents through NIST's secured file system, N-Files, by May 17, 2019.

Kick Off Webinar Requirements

- Each invited contestant must have their Official Representative attend the Challenge Kick-off and Teaming Webinar on May 7, 2019 (time TBD). Other team members are invited to attend.
- Each of the up to 3 Haptic Providers will have 10 minutes of the challenge kick-off webinar to share information about their haptic interface products (types of actuators, sensors, software/platform, etc), their proposed level of support, services and approach that they would offer the Haptic Development Teams with whom they teamed. The Haptic Provider may send up to 5 slides to psprizes@nist.gov to be included in the webinar. Slides are due by May 6, 2019 at 5PM MT.
- Each of the up to 9 Haptic Development Teams will have 3 minutes of the challenge kick-off webinar to introduce their team. The Haptic Development Team may send 1 slide to psprizes@nist.gov to be included in the webinar. The slide is due by May 6, 2019 at 5PM MT.

Teaming Agreement Requirements

- If the Haptic Development Team elects to team with a Haptic Provider, both the Haptic Development Team and Haptic Provider need to sign their teaming agreement and submit it by the deadline.
- If the Haptic Development Team elects to proceed through the competition without teaming with a Haptic Provider, they must still indicate their decision and share their plan on how they plan to complete the objectives from the Challenge in a letter by the deadline.
- Haptic Providers may team with up to 3 Haptic Development Teams. They will indicate their participation with a Haptic Development Teams through their signature on the teaming agreements.
- PSCR will provide the platform for the Challenge Kickoff and Teaming Webinar for Haptic Providers and Haptic Development Teams to introduce themselves and share their ideas, background, and capabilities, but PSCR will not arbitrate, intervene, advise on, or resolve any matters between teams.

Evaluation Criteria and Judging:

PSCR will initially screen submissions for completeness and compliance with the objectives and Official Rules of this contest. A submission that fails to meet the compliance criteria 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 the Judging panel. An evaluation of a submission by the Judging panel does not constitute the NIST's final determination of contestant or submission eligibility.

Scoring Criteria: Completeness and Compliance Testing (Pass/Fail)

- Each contestant entry will be reviewed to ensure the teaming agreement is completed by all applicable parties and received by the deadline.

Scoring Criteria: Solo Haptic Development Teams (Pass/Fail)

- Each letter documenting how contestant(s) opting not to team with Haptic Providers will be evaluated to assess the completeness of the contestant's proposed path forward and probability of meeting the objectives of the Challenge.

Official Rules of Phase 3: Demonstration of Haptic Interface Prototypes in Virtual Reality Contest

Introduction:

PSCR will provide the invited contestants with 3 fully functional Unreal Engine virtual environments with their corresponding scenario details (i.e., law enforcement, EMS, and fire service). Each of the environments requires a desired performance task of which the haptic interface prototypes will be tested and evaluated to determine their impact on the task. Contestants will submit a video of their prototype(s) highlighting the functionality and a write-up with instructions on use of the prototype for pass/fail evaluation. The subject matter experts and Judging panel will evaluate the prototypes and invite contestants with passing entries to demonstrate their prototypes at the 2019 Stakeholder Meeting. A minimum of 2 prototypes are required for submission and demonstration at the meeting, however, contestants will be receiving feedback from first responders in attendance and would benefit from showcasing as many solutions as possible.

Haptic Providers

If at least 1 of the Haptic Development Teams supported by a Haptic Provider is invited to demonstrate, the Haptic Provider will also be invited to attend the 2019 Stakeholder Meeting. Up to 3 Haptic Providers may be invited to the 2019 Stakeholder Meeting. At the 2019 Stakeholder Meeting, Haptic Providers will have the opportunity to demonstrate their products. Also, they will provide support to their matched Haptic Development Teams during the demonstration of their prototypes. No official prize challenge judges will evaluate the prototypes. Invited Haptic Providers will receive travel funding to attend the 2019 Stakeholder Meeting, up to \$5,000 for two team members. All contestants invited to demonstrate at the 2019 Stakeholder Meeting will also be deemed eligible to move forward to the next contest, Evaluation Round 1: Haptic Interface Prototypes in Virtual Reality.

Haptic Development Teams

Each Haptic Development Team's haptic interface prototype(s) must meet UI/UX and functional elements based on the desired objectives in the 3 scenarios, for example, situational awareness for law enforcement, navigation for fire, and vital monitoring for EMS. Based on the compliance testing and functional evaluation, up to 9 Haptic Development Teams will be invited to demonstrate at the 2019 Stakeholder Meeting.

At the 2019 Stakeholder Meeting, invited the Haptic Development Teams will have their prototypes available for demonstration and feedback from the attending public safety community; there will be no official judging during the stakeholder meeting. Invited Haptic Development Teams will receive travel funding to attend the 2019 Stakeholder Meeting, up to \$5,000 for two team members. All contestants invited to demonstrate and that attend the 2019 Stakeholder Meeting will also be deemed eligible to move forward to the next contest, Evaluation Round 1: Haptic Interface Prototypes in Virtual Reality.

Important Dates:

Demonstration of Haptic Interface Prototypes in Virtual Reality: Start Prototype Development May 24, 2019;
Submissions due June 26, 2019; Notify contestants by July 2, 2019; Demo July 9-11

How to Enter:

- Complete the research and coding required for your haptic interface prototype(s)' design.
- Ensure that code is compliant with the best practices for virtual environments, for example <https://docs.unrealengine.com/en-us/Platforms/VR/ContentSetup>.
- Provide your entry to PSCR for compliance testing and functional evaluation.
- The contestants with compliant designs, and the greatest functionality will advance to the next contest in the challenge.

Evaluation Criteria and Judging:

PSCR will initially review submissions for compliance with the objectives and Official Rules of this contest. A submission that fails to meet the compliance criteria will be disqualified and will be ineligible to compete in this contest.

Scoring Criteria: Compliance Testing (Pass/Fail)

- The virtual environments were not modified other than to integrate the haptic device.
- The haptic interface prototype provides feedback to the user based on interactions within the virtual scenario.
- The haptic interface is integrated into the virtual environment and is not triggered by external user input (e.g., controller, mobile phone app).

Official Rules of Phase 4: Evaluation Round 1: Haptic Interface Prototypes In Virtual Reality

Introduction:

Haptic Providers

The contestants are encouraged to incorporate feedback from the 2019 Stakeholder Meeting and collaborate with any external public safety mentors and advisors for their haptic interface prototypes. The contestants will submit their haptic interface prototypes paired with the 3 virtual environments for evaluation by the Judging panel. Up to 3 Haptic Providers will be invited to the Evaluation Round 2: Haptic Interface Prototypes at a Firefighter Navigation Course contest. If at least 1 of the Haptic Development Teams supported by a Haptic Provider was invited to move forward to Phase 5, the Haptic Provider will also be invited to attend the final contest. Additionally, up to 3 Haptic Providers will be eligible for a prize award of \$7,500 per Haptic Development Team supported that advances to Phase 5.

Haptic Development Teams

The contestants are encouraged to incorporate feedback from the 2019 Stakeholder Meeting and collaborate with any external public safety mentors and advisors for their haptic interface prototypes paired with the 3 VR environments. Contestants will submit their prototype(s) for evaluation by the judge panel. Up to 9 Haptic Development Teams will be invited to the Evaluation Round 2: Haptic Interface Prototypes at a Firefighter Navigation Course contest. Invited teams will receive firefighter PPE to embed their haptic interface prototype for the final contest of the challenge.

Invited Haptic Development Teams will receive travel reimbursement to attend the firefighter navigation course and live competition, up to \$4,000 for two team members. Up to 9 Haptic Development Teams will receive \$2,500 in cash prizes and firefighter PPE if selected to advance to Phase 5. PSCR will also rank and award the top 3 Haptic Development Teams based on Evaluation Round 1 who will be eligible to receive additional cash prizes – 1st \$7,500, 2nd \$5,000, 3rd \$2,500.

Important Dates:

Phase 4: Evaluation Round 1: Haptic Interface Prototypes in Virtual Reality: Phase commences July 9, 2019; 3 Prototypes due by August 23, 2019; Notify contestants by September 10, 2019

How to Enter:

- Contestants should revisit the prize challenge website for details and links to the 3 virtual reality environments and the corresponding scenarios and specific tasks. Invited contestants will receive an email to confirm their access to the 3 PSCR virtual environments, and details regarding each scenario.
- Each contestant will independently integrate their haptic interface prototypes (i.e., law enforcement, EMS, and fire service) in the 3 PSCR virtual environments and complete a series of compliance and functional evaluations to assess the effectiveness of their design.
- To document these independent compliance tests and functional evaluations, each contestant will submit 3 haptic prototypes, source code, an executable build, and a readme file (e.g., instructions on use) to PSCR for test and evaluation of their work by the subject matter experts and the Judging panel.
- PSCR will keep all prototypes submitted during Phase 4 for public safety demonstration purposes. Contestants will be required to develop a separate prototype embedded in PPE for Phase 5, Evaluation Round 2: Haptic Interface Prototypes at a Firefighter Navigation Course.

Evaluation Criteria and Judging:

Phase 4 consists of testing the haptic prototypes in 3 virtual scenarios. Each scenario will be judged individually based on the scoring criteria below. The scenario scores will be averaged together for a final Phase 4 score. To advance to Phase 5, a contestant must score at least 60 points on the final score.

PSCR will initially review submissions for compliance with the objectives and Official Rules of this contest. A submission that fails to meet the compliance criteria 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 the Judging panel. A contestant must have at least two of their haptic prototypes pass the compliance test. An evaluation of a submission by the Judging panel does not constitute the NIST's final determination of contestant or submission eligibility.

Scoring Criteria #1: Compliance Testing (Pass/Fail)

- All required components of Phase 4 were submitted (i.e., 3 haptic prototypes, source code, executable build, and readme file).
- The virtual environments were not modified other than to integrate the haptic device.
- The haptic interface prototype provides feedback to the user based on interactions within the virtual scenario.
- The haptic interface is integrated into the virtual environment and is not triggered by external user input (e.g., controller, mobile phone app).
- Contestants must have at least 2 of their 3 haptic prototypes pass the compliance test.

Scoring Criteria #2: Efficiency and effectiveness of Haptic Interface Prototypes (Max 60/100)

- Each participant will assess the ability of the contestants' submissions in assisting with the scenarios' tasks within the PSCR virtual environments. These tasks are assigned to test the capabilities of the haptic interface prototypes and to measure their

impact on completing the objectives. participant will provide feedback on any environmental errors in the PSCR provided scenarios potentially impacting the metrics. Scoring will include two components:

- Completion of objectives (e.g. situational awareness, monitor patients' vitals, navigate to victim), including feedback from participant on impact of haptic interface (e.g. gaze direction for situational awareness).
- Cumulative task time; how long did it take to complete the objectives in the scenarios
- The quality of the data representation (e.g., blood pressure, route to victim, threat location) integrated into the haptic interface prototypes:
 - Data enables users to make decisions
 - Data interfaces with operational tasks
- Participant will rate how effective the haptic prototype aided in completion of the task.
 - Effectiveness of the data analysis
 - Ability to calculate scenario parameters (i.e., threat location, navigational routes, vitals)
 - Convey task information through the haptic interface

Scoring Criteria #3: User satisfaction of haptic interface prototypes (Max 40/100)

- Integration of key data into the haptic interface prototypes that supports critical elements of the public safety mission: reviewers will evaluate each contestant's demonstrated knowledge of public safety requirements, missions, operations, and tasks.
- The haptic prototype is intuitive and does not cause physical discomfort. The device should not interfere with the participant's primary task.

Official Rules of Phase 5: Evaluation Round 2: Haptic Interface Prototypes at Firefighter Navigation Course

Introduction:

Contestants' prototypes will be worn by subject matter experts and the judging panel to complete a search and rescue task at a firefighter navigation course:

For Haptic Providers

Contestants' embedded prototypes will compete in a search and rescue task at a firefighter navigation course. The haptic interface prototypes embedded in PPE will be tested and reviewed by subject matter experts, and then will be evaluated by the Judging panel. Each Haptic Provider will receive points based on the performance of the up to 3 Haptic Development Teams they support. Up to 3 Haptic Providers will compete for final prize awards, 1st Place: \$20,000; 2nd Place: \$10,000 and 3rd Place: \$5,000 and an optional prize the judge panel can elect to award for the Most Commercially Promising: business technical assistance valued up to \$3,500.

For Haptic Development Teams

Contestants' embedded prototypes will compete in a search and rescue task at a firefighter navigation course. The haptic interface prototypes embedded in PPE will be tested and evaluated by the subject matter experts and the Judging panel. Each invited

Haptic Development team will compete for up to six (6) final prize awards, 1st Place: \$25,000; 2nd Place: \$20,000; 3rd Place: \$15,000; 4th Place: \$10,000; 5th Place: \$7,500 and an optional award, the Most Commercially Promising: business technical assistance services valued up to \$3,500.

Important Dates:

For Phase 5, PSCR is currently targeting the live competition to occur November 5-7, 2019, but will be announce and finalize the dates and location of the live competition no later than September 1, 2019. Due date of the prototype embedded in PPE will commence at the start of the live competition.

How to Enter:

- Invited contestants will receive an email with information on the objectives, structure and conditions of the firefighter navigation course.
- Each contestant will independently embed their haptic interface prototype into the selected PPE.
- Each contestant's embedded prototype will be worn while subject matter experts and the Judging panel complete a search and rescue task using their haptic interface prototype.
- Participants in the live competition will be visible, and location of victim(s) will be known to the Haptic Development Teams and Haptic Providers. Haptic Development Teams will remotely control the haptic interface while subject matter experts and judges navigate the firefighter maze.

Evaluation Criteria and Judging:

PSCR will initially screen submissions for compliance with the objectives and Official Rules of this contest. A submission that fails to meet the compliance criteria 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 the Judging panel. An evaluation of a submission by the Judging panel does not constitute the NIST's final determination of contestant or submission eligibility.

On the first day of the live challenge, the subject matter experts and the Judging panel will receive a safety briefing and basic training, including a self-contained breathing apparatus (SCBA) fit, use of a firefighter airpack, and an overview and fitting of firefighter PPE. Each participant will conduct a trial search and rescue task in the firefighter navigation course. This will produce a baseline for each subject matter expert and the judging panel to measure distances and times. The Haptic Development Teams will have the opportunity to provide a short demonstration on their prototype. On the second day, each member of the judging panel will conduct 6 live tests using randomly selected prototypes. On the third day, each member of the Judging panel will evaluate the up to 3 remaining prototypes. A Q&A session for each contestant will be scheduled with the Judging panel for the afternoon. Prior to each live test, the contestants will have an allotted time to assist the participating member of the Judging panel in donning the PPE and to review instructions on its proper use.

Scoring Criteria #1: Compliance Testing (Pass/Fail)

The compliance testing includes:

- Haptic interface prototype is embedded in PPE
- Haptic interface feedback can be detected by user
- Haptic prototype does not pose a risk to the participant (e.g., impair seal on SCBA mask, expose skin to environment)

Scoring Criteria #2: Efficiency and Effectiveness of Haptic Interface Prototype (Max 50/100)

- Each participant will rate how effective the haptic prototype aided in completion of the task. These tasks are assigned to test the capabilities of the haptic interface prototypes and the calculations to complete the objectives. Participants will also provide feedback on any environmental errors in the PSCR provided scenarios potentially impacting the metrics. Scoring will include the following components:
 - Completion of objectives (i.e., navigate to victim, navigate to exit)
 - Time for completion; how long did it take to complete the scenario compared to baseline.
- The quality of the data representation (e.g., navigation) integrated into the haptic interface prototype:
 - Data enables users to make decisions
 - Data interfaces with operational tasks
- Participants will rate how effective the haptic prototype aids in the completion of the task

Scoring Criteria #3: User satisfaction of haptic interface prototypes (Max 40/100)

- Participants will evaluate the demonstrated knowledge of public safety requirements, missions, operations, and tasks, particularly how the integration of key data into the haptic interface prototypes supports the public safety mission.
- Participants will rate how effective the contestant's training/demonstration of the haptic interface prototype was in using the contestant's device.
- The haptic interface prototype is intuitive and does not cause physical discomfort. The device should not interfere with the participant's primary task.

Scoring Criteria #4: Judge Panel Q&A (Max 10/100)

Each Haptic Development Team will complete a short presentation to the Judging panel, followed by Q&A from the panel. The Judging panel will award points based on the quality of the presentation and the ability to answer the questions.

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.
- No NIST logo - submission(s) must not use NIST's logo or official seal and must not claim NIST endorsement.
- 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.
- 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 will not be accepted if they contain any matter that, in the sole discretion of NIST, is indecent, obscene, defamatory, libelous, in bad taste, or demonstrates a lack of respect for public morals or conduct.
- If NIST, in its discretion, finds any submission to be unacceptable, then such submission shall be deemed disqualified.

Judging Panel

The submissions will be judged by a qualified panel of expert(s) selected 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 and will judge the submissions according to the judging criteria identified above in order to select winners. Judges may 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 contest; or (B) have a familial or financial relationship with an individual who is a registered contestant.

The decisions of the Judging panel for the contest will be announced in accordance with the dates noted in the "Important Dates" section of these rules.

Verification of Winners

ALL CONTEST 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

Winners must comply with all terms and conditions of the Official Rules. Winning a prize is contingent upon fulfilling all requirements contained herein. The Winners will be notified by email, telephone, or mail after the date of winning results. Each 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 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 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 of a disqualification of a winner, the Department of Commerce, National Institute of Standards and Technology in their sole discretion may award the applicable prize to an alternate winner when applicable.

Eligibility Requirements:

A Participant (whether an individual, team, or legal entity) must have registered to participate and complied with all of the requirements under section 3719 of title 15, United States Code as contained herein. At the time of Entry, the Official Representative (individual or team lead, in the case of a group project) must be age 18 or older and a U.S. citizen or permanent resident of the United States or its territories. In the case of a private entity, the business shall be incorporated in and maintain a place of business in the United States or its territories.

Contestants may not be a Federal entity or Federal employee acting within the scope of their employment. NIST Associates are eligible to enter, but may not utilize NIST funding for competing in this challenge, nor are they eligible to receive a cash prize award. Individuals currently receiving PSCR funding through a grant or cooperative agreement are not eligible to apply. Previous and current PSCR prize challenge contestants are eligible to apply. Non-NIST Federal employees acting in their personal capacities should consult with their respective agency ethics officials to determine whether their participation in this Competition is permissible.

Contestants, including individuals and private entities, 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.

Multiple individuals and/or legal entities may collaborate as a group to submit a single entry and a single individual from the group must be designated as an Official Representative for each entry. That designated individual will be responsible for meeting all entry and evaluation requirements.

TEAMS:

Contest submissions can be from an individual or a team(s). If a team of individuals, a corporation, or an organization is selected as a prize winner, NIST will award a single dollar amount to the Official Representative. The Official Representative is solely responsible for allocating any prize amount among its member contestants as they deem appropriate. NIST will not arbitrate,

intervene, advise on, or resolve any matters between entrant members. It will be up to the winning Team(s) to reallocate the prize money among its member contestants, if they deem it appropriate.

Submission Rights:

Any applicable intellectual property rights to a submission will remain with the Contestant. By participating in the prize challenge, 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 contest 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. The Department of Commerce, National Institute of Standards and Technology 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.

- As part of its submission, the Contestant must provide written consent granting 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.

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.

By submitting an Entry, 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 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 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.

Additional Terms and Conditions

This document outlines the Official Rules for the *Haptic Interfaces for Public Safety* Challenge. Nothing within this document or in any documents supporting the *Haptic Interfaces for Public Safety* 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.

Contest Subject to Applicable Law

All contests 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 contest. 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 contest.

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 contest constitutes each winner's consent to the Department of Commerce, National Institute of Standards and Technology's and its agents' 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.

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 contest, 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 contest, whether the claim or cause of action arises under contract or tort. 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 and damage of any nature whatsoever (whether existing or thereafter arising, whether direct, indirect, or consequential and whether foreseeable or not), including but not limited to any damage that

may result from a virus, malware, etc., to Government computer systems or data, or to the systems or data of end-users of the software and/or application(s) which results, in whole or in part, from the fault, negligence, or wrongful act or omission of the contestants or contestants' officers, employees or agents.

Contestants are required to demonstrate liability insurance coverage of \$100,000 for this Challenge.

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.

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. In this regard, 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 contest, the extent to which a submission complies with the requirements for accessible technology required by Section 508 will be considered.

General Conditions

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

ALL DECISIONS BY The Department of Commerce, National Institute of Standards and Technology ARE FINAL AND BINDING IN ALL MATTERS RELATED TO THE CONTEST. NO PURCHASE OR PAYMENT NECESSARY. A PURCHASE OR PAYMENT OF ANY KIND WILL NOT INCREASE YOUR CHANCES OF WINNING.