



XPRIZE
AVATAR



Rules and Regulations

Version 3.2

October 21, 2021

These RULES AND REGULATIONS (“Rules”) govern the ANA AVATAR XPRIZE. This Rules and Regulations Version 3.2, published on October 21, 2021, updates and supersedes all previous versions herein listed. Version 3.1 updates and supersedes Version 3.0, published on April 15, 2021, Version 2.0, published September 15, 2020, and Version 1.0 published on August 30, 2019. This Version also serves as an addition to and, where applicable, overrides information contained in the published Competition Guidelines originally published September 10, 2018, and updated August 30, 2019.

All participating Teams must adhere to these Rules in order to be eligible to progress through the Competition milestones and be qualified for selection as a winner of the Competition. Failure to adhere to these Rules may result in consequences as detailed in the Competitor Agreement.

XPRIZE may update these Rules as necessary during the course of the Competition to provide additional information or to improve the quality of the Competition. There may also be unanticipated issues that will require modifications to these Rules. XPRIZE reserves the right to revise these Rules as it, in its sole discretion, deems necessary. Dates and locations are subject to change pursuant to the Competitor Agreement. Competing Teams will be notified directly of any such revisions.

Note: All terms that are in bold throughout the document have a corresponding definition in the Glossary section.

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1. Introduction and Scope

The ANA Avatar XPRIZE was launched in March 2018, and is sponsored by All Nippon Airways (ANA). The competition challenges Teams to integrate a range of diverse, cutting-edge technologies to create a physical robotic **Avatar System** that will transport a person's senses, actions and presence to a remote location in real time.

Robotic technologies have advanced greatly in the last decade and are now employed in a wide range of applications and services. The ANA Avatar XPRIZE seeks to accelerate the development of robots as an integral part of human communications and increase the functionality and application of robots in society.

The winner of this XPRIZE will demonstrate a functional Avatar System, which consists of a human **Operator** controlling a robotic Avatar (**Operator/Avatar**) at a real and/or **Simulated Distance** that allows the Operator to interact with another human (**Recipient**), or the remote environment, receiving all sensory information through the robotic Avatar. The ultimate goal is for a person to feel as if they are truly where the Avatar is, experiencing a sense of **Presence** through the Avatar.

2. Rules and Regulations Revisions

XPRIZE may update these Rules as necessary during the course of the Competition to provide additional information or to improve the quality of the Competition. There may also be unanticipated issues that will require modifications to these Rules. XPRIZE reserves the right to revise these Rules as it, in its sole discretion, deems necessary. Dates and locations are subject to change pursuant to the **Competitor Agreement**. Competing Teams will be notified directly of any such revisions.

In the Rules and Regulations Version 3.0, the following sections have been updated, so please pay particular attention to these, as some dates have changed and new details have been added. The **Competition Milestone Reference Table** in Section 5 is updated. Many details in Section 5.3 **Semifinalist Verification** have changed, and a new Section 5.4 **Semifinals Team Video** has been added. Section 7.3 **Scenarios for Semifinals** has also been slightly updated. Be sure to review these revised sections thoroughly.

In Version 3.1 the following sections have been revised: The **Judging Panel Roles During Testing** in Section 4.2; **Scenario Capabilities** language updated in Section

7.2.3; and minor tweaks to language in Section 7.3 **Scenarios for Semifinals**. An additional day has been added to the Team setup schedule as noted in Section 8.1.3, **Semifinals Schedule**. In addition, the Reattempt process in Section 8.1.5 **Semifinals Scored Trial** is further defined, and the Judges scoring questions have been updated in **Semifinals Scoring** Section 8.1.6.

In Version 3.2 a new section, 8.1.3 **Alternative Testing Procedures**, has been added. In addition, the following sections have been revised: Section 9 on distribution of the **Semifinals Prize Purse**, Section 3.2 updates to the dates within the **Team Progression Chart**, as well as updates to the dates in the Section 5 charts: **Competition Timeline and Milestones**.

3. Teams

3.1 Eligibility

XPRIZE believes that solutions can come from anyone, anywhere. Scientists, engineers, academics, entrepreneurs, and other innovators with new ideas from all over the world are invited to form a Team and register to compete. To participate, a Team is required to first create an account in the [Prize Operations Platform \(POP\)](#) system. POP is an online platform through which all Teams will register for the Competition, pay the required registration fee, and submit their qualifying documents throughout the life of the Prize. Teams are expected to maintain their POP profiles throughout the Competition, ensuring their profile is always up to date with the most recent Team and Team members information.

A Team may recruit additional experts and can add new members to their Team profile page in POP at any time throughout the Competition. Teams may also merge with other Teams during the Competition. Teams must notify XPRIZE of a merger before it takes place. Please refer to the **Competitor Agreement** for all eligibility terms, and contact XPRIZE with related questions.

3.2 Team Definitions

Teams are categorized per the following:

- **Interested Team:** A Team or individual that is interested in participating in the Competition and has created a profile in the XPRIZE internal POP system.

- **Registered Team:** A Team that has paid the required registration fee and is eligible to submit a **Qualifying Submission** for Judge review.
- **Qualified Team (up to 150 Teams):** A Team that has been selected by the Judging Panel from the pool of Registered Teams based on the strength of their Qualifying Submission.
- **Semifinalist Team (up to 75 Teams):** A Team that has successfully completed the **Semifinalist Selection** and is selected by the Judges to proceed in the Competition and attend **Semifinals** testing.
- **Finalist Team (up to 20 Teams):** A Team that has successfully completed Semifinals testing and is chosen by the Judging Panel to attend **Finals** testing.

Team Progression Chart



3.3 Team Roles and Responsibilities

Teams are responsible for the items listed below. This is not a comprehensive list. Please contact XPRIZE at avatar@xprize.org if you have any questions.

1. Completing all required activities for each stage of the Competition in the POP system.
2. Remaining in compliance with the Competitor Agreement.
3. Fulfilling insurance and eligibility requirements as detailed in the Competitor Agreement.
4. Design and development of the **Avatar Solution**.
5. Transporting the Avatar Solution to and from physical testing sites.
6. Deployment and setup of the Avatar Solution before any test and removal of the Avatar Solution after the end of testing, in keeping with the allotted schedule set by XPRIZE.
7. Costs associated with lodging and travel for Team members to any Competition

- event.
8. Costs associated with transporting the Avatar Solution, insurance, customs fees, and other fees that may be incurred from bringing the Team's Avatar Solution to a testing location.
 9. Training Judges and XPRIZE operations staff (as needed) to operate their Avatar Solution.
 10. Cooperating with the Judging Panel in any verification activities both onsite, as well as any follow up verification (post-testing) as necessary.
 11. Following all safety protocols as required during testing to ensure the safety of all participants during testing events.

As defined in the Competitor Agreement, all Teams and Team Members must adhere to all applicable laws, including, but not limited to, local, regional, national, and international laws, orders, directives, ordinances, treaties, rules, and regulations for all aspects of the Competition. Teams are solely responsible for acquiring any appropriate licenses, waivers, or permits from the applicable regulatory bodies or other applicable third parties.

4. Judging Panel

4.1 Selection and Contributions

The Judging Panel has been selected from a wide range of experts in the technology domains that are expected to be integrated into an Avatar Solution. The Judging Panel is composed of volunteers whose responsibilities include:

- Assist in the creation and/or validation of the Rules and Regulations and judging criteria that govern this competition.
- Review and judge Teams' initial Qualifying Submissions and select Semifinalist Teams to proceed forward in the Competition.
- Evaluate the viability of each Team's solution ahead of Semifinals and Finals.
- Select the Teams to advance to Semifinals and Finals.
- Score Team entries for both the in-person Semifinals and in-person Finals rounds of Testing.

4.2 Judging Panel Roles During Testing

During Semifinals, two Judges will participate in any given Testing Run. One Judge will serve as the Operator of the Avatar during the **Scenario** run. A second Judge will

serve as the Recipient at the remote location. Each Judge will have an Assistant in their room during the testing session.

Judges will perform tasks listed in the Scenario with the Team's Avatar Solution.

Judges will be assigned their roles at XPRIZE's discretion. Teams may not request a particular Judge and will not know ahead of time which Judge is acting in what role at testing.

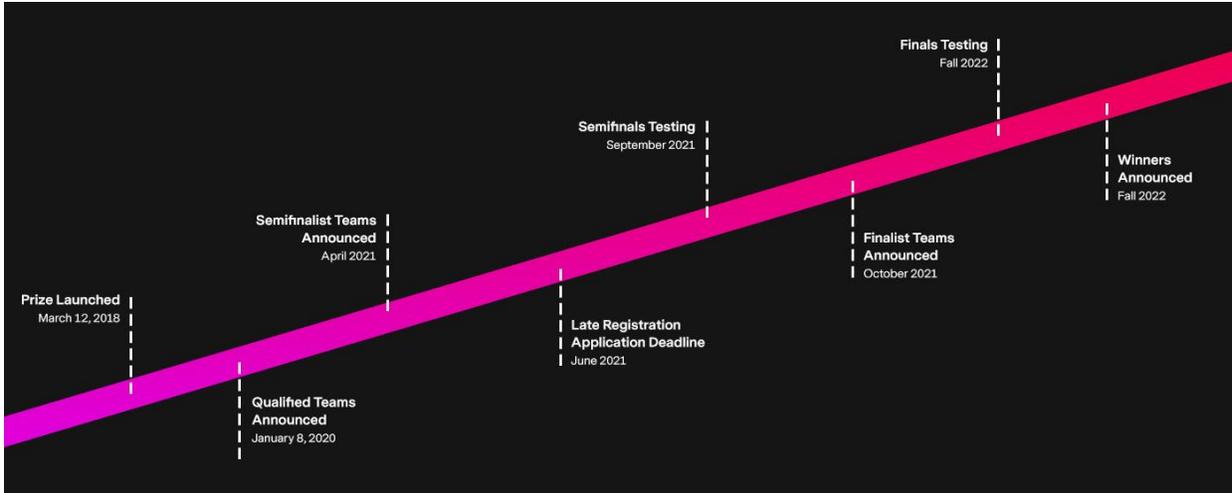
4.3 Judges' Decisions

Judging decisions are final. Judges are prohibited from providing feedback to Teams. Teams may not contact Judges outside of XPRIZE-managed circumstances. XPRIZE does not interfere with the Judges' deliberations or decisions in any way. Judges are required to recuse themselves for any reason that might compromise the impartiality of their deliberations or decisions.

In some instances, the Judging Panel may require additional information from Teams and XPRIZE will facilitate these discussions as necessary.

The Judging Panel retains ultimate discretion to declare the winners of the Competition and otherwise award all Prizes (subject to the Competitor Agreement). All judging decisions and opinions made by the Judging Panel are binding on both Teams and XPRIZE, and are not subject to review or contest. No judging decision may be challenged by a Team, and all Teams agree to abide by and refrain from any such challenge.

5. Competition Timeline and Milestones



Teams must accomplish the following milestones in order to progress in the Competition.

Competition Milestone Reference Table

Competition Milestone	Date	Requirements	# Teams
<i>Qualifying Submission and Competitor Agreement Deadline</i>	October 31, 2019	Complete written submission on POP (See Section 5.1) and sign the Competitor Agreement	Up to 150 will be selected
<i>Semifinalist Selection Submission</i>	February 2, 2021	Submit written and video portions (See Section 5.2)	Up to 75 will be selected as Semifinalists
<i>Semifinalist Verification</i>	June 1, 2021	Complete Semifinals Insurance & Eligibility Requirement, Technical Enrollment (See Section 5.3)	Up to 75 will advance to Semifinals testing
<i>Semifinals Team Video</i>	July 1, 2021	Submit Semifinals Team Video (See Section 5.4.1) & Team Video Documentation (See Section 5.4.2)	This video will be scored by Judges (as in Section 8.1.7) and counts for 10 points of your Semifinals Score

<i>Semifinals Testing</i>	September 2021	Transport Avatar Systems to testing facility; demonstrate Avatar capabilities to Judging Panel (See Section 8.1)	Up to 75 will test at Semifinals; Up to 20 will advance to the Finals and split \$2 Million prize purse; individual Team testing schedules will be released by July 2021
<i>Semifinals Testing Plan 2</i>	2022 (TBD)	Transport Avatar Systems to testing facility; demonstrate Avatar capabilities to Judging Panel (See Section 8.1)	Teams unable to attend Semifinals testing due to travel restrictions may apply for Plan 2 testing
<i>Finals Verification</i>	April 2022	Details pending (See Section 8.2.3)	Up to 20 will advance to Finals testing
<i>Finals Testing</i>	Fall 2022	Details pending (See Section 8.2)	Up to 20 will test at Finals
<i>Announce Competition Winners</i>	Fall 2022	(See Section 9)	First, Second, and Third place prizes will be awarded

5.1 Qualifying Submission

Registered Teams are required to fill out the online **Qualifying Submission** form in POP by October 31st, 2019. This submission comprises a series of questions to be answered that outline the expertise, capabilities and plans for the functional Avatar Solution that each Team is creating. An Executive Summary of up to two pages of text, and any supporting images, diagrams, or charts was also required as part of the Qualifying Submission.

Judges will use the information provided by Teams to determine, at their sole discretion, if a Team is qualified to continue forward in the Competition as one of the up to 150 Qualified Teams. If a Team is determined to be “Qualified” by the Judging Panel, their status changes from “Registered” to “Qualified.”

5.2 Semifinalist Selection

At **Semifinalist Selection**, Qualified Teams are required to demonstrate they are sufficiently advanced to progress in the Competition as a Semifinalist Team (up to 75

Teams will be selected). The Semifinalist Selection submission deadline is scheduled for February 2, 2021. All submission materials must be uploaded to POP.

Team submissions will be evaluated by the Judging Panel on a Pass/Fail basis, accounting for technical maturity, safety, and the ability of the Team to meet the Competition timeline. Teams that pass the Semifinalist Selection process become official Semifinalist Teams.

The Semifinalist Selection submission components are detailed below.

5.2.1 Semifinalist Selection: Sample Scenario

Each Team must devise a **Semifinals Sample Scenario** consisting of six tasks, referring to scenarios from Section 7.3 as a model. These tasks should demonstrate specific capabilities of your Avatar System that might not otherwise be showcased within the XPRIZE testing. The capabilities being demonstrated should be aligned with the overall spirit and goals of the Competition.

These tasks can include, but are not limited to, demonstrating specialized haptics, perception, mobility, manipulation or other sensory modalities.

For this Semifinals Sample Scenario, Teams are encouraged, but not required, to connect with outside organizations (corporations, universities, patrons) that may want to sponsor their team and advise in the development of this custom Semifinals Sample Scenario. Product placement may also be allowed for this Sample Scenario in the context of sponsorship.

5.2.2 Semifinalist Selection: Written Portion

The written portion will outline a Team's progress in developing their Avatar Solution. Additionally, Teams should explain their Sample Scenario and objectives of tasks and should showcase any special capabilities of their system. The written portion should also include the details of:

1. The **Operator Interface** equipment
2. The **Avatar System** components
3. The Team's safety protocols
4. The communication technology to be used for the testing rounds

The written portion should be no more than three pages, at least 10-point font, single-spaced, and should sufficiently describe the system and its capabilities. Additional details such as system diagrams, images and network architectures are welcome as long as they fit within the three-page limit.

5.2.3 Semifinalist Selection: Video Portion

The video of the Semifinals Sample Scenario should demonstrate the tasks described in the written portion of the submission from the perspectives of the Operator as well as that of the Recipient. The video footage collected is to be of the same Trial and should be shown in *real time* (without any time speed editing, speeding up or slowing down). Editing to include different viewpoints is acceptable. Demonstrating multiple attempts in the video is allowed. Video submissions are limited to 15 minutes of total run time. Exact specifications for this video portion will be sent to Teams ahead of the submission deadline.

This video should capture the following elements or perspectives:

1. Operator controlling the Avatar through the interface to be used at Semifinals
2. The Avatar System to be used at Semifinals performing the tasks
3. A Recipient safely interacting with the Avatar
4. The Operator's actions initiating movement of the Avatar
5. View of what the Operator is seeing through the Operator's part of the system
6. A segment that demonstrates the Avatar's emergency stop function and other safety features

Details related to the POP upload requirements for the Semifinalist Selection will be provided to Teams closer to the submission deadline.

5.3 Semifinalist Verification

After a Team has been officially selected as a Semifinalist they will enter the **Semifinalist Verification** phase, during which the Team will be required to submit materials to verify they are prepared to proceed to Semifinals. The Semifinalist Eligibility and Verification submission deadline is scheduled for June 1, 2021.

There are two requirements for the Semifinalist Verification phase:

Due by June 1, 2021:

1. Insurance and Eligibility (refer to the **Eligibility Compliance Checklist**)

2. Technical Enrollment

Teams are encouraged to work on these requirements early in the process to ensure they are able to meet the deadline.

Details on upload requirements for the Semifinalist Verification will be provided to Teams closer to the deadline. Any required components that are received late or corrupted will not be evaluated and will affect the Team's ability to progress to Semifinals. It is the Team's responsibility to ensure all components are received on time and in the correct, uncorrupted format.

5.3.1 Insurance and Eligibility Requirements

Teams are encouraged to refer to the Eligibility Compliance Checklist, which can be found on the POP Resources Page.

IMPORTANT NOTE: Only Teams whose Insurance and Eligibility Requirements have been fulfilled and confirmed by XPRIZE (as per the Competitor Agreement) will be permitted to attend Semifinals.

5.3.2 Technical Enrollment

Additionally, each Team will be required to complete their Technical Enrollment for their Avatar System, which includes personnel enrollment of their Semifinals attendees and details of the Team's system. These required details will include:

- Weight and size details of Avatar robot
- List and descriptions of all Operator equipment
- Power requirements for Avatar System
- Network Diagram of complete Avatar System (including wireless and wired items)
- Weight estimate for all equipment that will be brought to testing
- Labeled image of Operator System
- Labeled image of Avatar robot
- As per Section 10, document your approach to health and safety compliance for Operator and Recipient
- Describe your emergency shutdown procedure for the robot. Where is it triggered? What state does the system go into?

The upload process for Technical Enrollment will be provided to Semifinalist Teams in May 2021.

5.4. Semifinals Team Video

The next requirement of the Semifinalist process is the Semifinals Team Video submission.

Due by July 1, 2021:

1. Semifinals Team Video
2. Semifinals Team Video Documentation

Teams must devise and perform a Sample Scenario consisting of six tasks that best demonstrates the capabilities of their system. The Scenario tasks may be the same as devised for the Semifinalist Selection (as described in Section 5.2.1), but the video should be updated to show technical progress since that time. This Sample Scenario should not duplicate any of the three XPRIZE-defined scenarios in Section 7.3.

This video will count for up to 10 points of a Team's Semifinals score, as described in Section 8.1.6.

Teams are advised to adhere closely to the following submission guidelines.

5.4.1 Semifinals Team Video

The **Semifinals Team Video** of the Sample Scenario must demonstrate the tasks described in the written portion. The videos collected are to be of the same Trial and are to be shown in *real time* (without any time speed editing, speeding up or slowing down). Editing to include two different viewpoints (Operator and Recipient) is acceptable (overlays, side-by-side or sequential viewpoints are all permitted). A Team's video submission is limited to 15 minutes of total run time.

This video should capture the following elements or perspectives:

1. Operator controlling the Avatar through the interface to be used at Semifinals
2. The Avatar System to be used at Semifinals performing the tasks
3. A Recipient safely interacting with the Avatar
4. The Operator's actions initiating movement of the Avatar
5. View of what the Operator is seeing through the Operator's part of the system
6. A segment that demonstrates the Avatar's emergency stop function and other safety features

The upload process for the Semifinals Team Video will be provided to Semifinalist Teams in May 2021.

For this Semifinals Team Video, Teams are encouraged, but not required to, connect with outside organizations (corporations, universities, patrons) that may want to sponsor their Team and advise in the development of this custom video. Product placement for this video is allowed in the context of a sponsorship.

A Semifinals Team Video that is not submitted, or is received late, corrupted or unviewable, will result in that Team receiving 0 points for that portion of Semifinals scoring.

5.4.2 Semifinals Team Video Documentation

The final requirement is the **Semifinals Team Video Documentation**, a written document that must list the six discrete tasks the Avatar robot is performing in the Team Sample Scenario. Please use the format shown in Section 7.3 to list these tasks.

XPRIZE will supply a template along with the upload instructions in May 2021.

The written documentation may also explain the objectives of each task, and any special capabilities of the Avatar being demonstrated. This documentation should be no more than two pages, at least 10-point font, single-spaced.

6. System Requirements

6.1 Avatar Robot

Teams are encouraged to design and build or purchase existing Avatar Systems that will allow them to be successful in the Competition. However, due to safety considerations and planned indoor testing, the **Avatar Robot** must meet the following conditions:

- Total weight, including its power source, must not exceed 160 kg.
- Width and length dimensions must be no more than 100 cm x 120 cm maximum.
- Total height must be less than 210 cm.
- The Avatar must be able to safely operate indoors, and must not release any direct emissions.

- Teams may use a network and power tether for their system.
- It is anticipated that the power in the test location will be 120 VAC nominal.
- Some scenarios will require mobility of the Avatar. The mobility solution can vary, but must be safe for humans to be around.

6.2 Use of Drone Technology

Because the overall purpose of the Avatar XPRIZE is to facilitate human-to-human interaction, Avatar forms that do not support this key aspect, including drones, robots that operate underwater or within other environments not conducive to our indoor testing protocols, or forms that do not provide some correspondence to the Operator's physical performance through the Avatar, will not be permitted.

6.3 Operator Interface

Teams are permitted to use the Operator Interface they deem to be the most effective in allowing the Operator to feel the senses and actions transported to and from the robotic Avatar. These may be existing commercial systems or custom-made solutions. They should be intuitive and easy for the Operator Judge to learn and use effectively.

To ensure safety and testing considerations, the Operator Interface should adhere to the following provisions:

- The overall specifications of such a system must be reasonable and not impair the user's normal activities in any significant way, such as excessive size or weight.
- The interface system worn by the Operator may be tethered or untethered, as long as adequate connection is maintained between the elements of the system.
- It is permissible for the interface system to include a Heads-Up Display that includes overlaid information in addition to visual or sensory input from the robot.
- Any use of **Brain Computer Interfaces (BCI)** as part of the Operator Interface must not be of an invasive nature. Only externally-worn devices are allowed.

6.4 Avatar Communications

During Semifinals and Finals, Teams should plan to have a data communications network approach where all network traffic between Operator and Avatar will go through the Competition Network. Details are included in the **ANA Avatar XPRIZE**

Network Guide. The ANA Avatar XPRIZE Network Guide can be found in the Competing Teams Access Folder on Google Drive.

7. Testing Scenarios

7.1 Introduction

Specific **Testing Scenarios** will be used to evaluate Team performance in **Semifinals** and **Finals** testing. The Testing Scenarios are designed to evaluate the ability of the Avatar to allow the Operator of the system to experience a sense of presence as if they are actually in the remote location. The Avatar System must facilitate the transfer of sensory information from the remote location back to the Operator who is controlling the Avatar. This sensory information includes aspects of the location, such as understanding the layout, placement of objects, path navigation and other location-specific cues. It also includes interactions with a Recipient in a remote location, which includes recognition, understanding, communications, gestures, and shared experience. In addition, the **Avatar Ability** will be judged based on the Avatar being able to complete each task. **Overall System** is the final evaluation category and includes the reliability and safety aspects of the system (See Section 8.1.6).

7.2 Scenario Domains, Tasks and Capabilities

7.2.1 Scenario Domains

The **Scenario Domains** have been developed through extensive consultation with industry experts, the ANA Avatar XPRIZE Advisory Board and Judging Panel. They are representative of the anticipated areas in which Avatars will provide benefits to humans in the coming years. These include Business Interactions, Cultural Exchanges, Healthcare Activities, Training (various domains), and Social Interactions. The three Scenarios chosen for Semifinals capture aspects of these domains to reflect real world situations.

7.2.2 Scenario Tasks

Each Testing Scenario is composed of a set of six discrete tasks within a domain, and is designed to fit within the allotted testing **Slots** during the testing event. The three Scenarios listed below in Section 7.3 will be presented for Teams to complete during Semifinals.

7.2.3 Scenario Capabilities

Capabilities that are anticipated to be evaluated as part of the Scenario tasks include the following:

(**Note:** these capabilities are **not** listed by level of importance)

- Visual and auditory perception
- Localization of people, objects and sounds
- Gaze control
- Gestures
- Aspects of touch (haptics capabilities)
- Manipulation
- Grasping
- Mobility

In addition, communication qualities such as the following are built into the Scenario tasks:

- Body language
- Emotional expression
- Conversational turn-taking
- Shared experience

Usability considerations such as intuitive controls, ease of deployment and safety will also factor into the evaluation process.

7.3 Scenarios for Semifinals

The following three Scenarios have been chosen for the Semifinals competition round. All Team systems will be required to attempt each of these Scenarios during their allotted testing time.

The Semifinals Scenarios are presented as task lists below. Each Scenario is designed to have six discrete tasks, which present the opportunity for the Teams to accomplish or demonstrate various capabilities (as described in Section 7.2.3).

For each of the scenarios, the Operator/Avatar is designated by O/A, and the Recipient role is designated by R.

Scenario #1: Social, Cooperative Interaction

Title	Collaborative Puzzle Activity
Scenario Description	One person (R) helps to finish a partially completed peg puzzle with another person (O/A) at a remote location.
Setup	Cleared table with simple, toddler-type puzzle with images on each piece (such as this puzzle) and peg grips. R is seated on the far side of the table. O/A is positioned on the other side of the table.
Tasks	Task 1. O/A greets R and R asks if they would like to work on the puzzle together.
	Task 2. R moves the puzzle and the detached pieces within reach of O/A and explains the process and instructions, including who goes first; the O/A verbally acknowledges that they understand.
	Task 3. O/A places a piece of the puzzle in its place while verbally identifying the image on the puzzle piece.
	Task 4. O/A points to a piece for R to do next while identifying the image on that puzzle piece.
	Task 5. O/A hands another piece to R and asks them to place the piece. This should complete the puzzle.
	Task 6. When done, the O/A and R share a gestural “high five” (with no contact) to celebrate completion of the puzzle.

Scenario #2: Business Interaction

Title	Final Stage of a Business Deal
Scenario Description	A business partner (O/A) is Avataring In to a meeting with a business partner acting as the host (R) at their office to celebrate the closing of an important deal.
Setup	R is seated at a table with a variety of non-breakable beverage containers (coffee mugs and plastic wine glasses) set up on the table.
Tasks	Task 1. R greets O/A. O/A waves hello.
	Task 2. O/A audibly expresses excitement about being able to meet.
	Task 3. R asks O/A which beverage they would like from a selection of beverage containers on the table. O/A chooses one beverage container by pointing to it.
	Task 4. R acknowledges the choice and moves the beverage container within range of O/A. O/A lifts the beverage container. R selects the same beverage container and lifts it.

	Task 5. While the container is lifted, O/A moves it above the table towards Rs, and R completes a toast. The two beverage containers should touch, as in a normal toast, and are then placed back on the table.
	Task 6. R says congratulations and goodbye. O/A maneuvers away from the table to a marked, designated area.

Scenario #3: Culture, Travel, Teaching Activity

Title	A Visit to a Distant Museum of Antiquities
Scenario Description	A visitor (O/A) is Avataring In to a Museum to explore the Museum's offerings and interact with the Museum host/greeter (R).
Setup	R is seated behind a table with representative objects from the Museum on it. O/A is positioned on the other side of the table to start. Also on the table are two posters advertising different exhibits.
Tasks	Task 1. R greets the visitor and asks O/A to indicate the exhibit they want to explore. O/A points to the desired exhibit poster.
	Task 2. R moves one artifact toward the center of the table related to that exhibit and asks O/A to describe it. O/A describes the artifact visually.
	Task 3. R says the O/A can touch the artifact. O/A then explores the artifact by touching it.
	Task 4. O/A explores the object and describes the texture they feel.
	Task 5. O/A picks up the artifact and describes the weight of the object and places it back on the table.
	Task 6. R points to where O/A can find the start of their exhibit marked on the floor. O/A maneuvers away from the table to the marked, designated area.

7.4 Scenarios for Finals

Future details of Finals Scenarios will be provided at the Team Summit in late 2021. Teams can expect Finals Scenarios to be significantly more difficult, and these may include advanced mobility and interaction tasks.

The Finals Scenarios are still under development and will be released approximately six months ahead of Finals.

8. Competition Testing

The following sections cover the details of testing for the in-person Competition events.

8.1 Semifinals Testing

8.1.1 Semifinals Location and Facilities

Teams will be invited to a single testing location in the United States. The exact location and details will be provided in the Semifinals Operations Guide. All testing will be done indoors.

At least one member of the Team is required to be present onsite during their Team's allotted test Slots. Additionally, XPRIZE will be limiting the number of overall Team members that may attend or be inside the testing venue at one time. This number will be based on space, configuration, and safety considerations at the testing center and will be defined in the Semifinals Operations Guide. It is currently estimated that Team members onsite will be capped at 20.

XPRIZE will publish the Semifinals Operations Guide approximately 120 days before Semifinals testing. The Operations Guide will detail the policies and procedures for testing including test scenarios, event operations, logistics, shipping, safety and other details to effectively participate in Semifinals.

8.1.2 Semifinals Dates

Semifinals testing is currently scheduled to take place during a two- to three-week timeframe during September 2021. The exact testing dates for each individual Team will be provided no later than July 2021, after Semifinalist Verification.

8.1.3 Alternative Testing Procedures

In the event that teams are unable to attend Semifinals testing due to travel restrictions, they may choose to apply for Testing Plan 2, which will allow a team to test at a later date in 2022. Plan 2 is currently expected to be a similar setup as Semifinals. Testing will be conducted using the Team's Avatar Systems approved at Semifinalist Verification with no major modifications. Additional verifications will be required ahead of Plan 2 testing.

Teams testing under Plan 2 will not be eligible to receive any portion of the \$2M Semifinals prize purse. In addition, the total number of Finals slots available to Plan 2 teams will not be known until after Semifinals Testing Plan 1 has concluded.

8.1.4 Semifinals Testing Procedures

During Semifinals testing each Team will be given two Slots on the schedule over the course of the two consecutive testing days. Each Slot will be two hours in duration with one hour for equipment setup and Operator training and one hour for the **Scored Trial**.

Semifinals Testing Breakdown

	Day #1 - Slot #1	Day #2 - Slot #2
Hour 1	Setup & Judge Training	Setup & Judge Training
Hour 2 <u>Scored Trial</u>	Scenario #1 Scenario #2 Scenario #3	Scenario #1 Scenario #2 Scenario #3

8.1.5 Semifinals Scored Trial

During a Scored Trial, a member of the Judging Panel will serve as the Operator who controls the Avatar System and evaluates the experience. Another Judge will act as the Recipient to interact with the Avatar and evaluate the system and the interactions. A Judge’s assistant will also be in each room with the Judge.

During the first hour of each Slot, Teams will set up and train the Operator and the Recipient on the operation of the system. Teams should plan for a different set of Judges during each Slot.

Note: The testing setup will be such that the Operator, and the Recipient interacting with the Avatar, will be in discrete spaces: the **Operator Control Room** and the **Avatar Scenario Room**. There will be no communication between the Operator and the Recipient other than through the Avatar System.

During each Trial, the Team’s system will be evaluated by the Judges in three XPRIZE defined scenarios. Each scenario is currently estimated to take approximately ten minutes for Judges to complete.

A Team may ask the Judges to **Reattempt** a scenario as long as it can be done within the allotted Slot. Judges will determine if time remaining is sufficient for a reattempt. If a

Reattempt is initiated following a team request, the score of that reattempted Trial will be used regardless of the outcome. An Operator Judge may also call for the Reattempt of a scenario if they deem it necessary. In this case, the best score will be retained.

Reattempt requests are limited to 1 per Team and 1 per Operator Judge per Scenario.

8.1.6 Semifinals Scoring

Each Scored Trial will contain the three scenarios. Teams will be given two Slots to attempt the scenarios over the course of two consecutive days. The Judges will take the best score of the two Slots from each individual scenario. For example, a Team may have its best score on Scenario 1 and Scenario 3 during their second Slot, and their best score from Scenario 2 on their first Slot. The Team's performance during the scenarios will account for up to 90 points of their overall score, with each scenario accounting for 30 points. The remaining 10 points will be based on the Semifinals Team Video as described in Sections 5.3.3 and 5.3.4.

During testing the Judges will evaluate the Avatar System based on the following four categories. The evaluation criteria for each category are listed below.

1. **Operator Experience:** This category is evaluated based on the following criteria, and is worth up to 12 points in each scenario. Each component is worth up to 1 point each and will be scored as follows:

- Never (0 points)
- Rarely (.25 points)
- Sometimes (.5 points)
- Mostly (.75 points)
- Always (1 point)

- The Operator Judge felt present in the remote space with the Recipient.
- The Operator Judge was able to sense or understand the Recipient's emotion.
- The Operator Judge was able to express their emotions to the Recipient.
- The Operator Judge was able to clearly see and hear what was happening in the remote space using the Avatar System.
- The Operator Judge was able to get the necessary tactile/haptic/force/other feedback to complete the required tasks.
- The Operator Judge was able to sense their own position and movements in the remote space while using the Avatar System.
- The Operator Judge was able to move around in the remote space to

complete the required tasks.

- The Operator Judge was able to manipulate remote objects effectively using the Avatar System.
- The Operator Judge felt they were able to gesture effectively to the Recipient.
- The Operator Judge felt safe using the Avatar System.
- The Operator Judge felt the Avatar System was easy to use.
- The Operator Judge felt the Avatar System was comfortable to use.

2. **Recipient Experience:** This category is evaluated based on the following criteria, and is worth 8 points in each scenario. Each component is worth up to 1 point each and will be scored as follows.

Never (0 points)

Rarely (.25 points)

Sometimes (.5 points)

Mostly (.75 points)

Always (1 point)

- The Recipient Judge was able to identify the remote Operator and felt the remote Operator was present in the space.
- The Recipient Judge was able to understand the Operator's communications through the Avatar.
- The Recipient Judge was able to understand the remote Operator's emotions through the Avatar.
- The Recipient Judge felt a sense of shared experience with the remote Operator.
- The Recipient Judge felt safe while the Avatar was navigating the environment and manipulating objects.
- The Recipient Judge felt the Avatar's aesthetics were adequate to the interactions and not intimidating or threatening.
- The Recipient Judge was able to understand the Operator's gestures through the Avatar.
- The Recipient Judge felt the remote Operator could understand them through the Avatar.

3. **Avatar Ability:** This category is evaluated based on the following criteria, and is worth up to 6 points in each scenario. Each task will be scored Pass/Fail, with 1 point for each Pass and 0 points for each Fail.

Pass: Able to complete the task

Fail: Not able to complete the task

Scenario 1:

- Task 1: Was the Operator/Avatar able to greet the Recipient?
- Task 2: Was the Operator/Avatar able to verbally state they understood the Recipient's instructions?
- Task 3: Was the Operator/Avatar able to place a puzzle piece while verbally identifying the image on the piece?
- Task 4: Was the Operator/Avatar able to point to another puzzle piece while verbally identifying the image on the piece?
- Task 5: Was the Operator/Avatar able to hand another puzzle piece to the Recipient and ask them to place it?
- Task 6: Was the Operator/Avatar able to share a gestural "high five" with the Recipient to celebrate?

Scenario 2:

- Task 1: Was the Operator/Avatar able to wave hello?
- Task 2: Was the Operator/Avatar able to audibly express excitement?
- Task 3: Was the Operator/Avatar able to choose one beverage container by pointing to it?
- Task 4: Was the Operator/Avatar able to lift the beverage container?
- Task 5: Was the Operator/Avatar able to move it above the table towards the Recipient and complete a toast?
- Task 6: Was the Operator/Avatar able to maneuver away from the table to a marked, designated area?

Scenario 3:

- Task 1: Was the Operator/Avatar able to point to one of the exhibit posters?
- Task 2: Was the Operator/Avatar able to describe the artifact?
- Task 3: Was the Operator/Avatar able to touch the artifact?
- Task 4: Was the Operator/Avatar able to describe the texture they felt?
- Task 5: Was the Operator/Avatar able to pick up the artifact and describe its weight?
- Task 6: Was the Operator/Avatar able to move to the mark on the floor for their chosen exhibit?

4. Overall System: This category is evaluated based on the following criteria, and is worth up to 4 points in each scenario. Each component will be scored Pass/Fail, with 1 point for each Pass and 0 points for each Fail.

Pass: Criteria met

Fail: Criteria not met

To be scored by the Operator Judge

- Did the Avatar System (hardware and power) operate reliably enough for the Operator to attempt all the Tasks?
- Did the Avatar System (software and network) operate reliably enough for the Operator to attempt all the Tasks?

To be scored by the Recipient Judge

- Did the Avatar Robot remain in a safe and stable position when not being actively controlled by the Operator?
- Did the Avatar Robot complete the Scenario without needing to be repositioned or recovered by the Team?

Sample Semifinals Scoring Diagram

Scenario	Operator Experience	Recipient Experience	Avatar Ability	Overall System	Total
#1	12	8	6	4	30
#2	12	8	6	4	30
#3	12	8	6	4	30
Semifinals Team Video	-	-	-	-	10
TOTAL					100

Team scores may be made available to Teams on an individual basis, however the scores will not be released publicly. Final rankings may be released at the completion of testing. Internal scoring mechanisms will not be shared outside of the Judging Panel.

If two or more Teams are tied at the end of all Semifinals testing, the tie-breaker will be determined by the highest Operator Experience score.

8.1.7 Semifinals Team Video Scoring

The Semifinals Team Video (see Section 5.4) will count for 10 points of the Team's Semifinals score. If a Semifinals Team video was not submitted, that Team will receive 0 points for this portion of Semifinals scoring.

Videos will be judged on the following criteria, Each task will be scored Pass/Fail, with 1 point for each Pass and 0 points for each Fail.

Pass: Able to complete the task

Fail: Not able to complete the task

- Was the Operator/Avatar able to complete Task 1?
- Was the Operator/Avatar able to complete Task 2?
- Was the Operator/Avatar able to complete Task 3?
- Was the Operator/Avatar able to complete Task 4?
- Was the Operator/Avatar able to complete Task 5?
- Was the Operator/Avatar able to complete Task 6?
- Did the Avatar Robot remain in a safe and stable position when not being actively controlled by the Operator?
- Did the Avatar Robot complete the Scenario without needing to be repositioned or recovered by the Team members?
- Was the Operator able to manipulate remote objects effectively using the Avatar System?
- Was the form of the Avatar Robot adequate for the interactions and not intimidating or threatening?

8.2. Finals Testing

8.2.1 Finals Location and Facilities

Teams will be invited to a single testing location. The testing site will be selected by XPRIZE and the location will be released by January 2022.

At least one member of the Team is required to be present onsite during that Team's allotted test Slot times. Additionally, XPRIZE will be limiting the number of overall Team Members that may attend or be inside the testing venue at one time. This number will be based on space, configuration, and safety considerations at the testing center and will be defined in the Finals Operations Guide.

XPRIZE will publish the Finals Operations Guide approximately 120 days before Finals testing. The Operations Guide will detail the policies and procedures for testing including test scenarios, event operations, logistics, shipping, safety and other details to effectively participate in Finals testing.

8.2.2 Finals Dates

Finals testing is tentatively scheduled for June 2022. The exact testing dates for each individual Team will be provided no later than March 2022 after **Finals Verification**.

8.2.3 Finals Verification

Ahead of Finals testing, XPRIZE will conduct a Finals Verification to ensure Teams are prepared to proceed to the Finals. More details to be provided ahead of Finals testing.

8.2.4 Finals Testing Procedure

It is currently anticipated that Finals testing will be structured similarly to Semifinals testing, with the addition of the **Finals Team-Selected Scenario** (as defined below in Section 8.2.7).

8.2.5 Finals Scoring

Teams can expect Finals Scenarios to be significantly more difficult, and these may include advanced mobility and interaction tasks. Details of Finals scoring may change based on lessons learned during Semifinals. Final details will be provided later in the Competition.

It is expected that Judges will evaluate the Avatar Solutions based on similar categories used during Semifinals. The evaluation criteria will be finalized approximately six months prior to Finals. While categories and criteria may remain the same as Semifinals (See Section 8.1.6), the Scenarios will be different and designed to be much more challenging.

Teams' scores and rankings for Finals are currently planned to be made public during and after testing.

8.2.6 Finals Scored Trial

During Finals testing, a member of the Judging Panel will serve as the Operator to control the system throughout the Trial and evaluate the experience. Another Judge will act as the Recipient to interact with the Avatar and evaluate the system and the

interactions. During the first hour of each Slot, Teams will train the Operator and the Recipient on the operation of the system. Teams should plan for a new set of Judges during each Slot.

Note: The testing setup will be such that the Operator and the Recipient will be in discrete spaces: the Operator Control Room and the Avatar Scenario Room, respectively. There will be no communication between the Operator and the Recipient other than through the Avatar System.

During each Trial, the Team's system will be evaluated by the Judges in XPRIZE defined scenarios. The Scenarios for the Finals will be more challenging and are expected to require additional capabilities beyond those of Semifinals.

8.2.7 Finals Team-Selected Scenario

The intention of the **Finals Team-Selected Scenario** is for the Teams to demonstrate, in-person, the best capability features of their specific system. This scenario will be required to be described by the Teams and approved by XPRIZE prior to Finals testing. Further details of this process will be defined in late 2021.

9. Awards

There will be \$10,000,000 (Ten Million USD) in total **Prize Purses** available:

- **Semifinals Prize Purse**

There will be \$2,000,000 (Two Million USD) to be shared equally among all Teams (up to 20) selected as Finalists.

Note: Teams testing under Plan 2 will not be eligible to receive any portion of the \$2M Semifinals prize purse.

- **Finals Prize Purse**

There will be a Finals Prize Purse in the amount of \$8,000,000 (Eight Million USD). The Finals Prize Purse will be divided among the top ranking Teams as First, Second, and Third Place Awards.

- First Place: \$5,000,000 (Five Million USD)
- Second Place: \$2,000,000 (Two Million USD)
- Third Place: \$1,000,000 (One Million USD)

10. Operational Health and Safety

Operational health and safety are fundamental concerns in this Competition. Teams must design their systems with operational health and safety for Operators, Recipients, and bystanders in mind. Teams will document their approach to health and safety compliance in their Qualifying Submission and also in all Semifinals and Finals submissions. Teams are responsible for operating safely and in compliance with local, regional, or national occupational health and safety regulations relevant to their technology during both Semifinals and Finals onsite testing.

Safety checks will be conducted before formal testing begins and additional safety details will be provided well in advance of all testing. XPRIZE staff, Judges, and/or third-party measurement and verification teams may refuse to test Teams whose submissions are deemed unsafe. XPRIZE will make all final determinations on safe and acceptable operating conditions for Competition operations.

GLOSSARY

Avatar Ability: This refers to the actual performance and capabilities of the robotic Avatar during testing.

Avataring In: This refers to the act of the Operator controlling the remote Avatar.

ANA Avatar XPRIZE Network Guide: This document details the XPRIZE-supplied setup and data communications network that message traffic will use during testing events.

Avatar Scenario Room: The discrete physical area of the testing setup where the Avatar and the Recipient will be positioned. It is connected to the Operator Control Room only through the communication network.

Avatar Robot: This is the actual physical robot part of a Team's Avatar Solution. It is also referred to as the robotic Avatar.

Avatar Solution: This refers to a Team's specific Avatar System (including the Operator Interface, the robotic Avatar and all sensors, software and mechanical parts) that will be used in the Competition.

Avatar System: This refers to the complete and total system consisting of the Operator and Operator Interface, the robotic Avatar and all sensors, software and mechanical parts, and includes the environment or Recipient with which the Operator interacts.

Brain Computer Interface (BCI): This is any mechanism by which the robotic Avatar uses signals measured directly from an Operator's brain as part of the overall system. Also known as BMI, or Brain Machine Interface.

Capabilities: These are the aspects of the robotic Avatar System which are necessary to accomplish the required tasks. These can include perceptual, manipulation and movement as well as aspects needed to support communication between the **Operator** and the **Recipient** (See more details in Section 7.2.3).

Competitor Agreement: A legal and binding document that details the responsibilities of competitors for the prize.

Finals: The last set of testing events for the prize that will determine the overall winners.

Finals Team-Selected Scenario: This is a Team-defined scenario which includes tasks that can demonstrate the best capability features of their specific Avatar System. The Scenario will be required to be described by the Teams and approved by XPRIZE prior to Finals testing, where it will be performed in-person.

Finals Verification: This is a mandatory update to ensure Teams are prepared to proceed to the Finals round of the Competition.

Insurance Compliance Checklist: An insurance requirement list that outlines a Team's mandatory coverage during Testing rounds. This document can be found in the POP Resources Section.

Operator: The person in the Avatar System who is controlling the actions of the robotic Avatar through some form of Operator Interface.

Operator/Avatar: The Operator when controlling the robotic Avatar. Designated by the abbreviation **O/A**.

Operator Control Room: The discrete physical area of the testing setup where the Operator of the system will reside. This area is connected to the Avatar Scenario Room only through the communication network.

Operator Experience: This is both the objective and subjective involvement of the Operator controlling the robotic Avatar, by which they feel a sense of actual Presence in the remote location.

Operator Interface: The means (equipment, software, control devices) by which an Operator interfaces with the robotic Avatar at a distance.

Operations Guide: The Operations Guide will detail the policies and procedures for testing including test scenarios, event operations, logistics, shipping, safety and other details to effectively participate in testing events. There will be separate Operations Guides for Semifinals and Finals testing.

Overall System: This refers to the measure of the reliability of the system hardware and software.

Prize Operations Platform (POP): The standard internal XPRIZE portal for Teams to input data for use in this Competition.

Presence: This is the sense that one's actions and senses feel as if they are truly experiencing a location other than the one where the user's physical body currently resides.

Prize Purse: This refers to money offered, won, or received as a prize. It also refers to the overall amount of funds allocated to all prizes in this Competition.

Qualifying Submission: This is a form in POP that must be completed by Teams no later than October 31st, 2019. It consists of a series of questions to be answered that outline the expertise, capabilities and plans for the functional Avatar Solution that each Team will be creating. It will also require an Executive Summary of up to two pages of text and any supporting images, diagrams, or charts.

Reattempt: A request made by a Team for a second attempt at performing a Scenario. A Judge will determine if it can be done within the allotted Slot. An Operator Judge may also call for the Reattempt of a scenario if they deem it necessary. In this case, the best score will be retained.

Recipient: The human receiving the actions of the Operator via the robotic Avatar. Designated by the abbreviation **R**.

Recipient Experience: This refers to the experience of the person receiving the actions of the Operator via the robotic Avatar.

Sample Scenario: This is a Team-defined scenario for Semifinals that consists of a number of tasks that demonstrate the capabilities of the Team's Avatar System.

Scenario: See Testing Scenario.

Scenario Domain: A topical area that forms a general use case for testing purposes.

Scored Trial: The testing activity by which a Team's Avatar Solution will be scored during Semifinals and Finals, which comprises a series of scenarios and tasks to be completed.

Semifinals: The set of testing events for the prize that will help determine which Teams progress to Finals testing.

Semifinals Sample Scenario: See **Sample Scenario**.

Semifinalist Selection: The process by which Qualified Teams demonstrate they are sufficiently advanced to progress in the Competition as a Semifinalist Team.

Semifinals Verification: This is a process in which Teams must provide their Insurance Compliance documentation, their Semifinals Technical Enrollment and their Semifinals Team Video and Documentation (See Section 5.3.3).

Semifinals Team Video: This video will be submitted by each Team to show the level of technological achievement for their Avatar Solution. It will be evaluated by the Judging Panel and will count for 10 points of a Team's Semifinals scoring.

Semifinals Team Video Documentation: This is a written document that is submitted with the Semifinals Team Video and describes the contents of the video.

Simulated Distance: The goal of the Avatar System is to teleport one's senses and actions to a remote location. This distance, or separation, including any resulting technical circumstances such as networking delays, may be simulated rather than being an actual physical distance.

Slot: The two-hour timeframe allocated to Teams during testing events.

Team-Selected Scenario: See **Finals Team-Selected Scenario**.

Technical Enrollment: This enrollment will include certain steps and questions to be answered by the Teams, such as attending Team member lists, and other details required in advance of Semifinals and Finals testing.

Testing Scenario: This is the set of actions or tasks that a Team's Avatar Solution will complete and by which they will be judged.

Trial: See Scored Trial.