

# The First (2020) Advanced Robotics Challenge (ARC) Application Overview

Part 1: Guidelines for Applicants

Part 2: Competition Scenario

Part 3: Notes on Judging



Advanced Robotics Foundation

## Part 1: Guidelines for Applicants

### 1. Name

Advanced Robotics Challenge (hereafter, ARC)

### 2. Aims

In order to promote personnel development young people in advanced robotics fields, we aim to cultivate talented young people through competition to push the boundaries of robotics technology, using the competition format as a methodology for evaluation (outstanding teams will be rewarded with research grants, prize money, and acclaim, while also stimulating greater development in the future). As a result, this will contribute to the development of advanced robotics and the drone industries.

### 3. Target Fields

All fields related to next-generation robotics.

### 4. Contents

Participants will be asked to undertake a mission to disaster relief (search and rescue) on the assumption that a large-scale earthquake has occurred.

For further details, please refer to Part 2: “Competition Scenario”.

### 5. Qualification Requirements

Universities, civil and governmental organizations, and other groups, and individuals.

\* Applicants cannot enter as multiple teams.

### 6. Stages and Schedule

The stages of the ARC and its schedule are shown below.

Any changes to these details will be announced on our foundation’s website.

Stage	Schedule (Expected)	Notes
Announcement of guidelines for applicants	10/01/2019	
Applications (Submission of proposals)	10/01 – 12/20	

Briefing sessions	During the application period	Venues planned to be in Tokyo and Osaka.
Paperwork screening	12/20 – 12/27	
Notification of results of paperwork screening	Early 01/2020	
Payment of research grants	Late 01/2020	
Final judging (competition)	6/28 – 7/5	Expected schedule
Announcement of results of final judging		Contest venue
Submission of research and expenses reports	After the competition	
Presentation by the winning team, etc.	After the competition	

## 7. Applications

### (1) How to apply

Apply via the website (refer to 9. Proposal submissions).

### (2) Application deadline

12/20/2019 at 17:00 (JST)

## 8. Briefing sessions

Briefing sessions are expected to be held in both Tokyo and Osaka (details will be informed on our website later).

## 9. Submission of proposals

### (1) Paperwork for submission

Proposal forms in the format required by our organization can be downloaded from the dedicated page on the website.

### (2) How to submit

Please submit by downloading the proposal form, filling out, converting to PDF, and uploading it via the dedicated page on our website.

### (3) Deadline

17:00 JST on 12/20/2019

\* Please refer to “Proposal Preparation and Entry Procedures”.

## **10. Paperwork screening**

Our organization's review committee will, following a fair and careful review of the submitted proposals, determine which applicants will participate in the competition and establish the total amount of the research grant.

### **(1) Period**

12/20/2019 – 12/27/2019

### **(2) Notification**

The results of the paperwork screening will be notified to each applicant via email and posted on the website.

### **(3) Fairness**

To ensure fairness in the review process, any judge with a special interest in any applicants will not involve in screening. Please note that we are unable to respond to any inquiries regarding the details or procedures of the review process.

## **11. Payment of research grants**

### **(1) Grant amount**

The applicants will be notified that the research grant will be provided or not, and amount, based on the paperwork screening.

### **(2) Notification of bank account information**

Grantees must notify the bank account for transfer via email before 01/21/2020. If the notification is delayed, payment may be delayed.

#### **Bank Account Information:**

SWIFT Code, Bank Name, Branch Name, Account Number, Beneficiary Name, Beneficiary Address

### **(3) Date of payment**

Late 01/2020

Due to the ARC aims, we will generally not provide research grants to teams composed entirely by corporate entities.

## **12. Final judging (competition)**

### **(1) Details**

Please refer to Part 2: "Competition Scenario".

(2) Date

Across several days between 06/28/2020 and 07/05/2020 (details will be informed on our website later).

(3) Venue

In Fukushima Prefecture (details will be informed on our website a few days before the event).

(4) Schedule of the day

Details on the schedule of the final judging day, the order of participation, etc. will be contacted a few days before the event.

(5) Others

In addition to the above, the matters necessary for the final judging will be informed on our website.

(6) Fairness

In order to ensure fairness in the judging process, any judge with a special interest in any participant will not involve in judging. Please note that we are unable to respond to any inquiries regarding the details or procedures of the judging process.

(7) Inspections

Participation may be required to submit inspections where necessary.

### **13. Results announcement of final judging**

The results of the final judging (and winners of the prize money) will be announced to the participants on the last day and posted on our website.

### **14. Payment of prize money**

(1) Winners

We plan to provide prizes to several of the best teams as determined by the final judging.

(2) Prize amount

The prize amount will be decided by the review committee after the competition.

(3) Notification of bank account information

Winners of the prize money must notify the bank account for transfer via email before 07/31/2020. If the notification is delayed, payment may be delayed.

(4) Payment date

Late 08/2020

**15. Reporting responsibilities of teams in receipt of research grants**

We request that teams in receipt of research grants submit both a Research Results Report and Expenditure Report, in the format designated by our organization, within three months of the end of the final judging.

We will inform you about the format via email later.

**16. Withdrawal, suspension, and return of research grants**

Our organization may demand the return of a research grant when it judges any of the following to be true.

- (1) The team has provided a false application or report.
- (2) Activity on the relevant research has ceased.
- (3) Any other issue which either the review committee or the board of directors of our organization deems does not correspond with the aims of ARC.

**17. Presentation of achievement by prize winners, etc.**

We request prize winner presentations for their achievement in ARC.

We may also request other participant's presentations.

**18. Publication of achievement by the organizer and handling of intellectual property**

The details and achievements in ARC are planned to be published on our website.

Regardless of any provision of research grants, all intellectual property rights regarding hardware and software of aircraft, etc. participating in ARC shall belong to the participant (please complete any intellectual property procedures before publication).

## Part 2: Competition Scenario

### **Mission Overview:**

A large-scale earthquake has happened. There is a possibility that a serious disaster has occurred in a remote village, but details are unclear. It is necessary to confirm the damage status and dispatch a rescue team appropriately according to the situation. However, landslides and other obstructions on various routes obstruct the path to the site, meaning that a secure route to the site must be formulated first.

This mission composed of three submissions, Phases 1 to 3. Fundamentally, we assume that one team carry out continuously from Phase 1 to Phase 3. However, each phase has a time limit, You also possible to participate in one phase or some combination (e.g. phase 3 only, or phase 1 and 2 only) selected.

### **Mission Phase 1: Formulating a route using aerial search**

Formulate a route to the disaster site and search for people in need of help.

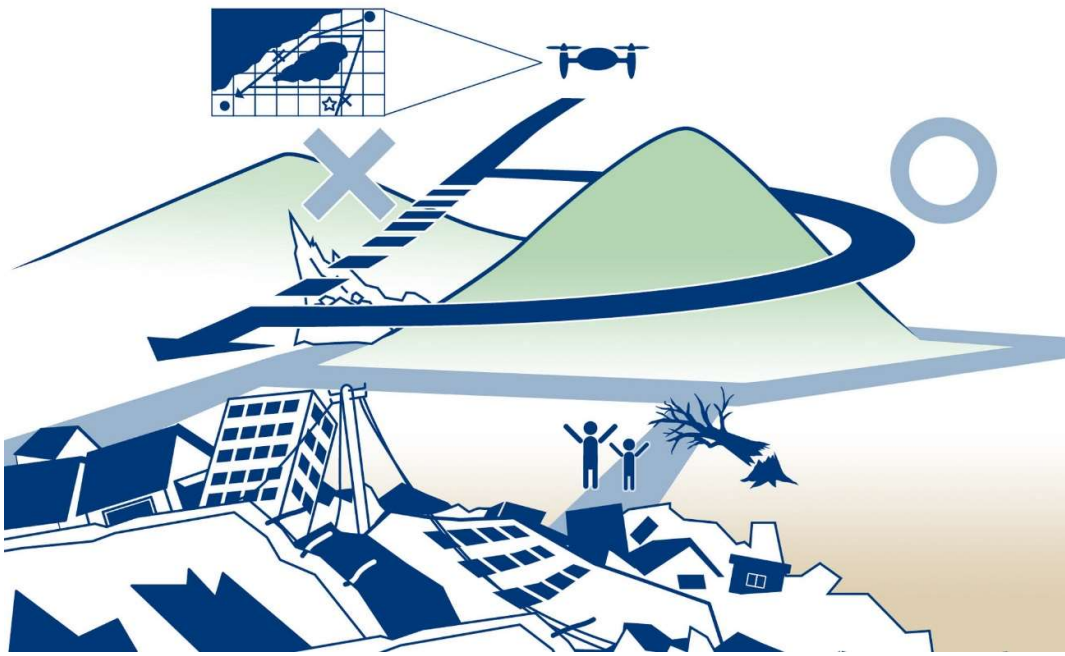
An approximately 25 square kilometers search area will be specified in advance. Teams will search the area using an aerial robot. Various routes to the disaster site will be present with this area but maybe obstructed by landslides and other obstructions caused by the earthquake. There are obstacles cannot be removed immediately (such as large-scale landslides) and obstacles that can be removed (small fallen trees, driftwoods, etc.). Each team will identify the location and type of obstructions, formulate a route to the disaster site by searching with a flying robot and report to the disaster response HQ as quickly as possible.

There may also be one or more people in need of help rescuers in the area, such as a person involved in fallen trees. The accurate locations of these people must be reported. Ideally, this reporting will be provided in the form of wide-area electronic data such as orthophotos or 3D maps.

Obstructions may use actual sand, trees, etc., or maybe designated using specified markers. People in need may be actual people, or represented by mannequins. In either case, teams are encouraged to use AI-based photo recognition and marking. If using this

methodology, teams must conduct this analysis using photos taken by their aerial robot, and must also submit any images produced by this analysis.

Judges will compare the information reported regarding the location and type of obstructions and the locations of people in need of help to the correct data, and calculate a resulting point total. Correct information will increase the point total, while incorrect information will decrease it. Bonus points will be assigned according to the shorter time at which the correct information is submitted.





## **Mission Phase 2: Delivery of relief supplies to rescuers and caregivers**

Deliver supplies to rescuers and caregivers on an access road as requested by the disaster response HQ. A variety of relief supplies must be appropriately delivered according to what those in need and the caregivers currently need.

To confirm and identify the types of supplies required by the rescuers, the team must first fly to and survey the surrounding area. The supplies required may be communicated vocally by the rescuers, or by the text is written on roads or paper around the area.

After establishing the supplies required, the team must use their flying robot to deliver them. The Landing will be prevented by fallen trees and driftwood surrounding the rescuers and caregivers, but someplace landing location will provably exist (though exactly where will be unclear).

Each team must send their flying robot to the site, confirm the landing location, select a landing point that maintains a safe distance from the rescuers and caregivers, and either perform a precise landing or a dropping to deliver the supplies.

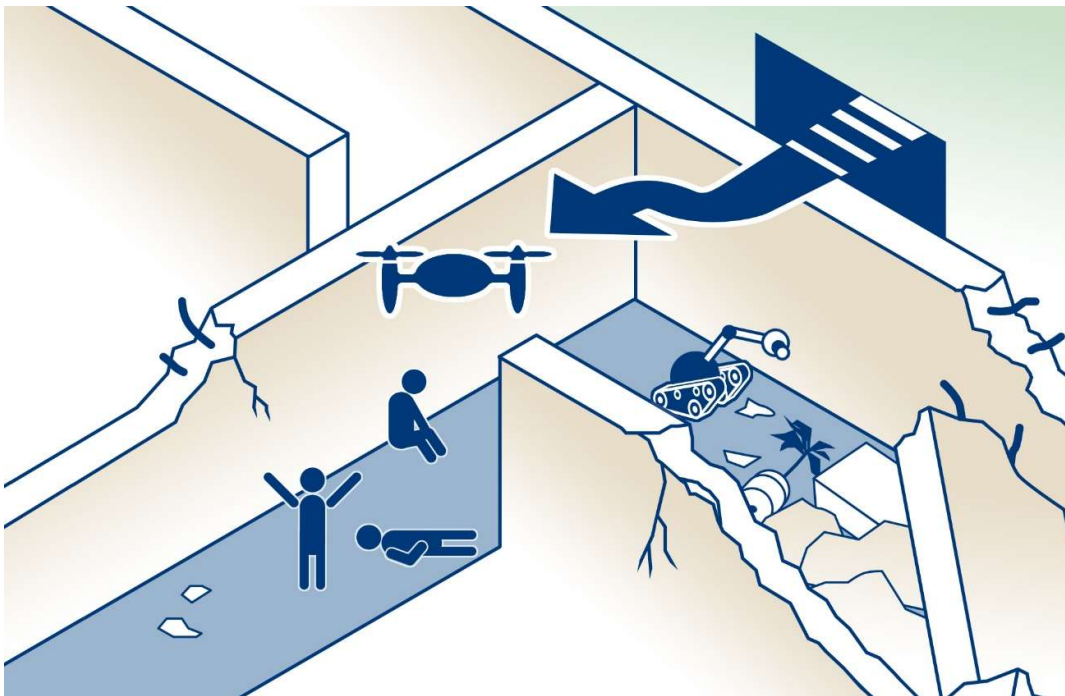


### **Mission Phase 3: Confirming the status of survivors in collapsed facilities**

It becomes clear that a populated facility has collapsed, and search rescuers within the facility must be performed. However, various mudslides surrounding the site making a ground approach difficult, leading the disaster relief HQ to request that an aerial robot perform the search.

The facility is partially collapsed, and it is necessary to identify the route that can enter the facility and search inside. The situation within the facility is unknown, and the search identifies how many survivors are left within the facility.

Teams must approach the distant facility using their aerial robot, locate an appropriate point of entry, enter the facility, and conduct a search. The robot that approaches the facility and the robot that enters the facility need not be the same; various combinations are possible, such as the use of a grounded search robot with a small aerial robot. Teams must create e.g. a 3D map, and use it to mark and report the locations of survivors.



## Part 3: Points to Consider in Review and Judging

### Phase 1

- Teams will be evaluated on their photo recognition technology, using methodology such as AI.
- Use of AI or similar methodology for recognition is recommended (other methodology, such as processing the data brought back on the ground, can be used, but will result in a point reduction).
- AI may also be used to perform candidate extraction from which a human makes the final judgment.
- Teams will be evaluated on their technology to denote rescuers and obstructions on an orthophoto/3D map.
- In the above case, teams will also be evaluated on their technology to quickly transmit data to cloud computing during flight, to shorten the time and high-speed processing, etc.
- Teams that finish reporting within the time limit may move immediately on to Phase 2.

### Phase 2

- Teams will be judged on the precision of their automated landing at a specific area, or by the accuracy of their drop of the objects.
- Teams will be judged on their voice recognition technology and technology for reading text written on the roads or paper.
- Teams will be awarded points for the safe delivery of the supplies. Points will be awarded for landing/dropping while maintaining a safe distance from the rescuers and caregivers. High points will be awarded autonomous detection of the landing zone and for precision landing.

### Phase 3

- Teams will be evaluated on the technology to denote rescuers on a 3D map.
- Points will be awarded for accurate reporting of the number of survivors.
- Teams may also detect the voices, etc. of people to determine their number.
- Beginning the mission from close to the collapsed facility is also permitted (resulting in a loss of points).