The Dawn of the AI-Powered Drone Age

World Drone Competition in Japan

The 1st

Advanced Robotics Challenge

Advanced Robotics Foundation

Introduction

Pioneers of the

Aircraft Age, Charles Lindbergh made the first transatlantic flight.

Autonomous Driving Age, Sebastian Thrun won the DARPA Challenge.

Artificial Intelligence Age, The University of Toronto team made a breakthrough at the ILSVRC (ImageNet Large Scale Visual Recognition Challenge).

In 1927, Lindbergh succeeds the first solo transatlantic flight and won the Orteig Prize.

Young talents who lead innovation have been produced by competitions.

In 2005, the Stanford Team led by Sebastian Thrun (now Vice President of Google) won the DARPA challenge.

In 2012, Jeoffrey Hinton (professor of The University of Toronto) sparked the third-generation AI boom with deep learning.

ARC aims to provide young talents with research assistance and path to great success.

In 2020, The 1st ARC will be held. Who's the next pioneer?

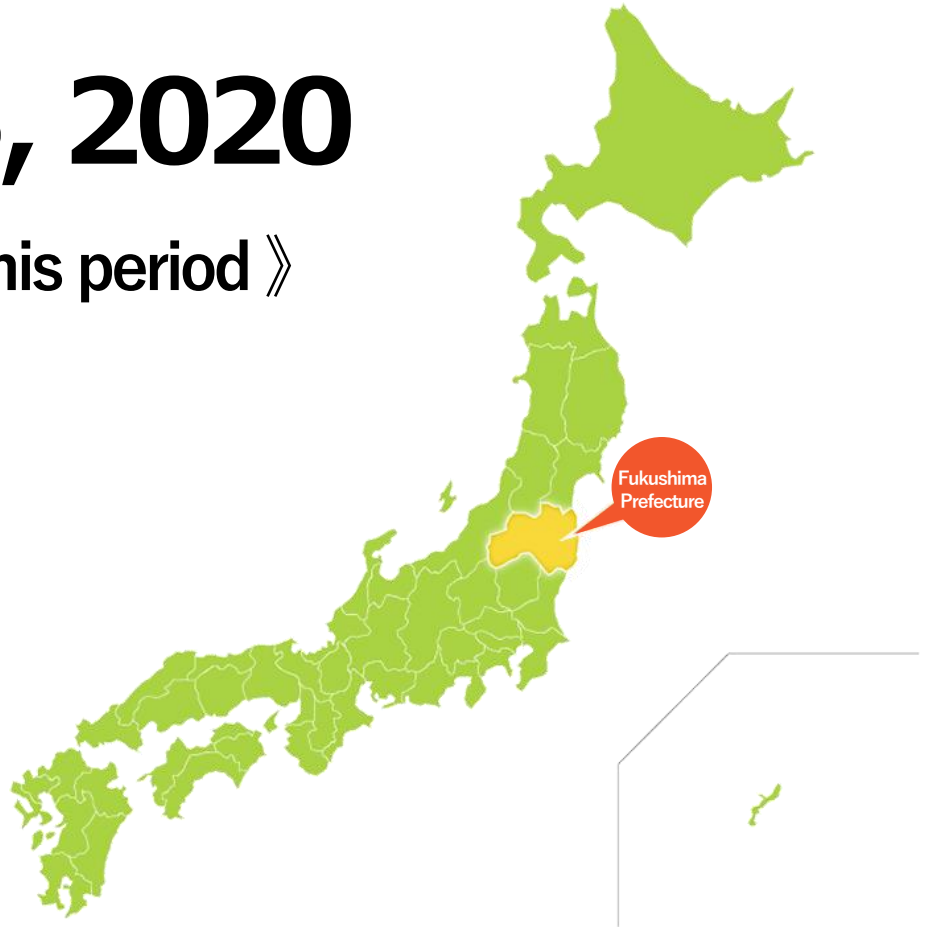
Date and Venue

Date : June 28 - July 5, 2020

《 Scheduled a few days within this period 》

Venue : In Fukushima

《 For details about the venue
will be announced at a later. 》



Aims

- **Discovery and development of young talents to be the pioneers in the advanced robotics field and drone industries (and to provide them with the start-up environment of new businesses).**
- **Promotion of the advanced robotics industry.**

The Money of Research Grants and Prizes

- We aim to cultivate talented young people through the competition to push the boundaries of robotics technology.
- Research grants will be provided for the team that has presented an excellent innovation proposal and plan.
- Prize money will be awarded to several outstanding team in the final judging (competition).
- The competition will also be an opportunity for corporate scouts.

Cooperator and Supporters

- **ARC is supported by 6 national organizations, 4 local governments, and 20 academic organizations.**
- **And sponsored by several global companies.**

Cooperated by Japan Drone Consortium (JDC)

Supported by Ministry of Education, Culture, Sports, Science and Technology, Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure, Transport and Tourism, Ministry of Internal Affairs and Communications, Cabinet Office, Fukushima Prefecture, Minami-soma City, Chiba City, Kanagawa Prefecture, New Energy and Industrial Technology Development Organization (NEDO), Agency of Industrial Science and Technology (AIST), National Institute of Information and Communications Technology (NICT), Japan Japan Aerospace Exploration Agency (JAXA), The Robotics Society of Japan, Fukushima Innovation Coast Initiative Promotion Organization, Japan Association of New Economy, Nikkan Kogyo Shimbun, etc. (in no particular order, including application)

Flow to the Final Judging (Competition)

Apply（Submit of proposal） — October 1 - December 20, 2019

▼ We review the submitted proposals.

Paperwork Screening — December 20-27, 2019

▼ ↓ Applicants living overseas are exempt from the Presentation Screening.

Presentation Screening — Early January 2020

▼ We support the development by providing the grants.

Final Judging (Competition) — June 28 - July 5, 2020

Competition Overview

The final Judging is a disaster relief mission.

A large-scale earthquake!
Next-generation flying robots dispatch!
Formulate a route to the disaster site,
and rescue the survivors!

Participants will be asked to undertake a mission to disaster relief on the following assumptions.

- A large-scale earthquake has happened, there is a possibility that a serious disaster has occurred in a remote village, but details are unclear.
- Landslides and other obstructions on various routes have obstructed the path to the site.
- It is necessary to formulate a route to dispatch rescue teams while discovering and supporting rescuers.

Three sub-missions

The final judging is composed of 3 sub-missions.

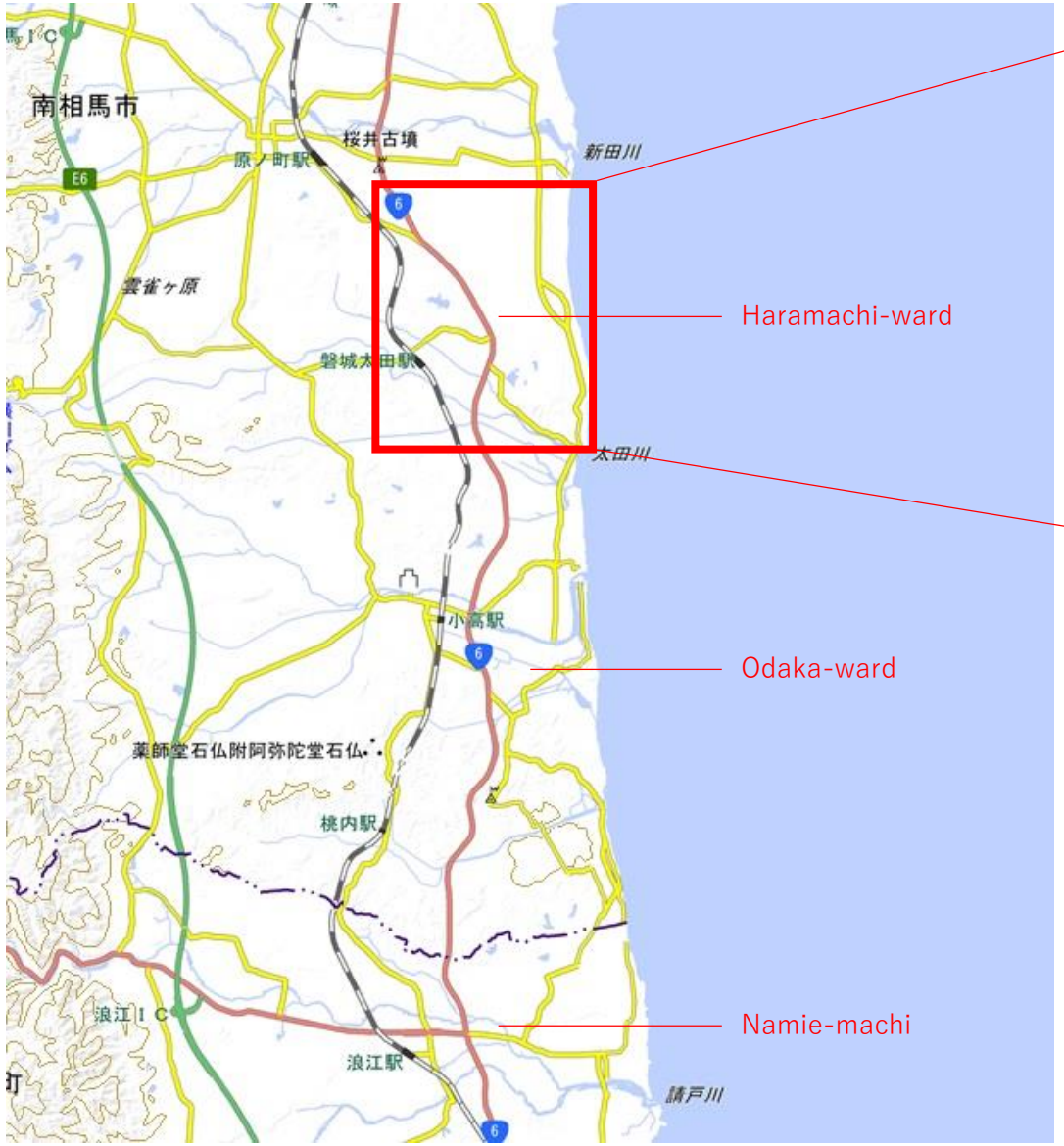
Phase 1 **Route formulation by searching from the sky**

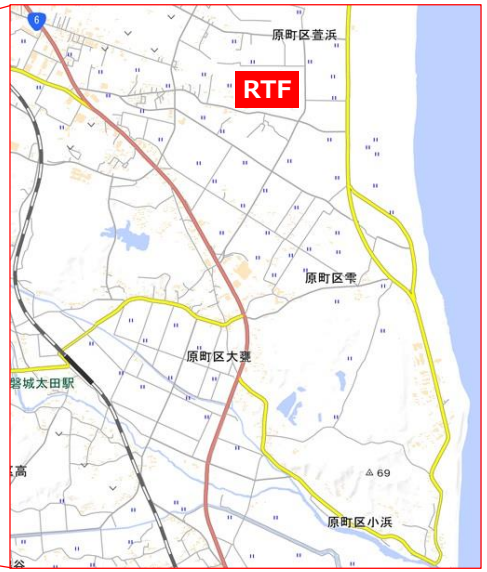
Phase 2 **Delivery of relief supplies to rescuers and caregivers**

Phase 3 **Confirming the situation of survivors in collapsed facilities**

We assume that one team will continually carry out from phase 1 to phase 3.
However, is also possible to enter with each Phase only or a combination of them.

Phase 1 & Phase 2 Flight Areas





※These maps are an excerpt from the Geospatial Information Authority of Japan maps.

※Fukushima Robot Test Field is located in Minamisoma City, Fukushima Prefecture.

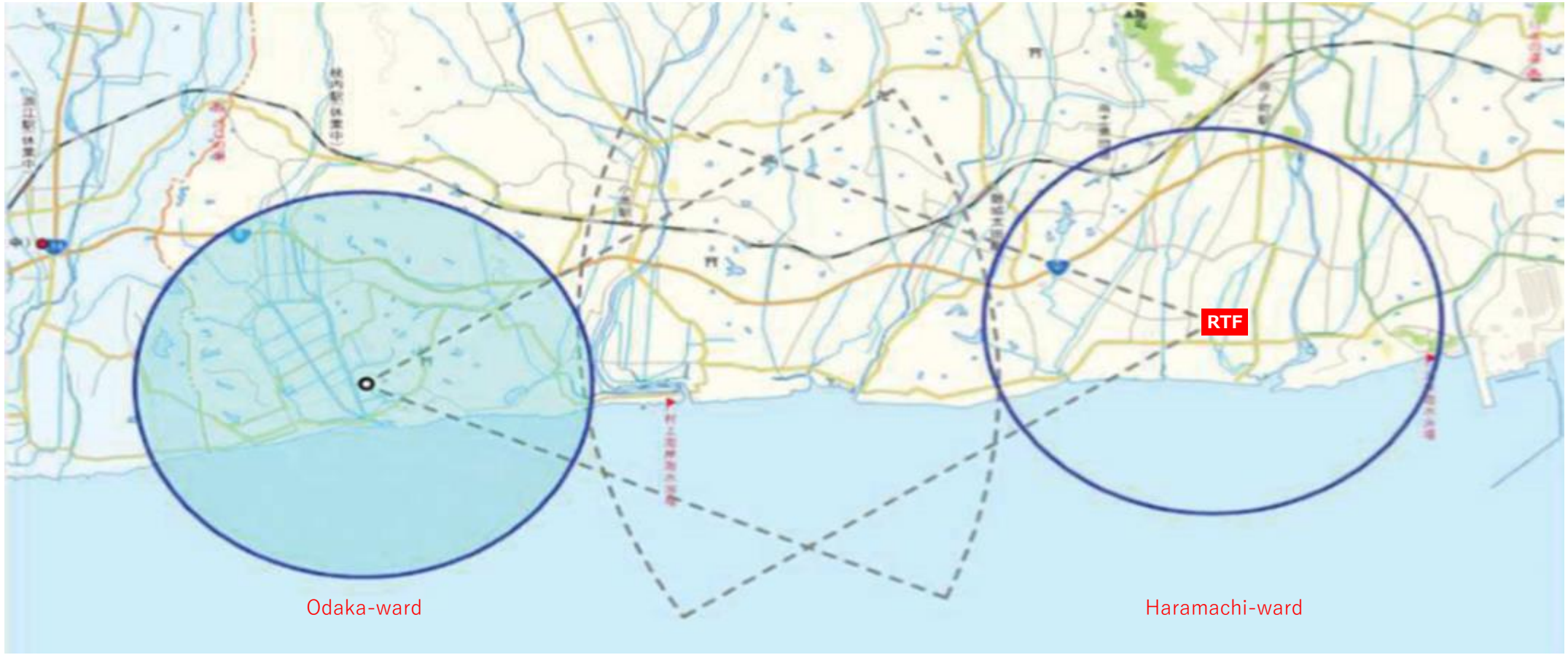
※ For the RTF, please refer to the following website.

https://www.fipo.or.jp/robot/

Fukushima Robot Test Field (RTF) and surrounding areas

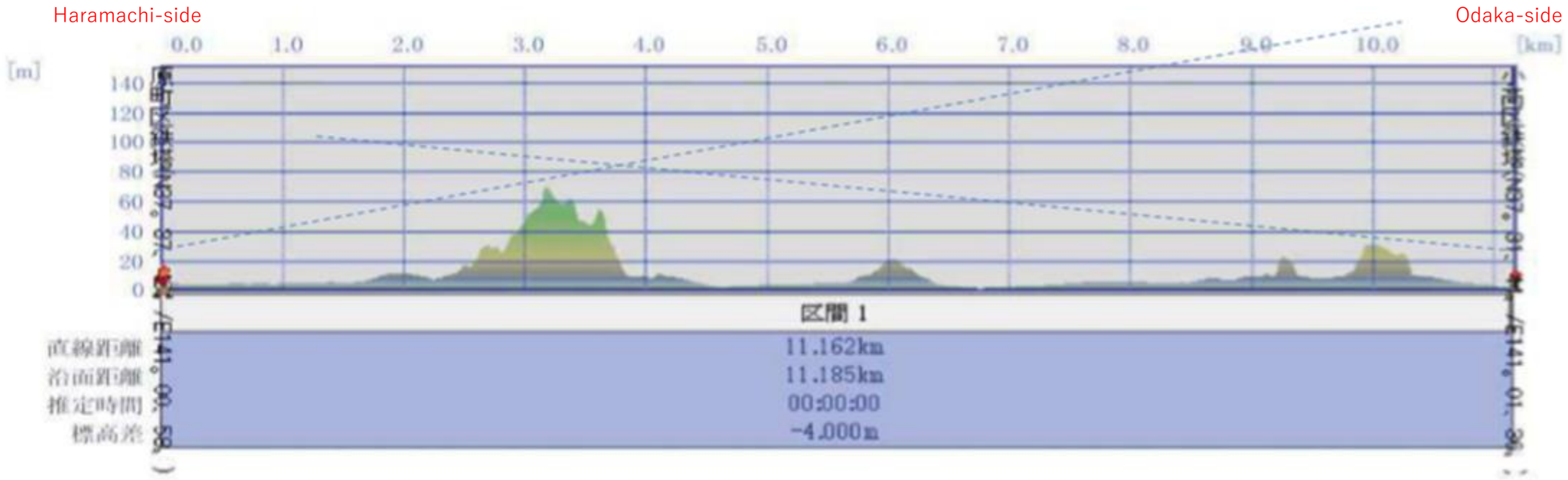
- A vast area of about 10 square kilometers including the RTF.
- There are many “No-fly zones” in the area.
  The teams have decided to participate in the competition will be informed with more information.

Communication Towers and Antennas



Two communication towers in Haramachi (In the RTF) and Odaka ward. Each communication tower has four antennas that 2.4GHz/920MHz rod antennas (2 km in radius) and 2.4GHz/920MHz directional antennas (8 km in radius).
Competitors always activate only one of the four antennas and fly long distances.

The Test Results for the Flight Level (Using the installed communication towers)



Test Data	
Distance	11.162 km
Side distance	11.185 km
Elevation difference	-4.000 m
Bearing	175.18°
Angle→	0.02°
Angle←	-0.02°
Sink	-8 m
Estimated time	00:00:00
Cumulative elevation (+)	174.844 m
Cumulative elevation (-)	178.402 m

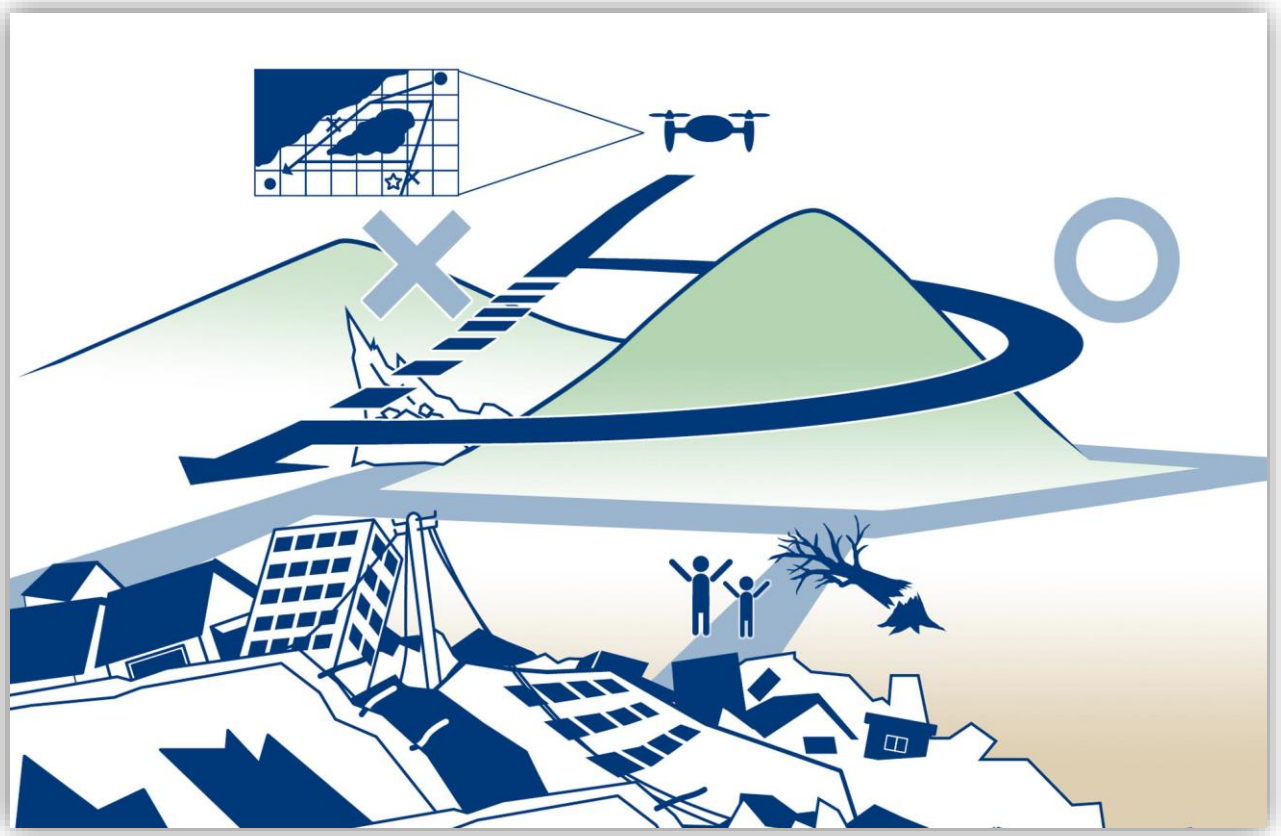
- In the visual flight, it is possible to communicate from a communication tower with a height of 30 meters.
- Even in the most difficult area of the middle part, it seems to be possible to communicate if it is more than 120 meters above sea level.
- When the drone flies over the sea, there are no obstacles, so it seems to have more freedom at the flight level.

※This data was provided by the Fukushima Robot Test Field.

Points of Phase 1

Route formulation by searching from the sky using flying robots

- Search a vast area pre-designated by flying robots.
- Identify the location and type of obstacles and report to the disaster response HQ.
- If there are one or more rescuers in the area, also the locations of them must be reported.
- While carrying out the above mission, formulate the dispatch route of the relief team.



Metrics of Phase 1

Speed and accuracy of the search, and the image recognition ability using AI, etc. are asked.

- Participants may use several aircraft (also, not limited to the rotary wings).
- The reports are encouraged to submit by wide-area electronic data using orthophotos, 3D maps, etc.
- In recognition technology, It's encouraged to use AI, etc.
  (You may process the data on the ground, but the score decreases).
- The technology of high-speed processing for shortening the time
  by transmitting data to cloud computing during the flight will be highly evaluated.
- Also it may be allowed that using AI for candidate extraction, and humans judge the type and location.
- Teams that finish reporting within the time limit, move to the mission Phase 2 immediately.

Points of Phase 2

Confirming and delivery of relief supplies needed by the rescuer and the caregiver

- Fly to the vicinity of the rescuer and confirm the type of supplies needed.
- We assume recognition by voice or text.
- The aircraft may not be able to land because fallen trees etc. are scattered around the rescuer and the caregiver.
- Select a safe place and deliver supplies by high precision landing or mid-airdropping.

Metrics of Phase 2

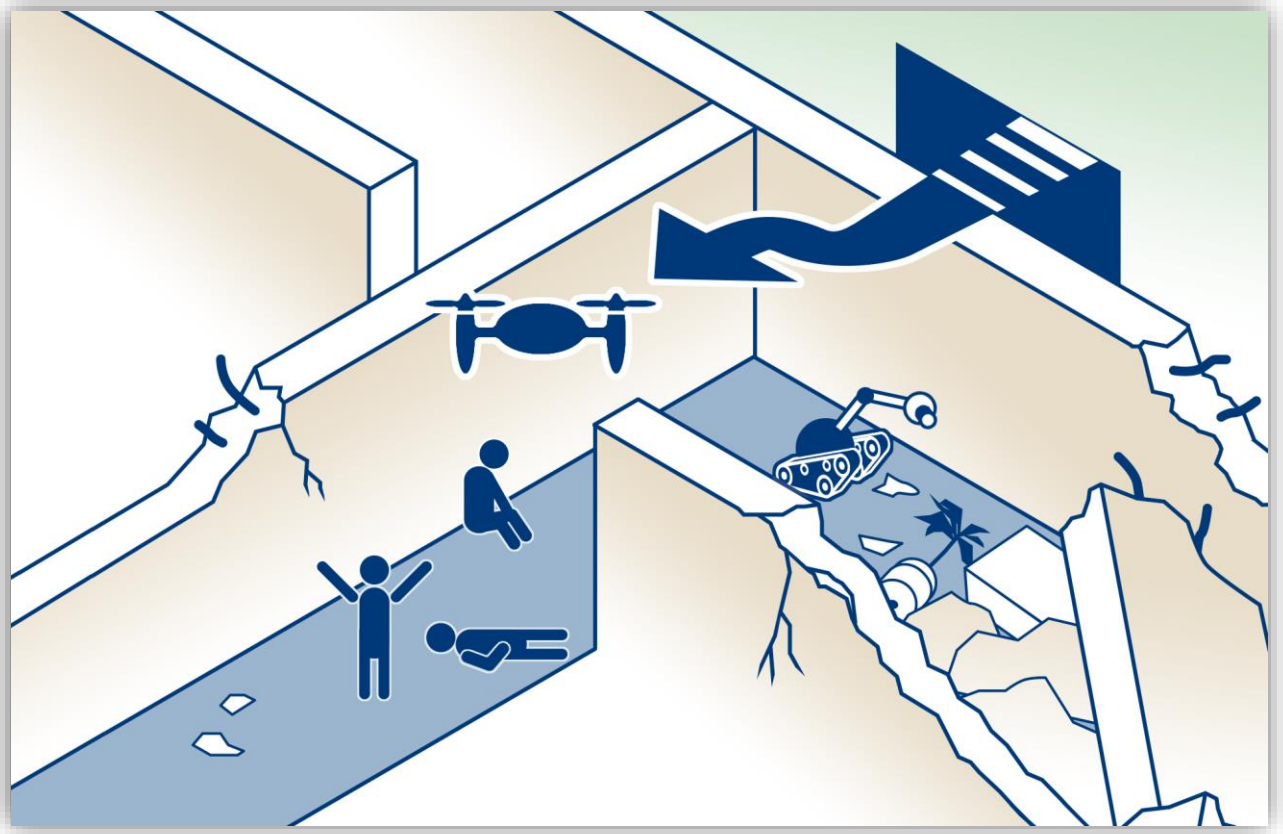
How quickly, safely and accurately delivered the relief supplies?

- If you could not identify in Phase 1 the location of the rescuer required for Phase 2, disaster response HQ announces the information (but the score decreases).
- The technology to recognize the text written on paper or the road, and to recognize the voices emitted by the rescuer is evaluated.
- The aircraft using confirm the type of supplies needed and using deliver it does not have to be the same.
- If you can land or drop accurately without damaging the supplies while maintaining a safe distance from the rescuer and the caregiver, you will get the high point..
- Especially, if your team automatically recognized by AI a suitable place for landing and successfully made a high-precision landing, you will be highly evaluated.

Metrics of Phase 3

Confirming the situation of survivors in collapsed facilities (unknown environments)

- Approach to a collapsed facility in a remote village using a flying robot.
- Recognize the appropriate path of intrusion and enter the facility (by flying or ground robots).
- Internal search to confirm the number of survivors and their locations and situations.
- After creating a 3D map in the facility, mark and report the location of the rescuer.



Metrics of Phase 3

The ability to search in the facilities with non-GPS environments and limited path of intrusion will be evaluated.

- It is also allowed to start the mission from the vicinity of the collapsed facility, but the score decreases.
  If you succeed the approaching from a remote location, it is appreciated more.
- Although we don't rule out the possibility to search with a large flying robot
  but assume the environment that cannot be full-searched without the use of small aircraft.
- In addition to using the flying robots (UAVs), to use the ground robots (UGVs) is also allowed,
  and the cooperation UAV and UGV, in that case, will be highly evaluated.
- After the creating of a 3D map, if you can identify the number and location of the survivors,
  and report them accurately, you will be highly evaluated.
- It is also good to recognize the voice and body temperature of the survivors and to use it for identification.

Points and Metrics of throughout

Aircraft technology, algorithms, and operational methods with high safety, practicality, and originality will be highly evaluated.

- Participation using only ready-made products is also acceptable (the score doesn't decrease), but the original aircraft and technology are more appreciated.
- A mission will be carried out one team at a time. It will not be mixed with other team's aircraft.
- The time limit will be announced at a later
  (we are considering that each team has about two hours through from Phase 1 to Phase 3).
  There is a time limit for each Phase, and the amount cleared earlier is added to the point.
- Because we place a great emphasis on safety if the flying robot crashes to the ground will be imposed a maximum penalty (but if the safety device operates properly in the event of a fall, reduce the width of the decreased score).
- If your team operates multiple aircraft, formation flight, and collision avoidance functions will be highly evaluated.

What is important in the proposal?

The review committee is looking for what is not a strategy to win the game, but a proposal for effective innovation in the disaster relief field.

- What solutions and innovations would you propose after correctly recognizing current status and issues in the advanced robotics field (especially disaster response robotics)?
- Do you have enough idea what kind of development and preparation should you do after imagining the real scene of disaster relief beyond the Competition Scenario?
- Please appeal to us that your team can carry out your proposals.
  What background and expertise do your team members have?
  What kind of work will each of them take in the project?
- Are you realistic about the equipment and consumables used to carry out the proposal, including total cost?

Research Grants and Prizes

Research Grants

- Research grants will be provided for the team that has presented an excellent innovation proposal and plan.
- The total amount is in accordance with "Research Grant Application" (specifically, we will notify individually, in the middle of January).
- The payment date is scheduled for the end of January 2020.
- Those who receive a research grant are obliged to submit a spending report after the ARC.

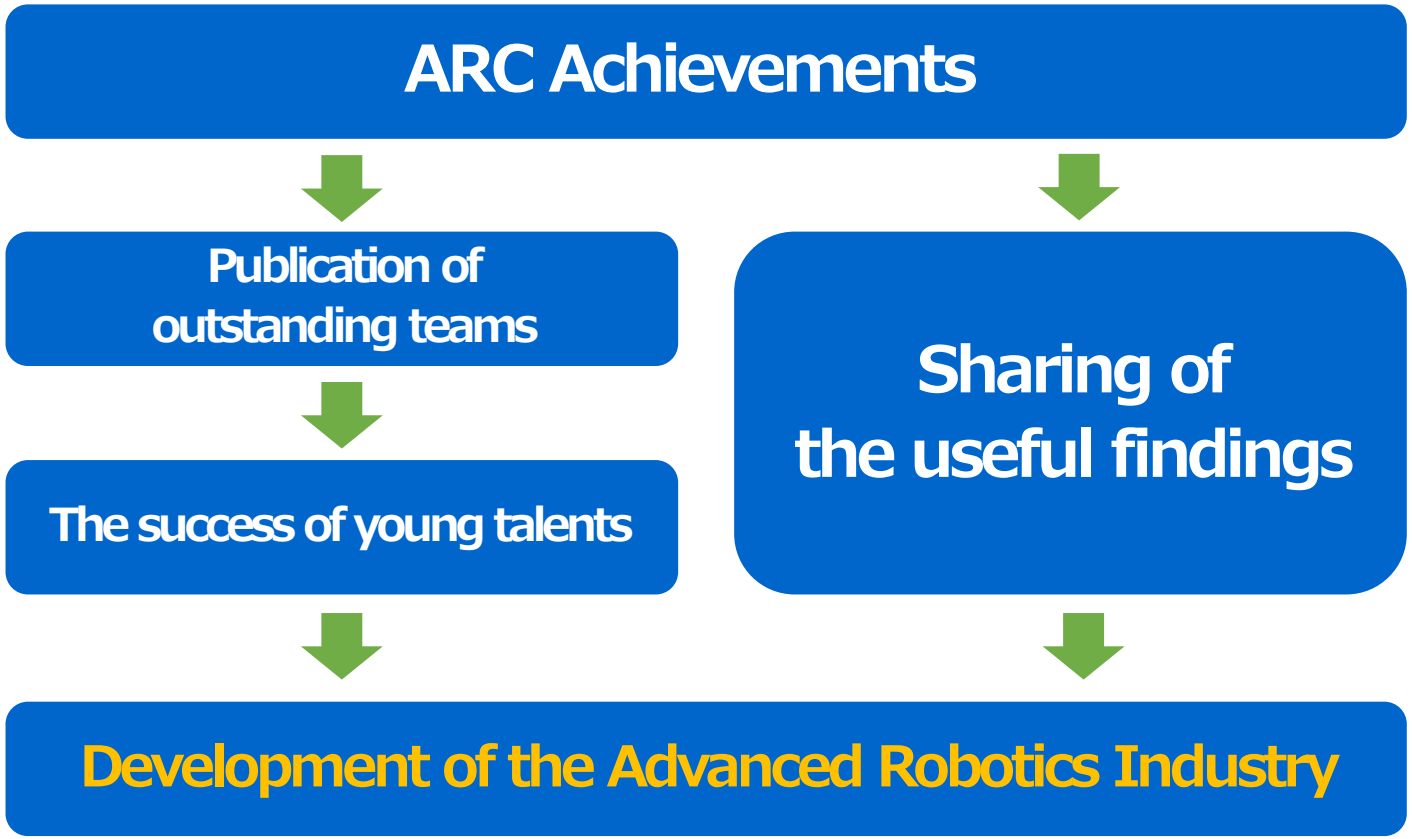
Prizes

- Prize money will be awarded to several outstanding teams in the final judging (competition).
- The amount of each award will be determined by the review committee, after the competition.
- Some teams may receive both research grants and prize money.
- The payment date is scheduled for early August 2020.

※ Both grants and prize money will be funded by donations from the Foundation and the sponsoring companies.

Publication of the Achievements

The competition results and the useful findings will contribute to the development of the advanced robotics industry.



- In addition to publishing these information through the mass media, it'll also post them on the Foundation's website and publishes booklets.
- Presentation of achievement by prize winners, etc.
- Outstanding teams will get a chance of the corporate scouts and start-up of new business.

Applications

Access the "Competitions" on the Foundation's website

Download from the "Official document download page"

▼

After carefully reading the "Application Overview", prepare the proposals (Proposal Overview, Proposal Plan, and Research Grants Application) and convert it to PDF.

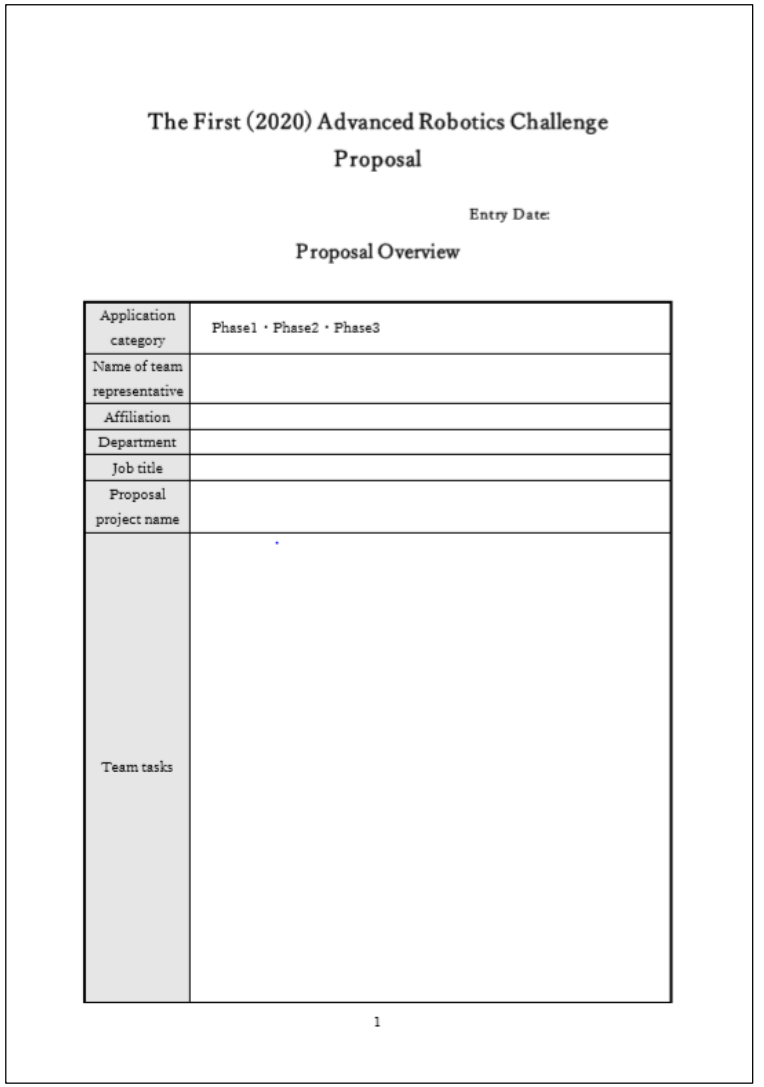
▼

Fill in the form in the "Entry Page"

▼

Attach (upload) and send a proposal

Deadline: December 20, 2019, 17:00 (JST)



The First (2020) Advanced Robotics Challenge

Proposal

Entry Date:

Proposal Overview

Application category	Phase1・Phase2・Phase3
Name of team representative	
Affiliation	
Department	
Job title	
Proposal project name	
Team tasks	

1

Notes

Attention on participation

・Participation fee is free
(However, please pay your expenses for travel, equipment transportation, accommodation, insurance, and other expenses related to participation in the competition).
・Participants cannot enter from more than one team.

Flight permit application

・The Foundation shall apply for a flight permit to the Ministry of Land, Infrastructure, Transport and Tourism in bulk (participants must submit the necessary information for the application by the specified date).

Handling of intellectual property

・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).

Forums and Workshops

The Foundation has been holding the "Next-Generation Robotics forum and workshop" to raise the level of knowledge of young human resources, including ARC participants.

The 1st Next-Generation Robotics forum and workshop

"Lecture 1" was held on October 2, 2019, at Ginza Blossom Central Hall.
"Lecture 2, 3" will be held on November 25 and January 2020 at the same venue.

Forum theme: "AI x Drone"

History of Deep Learning, New Topics, and Issues,
Application to Drone Technology

Lectured by : Dr. Helmut Prendinger

(Professor, National Institute of Informatics)

※ For details, please refer to our website.

Foundation Office

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