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Future From Fukushima.

FUKUSHIMA ROBOT TEST FIELD

Fukushima Innovation Coast Concept

Fukushima Robot Test Field

STARTS FY 2018!


Airfield with impact absorption net/
Runway attached hangar


Test bridge

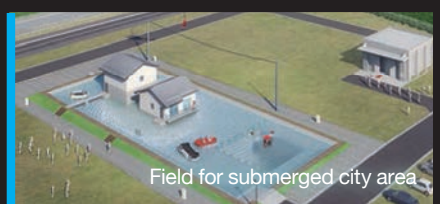

Test tunnel


Test plant/
Test preparing building


City area field


Debris/landslide field


Building for indoor water tank test


Field for submerged city area

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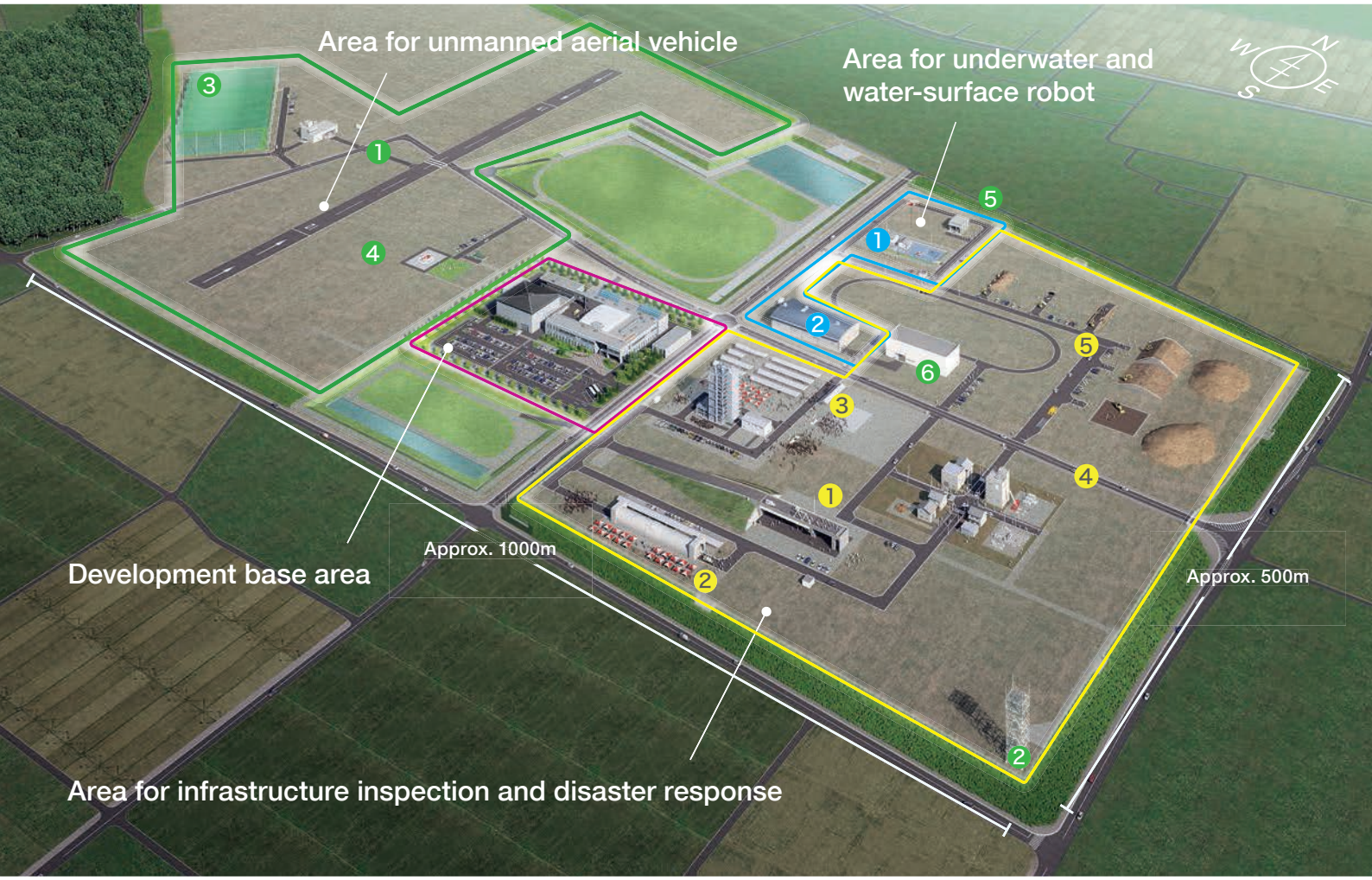
Fukushima Robot Test Field

"Fukushima Robot Test Field" to be developed based on Fukushima Innovation Coast Concept is one of the largest research and development bases in the world, where R&D, verification test, performance evaluation and maneuver training can be carried out while reproducing the actual use environment within the base, mainly for the field robots of land, sea and sky such as unmanned aerial vehicles, disaster response robots, underwater exploration robots that are expected to be utilized for logistic, infrastructure inspection, large-scale disaster time, and etc. This base is planned to develop a runway for long distance flight test in Namie-machi Tanashio industrial complex, as well as to establish "Area for unmanned aerial vehicle area", "Area for infrastructure inspection and disaster response", "Area for underwater/water-surface robot area" and "Development base area", securing the area of approx. 1000m east-west and approx. 500m north-south within the Restoration industrial complex site in Minamisōma city, and will be opened sequentially after FY 2018.

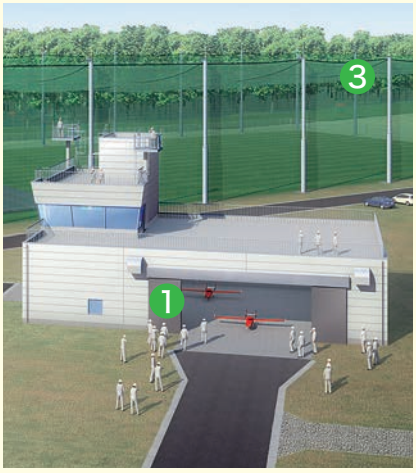


Fukushima Innovation Coast Concept

The Fukushima Innovation Coast Concept aims at building a new industrial base in this region, in order to restore industries in Hama-dori and other areas that have been lost due to the Great East Japan Earthquake and nuclear disasters. We are working on industrial clusters, human resource development, and expansion of interaction population, as well as promoting the implementation of projects relating to decommissioning of reactor, robots, energy, agriculture, forestry and fisheries.

Area for unmanned aerial vehicle

This area has the largest flight airspace, runway, and airfield with impact absorption net in Japan for unmanned aerial vehicle to provide an environment that enables basic flight test and other various tests such as collision avoidance, forced landing, falling, and long-distance flight, and promotes the practical application of unmanned aerial vehicle.



1 Runway / Runway attached hanger

Scheduled to be opened in the 1st quarter of FY 2019

This facility is used for flight tests and maneuver training as a runway for unmanned aerial vehicles. Special flight such as collision avoidance, forced landing, falling, and object dropping can be performed in a widely secured impact absorption zone. The hangar has the maintenance room directly connected to the runway, and the control room and the antenna installation base where the whole area can be viewed. This facility will be set up at 2 different places in Minamisōma city (runway located in north-south direction) and Namie-machi (runway located in east-west direction), so that one of the two sites can be chosen according to the test content or climate.

* The hangar will be opened in the 3rd quarter of FY 2019, and Namie-machi runway will be opened in the 4th quarter of FY 2019.

- Runway: 500 × 20m/Width including impact absorption zone and runway: 200m
- Power supply and LAN connection port available near the runway
- Hangar storage area: approx. 560m² (Approx. 300m² dedicated for the serviced office)

2 Wide area flight zone/ Communication tower

opened in July,2018

With individual consultation, a flight course on land and sea can be set individually for flying over long and wide areas within the area of approx. 13km between the two sites of Minamisōma city and Namie-machi. Communication tower, we observe objects such as low wind speed and wind direction, manned aerial vehicle and birds, as well as secure communication even at long distances to secure the safety of the flight.

- Communication tower height: 30m/Meteorological observation system (Measurable range: 6km)
- 2.4 GHz, 920 MHz wide area communication antenna (antennas can also be brought in)
- Airspace monitoring equipment (Detects cross section area of at least 20 ㎡ within 3.5km range)

3 Airfield with impact absorption net

Scheduled to be opened in the 3rd quarter of FY 2019

This airport is non-applicable to the aeronautical law, whose upper and surrounding parts are covered with net. Night flight and object dropping can be performed under an outdoor environment involving wind and rain or sunshine, without making any legal application in advance. Mats are placed on the ground, in order to relieve the falling impacts.

- 150m × 80m × effective height of 15m
- Lighting, power supply, LAN connection port

4 Heliport

Scheduled to be opened in the 4th quarter of FY 2018

This heliport can be used for arrival and departure of manned helicopters for aircraft tracking, collision avoidance with unmanned aerial vehicle, or disaster relief training etc., as well as for testing and training of single-rotor VTOL type unmanned aerial vehicles.

- 20m × 25m area for takeoff and landing belt with concrete pavement
- Parking space/fuel store for one vehicle

5 Building for continuous operation durability test

Scheduled to be opened in the 3rd quarter of FY 2019

This facility provides the test space covered with concrete, in order to securely perform the long-term continuous operation durability test for unmanned aerial vehicle.

- Test space: 10 × 9.5 × 5m height

6 Wind tunnel building

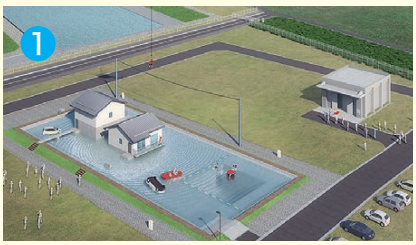
Scheduled to be opened in the 4th quarter of FY 2019

Tests on aerodynamic characteristics of unmanned aerial vehicles and resistance to strong wind and gust can be performed.

- Measuring section cross section: 3 × 3m
- Max wind speed: 20m/s

Area for underwater and water-surface robot

This is the only test site in Japan, maintained for the robot demonstration test regarding underwater infrastructure inspection and disaster response. This area can reproduce conditions occurring in the water such as dams, rivers, submerged city areas, or harbors.



1 Field for submerged city area

Scheduled to be opened in the 4th quarter of FY 2019

This field can reproduce conditions of submerged city area with flood damage to perform information gathering by robot and drone and search and rescue training. It can also be used for sinking test subjects or obstacles, rescue training with manned helicopters or boats.

- Outdoor water tank: 50 × 25 × water depth 0.7m (inside the tank, area of 10 × 10m has 5m depth)
- 2 houses (one has a completely flooded 1st floor, and another has a partially flooded)

2 Building for indoor water tank test

Scheduled to be opened in the 4th quarter of FY 2019

This facility reproduces conditions of dams, rivers, and harbors to perform tests and maneuver training on inspection and investigation with underwater/ water-surface robot. The large water tank is equipped with a test piece imitating an aging underwater structure, and enables installation of inspection objects, generating water flow, reproducing the dark places, and underwater positioning with acoustic sonar. In a small water tank, the performance on observation instruments to be installed can be tested by controlling the turbidity.

- Large water tank (30 × 12 × water depth 7m): water flow, lightness control, underwater structure installation table, acoustic sonar, movable observation stand, crane with weight of 4.8t
- Small water tank (5 × 3 × water depth 1.7m): turbidity control

Area for infrastructure inspection and disaster response

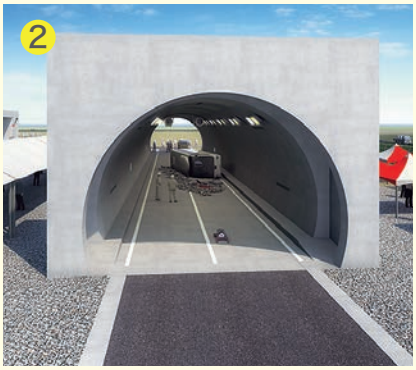
This is the only test site in Japan that is maintained for the demonstration test on infrastructure inspection and disaster response by robot. Almost every possible disaster environment and aging situation in the structures such as tunnel, bridge, plant, city area, and road can be reproduced. In the summer of 2020, "World Robot Summit", the international robot competition will be held.

1 Test bridge

Scheduled to be opened in the 4th quarter of FY 2019

This facility reproduces aging and obstacles with 4 types of bridges made of steel and concrete to perform tests and maneuver training on checking and inspecting conditions. It reproduces the objects to be inspected such as cracking/peeling/float on concrete, looseness/cracking on steel bolts, and dysfunction with bearings, and some variations can be replaced as test pieces. Also, illumination posts or protective fences that may hinder inspection, trusses, or cable tubes can be installed.

· Length: 50m, Road width: 10m, Bottom height: 5m
· Steel bridge part: 35m, multiple and minor main girders of steel simple plain girder
· Concrete bridge part: 15m, PC simple pretension method, T girder bridge and same deck bridge



2 Test tunnel

Scheduled to be opened in the 3rd quarter of FY 2019

This facility reproduces traffic accident, collapse, and aging in the tunnel to perform tests and maneuver training on situation checking, investigation, debris removal, and aging check. On its wall, it is equipped with lighting equipment on expressways and ordinary roads (LED lamp, sodium light) and jet fans to reproduce cracking/float parts to be inspected. Some variations can be replaced as test pieces. Inside the tunnel, obstacles such as vehicle, rubble, rock, or gravel can be placed and fixed freely, and also maximum capacity of the center part of the tunnel can be reproduced by closing the shutters on both side of the tunnel.

· Round tunnel with length 50m, road width 6m

3 Test plant, Test preparing building

Scheduled to be opened in the 3rd quarter of FY 2018

Test plant reproduces plants at normal/disaster situation to perform tests and maneuvering training on inspections, information gathering and equipment operation. This plant has been installed plumbs, valves, ducts, staircases, spiral staircases, catwalks, vertical ladders, tanks and chimneys in various shapes. Abnormal environments can be reproduced, by changing/blinking instruments and indicators, filling smoke or gas, and arranging heat sources and rubble. Test preparing building is a facility for preparation for the field test and maintenance of robots.

· 10 × 12m for 1 floor (20 × 12m only for 1st floor), 6 stories with height of 30m
· Total floor area of test preparing building approx. 220 m²

4 City area field

Scheduled to be opened in the 4th quarter of FY 2019

In this field, houses, buildings and intersections with signal/sign are arranged to reproduce the condition of city area. Vehicles, debris and objects to be inspected are placed inside/outside the buildings to perform testing and maneuvering training on information gathering, investigation, obstacle removal, search and rescue of personnel, and inspection. It can also be used for running tests using concrete and wood debris, bleaching training on building walls and floors, and automatic driving tests using road parts.

· Three-story building, two-story building: 100m² on each floor
· 4 houses of two-story buildings: each building area of 50m²
· Garage

5 Debris/landslide field

Scheduled to be opened in the 2nd quarter of FY 2019

This facility reproduces the road blocking sites and the landslide sites during the disaster to perform tests and maneuver training on situation checking, investigation, search and rescue, and recovery work with unmanned construction heavy machinery and robots.
It has a soil slope reproducible at 15 or 30 degree, muddy grounds with adjustable softness, and a circumferential road for running durability test, as well as various obstacles that can be placed freely on the road.

· Obstacles on the road: gravel, rocks, concrete pieces, fallen trees, vehicles, utility poles, cracks, sinks etc.
· Soil slope: tilt angle of 30 or 15 degree for each 30 sq. m
· Muddy ground: 30m × 30m × depth 30cm
· Circumferential road: paved road with circling distance of 400m

* Scheduled opening times may be changed according to the progress of design and construction.

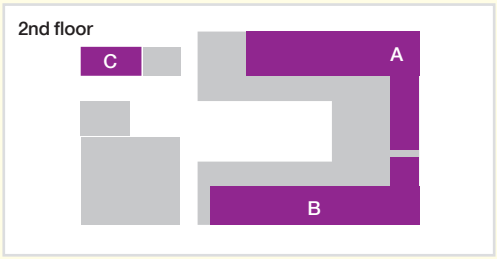
Development base area

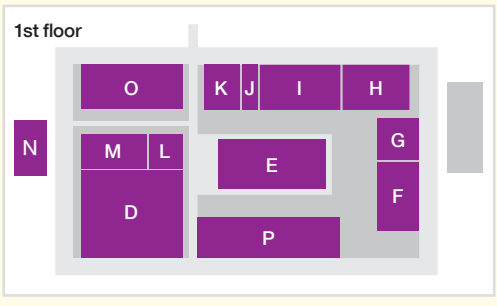
Scheduled to be opened in the 2nd quarter of FY 2019

This area functions as the main building of Fukushima Robot Test Field, where various tests against wind, rain, waterproof, dustproof, fog, water pressure, temperature, humidity, vibration, and radio wave can be executed for performance evaluation of robot, as well as preparation, processing and measurement for each test. It is also possible to use this area as a short/long term activity base for researchers, open an office, and hold a large-scale conference or an exhibition.

Building overview

· Construction area: approx. 5,200m² · Total floor area: approx. 7,600m² · 2 stories with RC construction
· 165 parking lots (available for large bus)





Main facilities

A. Laboratory
13 rooms of 30 - 60m² (Up to 3 rooms can be used together)

B. Conference room
9 rooms for 20 - 40 persons (3 rooms can be used together)

C. Comprehensive control room
Operation control can be achieved overlooking the unmanned aerial vehicle area

D. Indoor Test Building
32 x 30 x H10m, motion capture (outdoor usable), standard test course for robot running performance (conformed to NIST standard)

E. Courtyard
Test preparation available at 36 x 18m courtyard with half-covered

F. Conference hall
180 people capacity (including foyer)

G. Development laboratory
2 working rooms of approx. 40m² for short-term residents

H. Analysis and measurement room
Non-destructive inspection (X-ray: 450kV, sample ϕ600 x 1000mm, equipped with flat panel detector and line detector), SEM (with EDS), FT-IR, three-dimensional measurement, surface roughness/contour shape measurement, fluorescent X-ray analysis and more

I. Machining room
machining center, and more

J. Environmental measurement laboratory
Constant temperature and humidity test (1.5 × 1.5 × 1.5m, -70℃～+180℃, pressure reduction range: 10.7 - 101.3 kPa), dustproof test (IP5X, 6X compatible, chamber size of 1.5 × 1.5 × 1m), thermal shock test, and more

K. Anechoic chamber
EMC test with 3m method, OTA test available, internal combustion engine test available

L. Vibration test room
Max table size: 1.5 x 1.5m, max weight: 500kg, max frequency: 2000 Hz, testing together with constant temperature and humidity chamber (1 x 1 x 1m) is possible

M. Test room for wind resistance / rainfall
Wind resistance test (outdoor feasible), rainfall・fog test (max 180mm/h in the 4 x 4m range), water pressure resistance test (internal dimension ϕ 1.5 x H 1.5m, up to 2 MPa), waterproof test (IPX 3 - 6 compliant・turn table ϕ 1,050mm)

N. Building for explosion proof test
Chamber with internal dimensions of ϕ1 × 2m, hydrogen/ethylene/acetylene/propane available for each single use or mixed use

O. Rental warehouse, Storeroom
7 rooms of 30 - 100m²

P. Management room
Faculty room, reception

* Specifications of each facility may be changed.

Traffic access

Joban Expressway Minamisoma IC/Namie IC

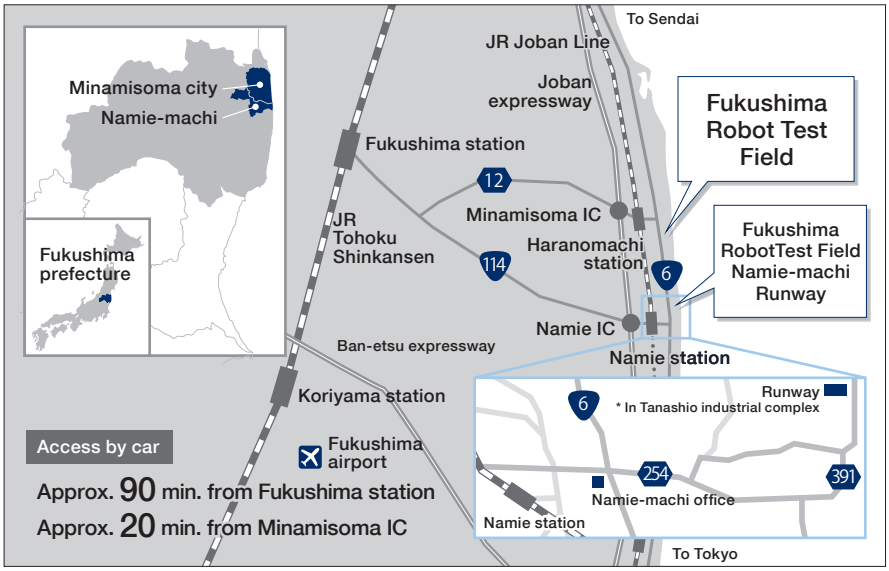
Approx.180min. by car fromTokyo

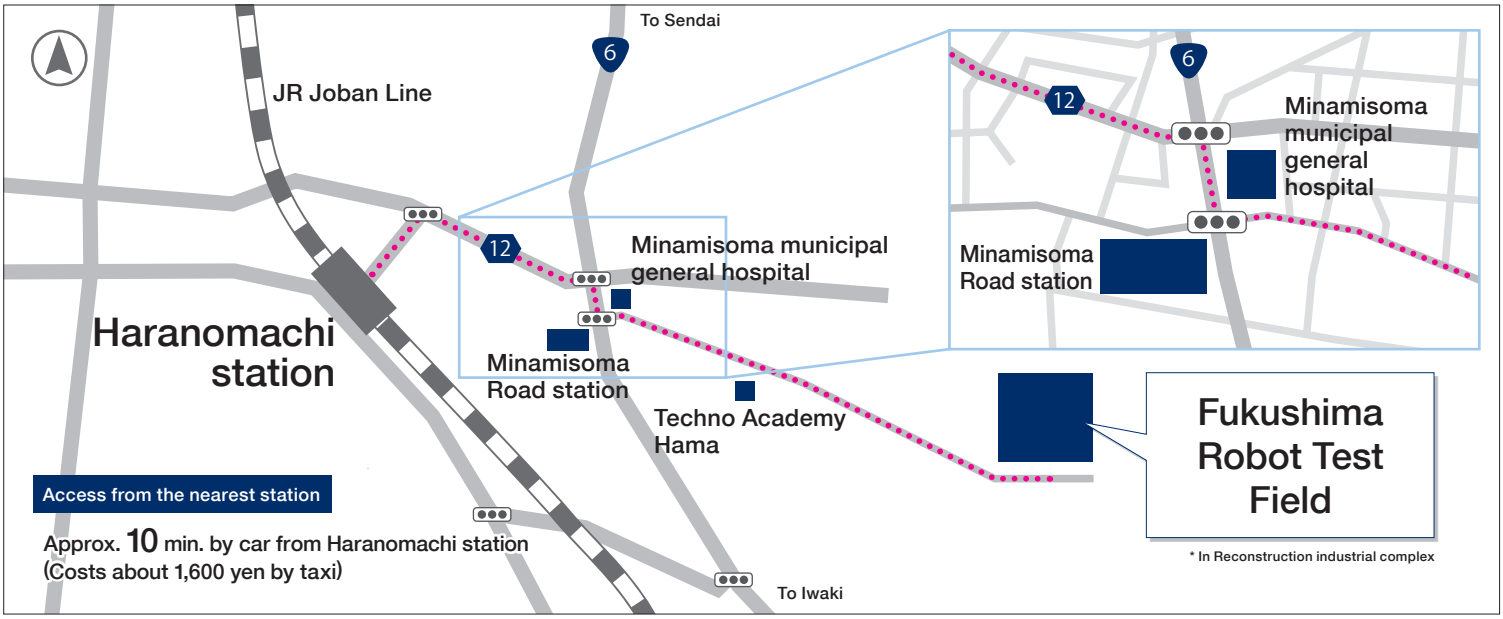
By car

Misato IC	Joban expressway Approx. 180 min.	Minamisoma Namie IC
Sendai	Joban expressway Approx. 60 min.	Minamisoma Namie IC
Fukushima station	Prefectural highway No.12・National highway No.114 Approx. 90 min.	Fukushima Robot Test Field

Railway

Tokyo station	Tohoku Shinkansen Approx. 90 min.	Sendai station	Joban Line Approx. 75 min.	Haranomachi station
			Joban Line Approx. 90 min.	Namie station





Fukushima Hama-dori for Robot Demonstration Area:

Demonstration tests and maneuver training on robot/drone can be achieved in Fukushima

With the intermediary of the government of Fukushima Prefecture, bridges, dams, rivers, mountains in this prefecture are provided as the sites for demonstration tests and maneuver training, for companies, universities, research institutions that work on the project relating to robot/drone used for logistics, infrastructure inspection, or disaster response. Since FY 2015, the number of site utilization cases have reached at least 140, and the total utilization days over 500 (as of Aug. 2018).

Specified area

Soma city

1. Soma city general waste disposal landfill site
2. Soma city industrial waste disposal landfill site

Minamisoma city

3. Yokokawa dam
4. Minamisoma Shimo-ota Industrial complex
5. Takanokura dam
6. Minamisoma city Baji park
7. Minamisoma city Reconstruction industrial complex

Naraha-machi

8. Kari bridge
9. Naraha Manabikan

For locations other than designated areas, please contact us.

Demonstration test case

Minamisoma city

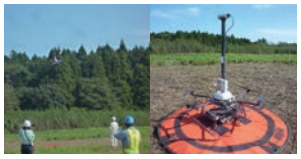
World first! Multiple drone operation control over the city area

World first! Luggage delivery over long distances with fully autonomous flying drone

Investigation for dam wall construction with underwater robot

Namie-machi

Aerial photograph with drone mounted multispectral camera



Low-level atmospheric observation using drone

Naraha-machi

Air quality survey with drone