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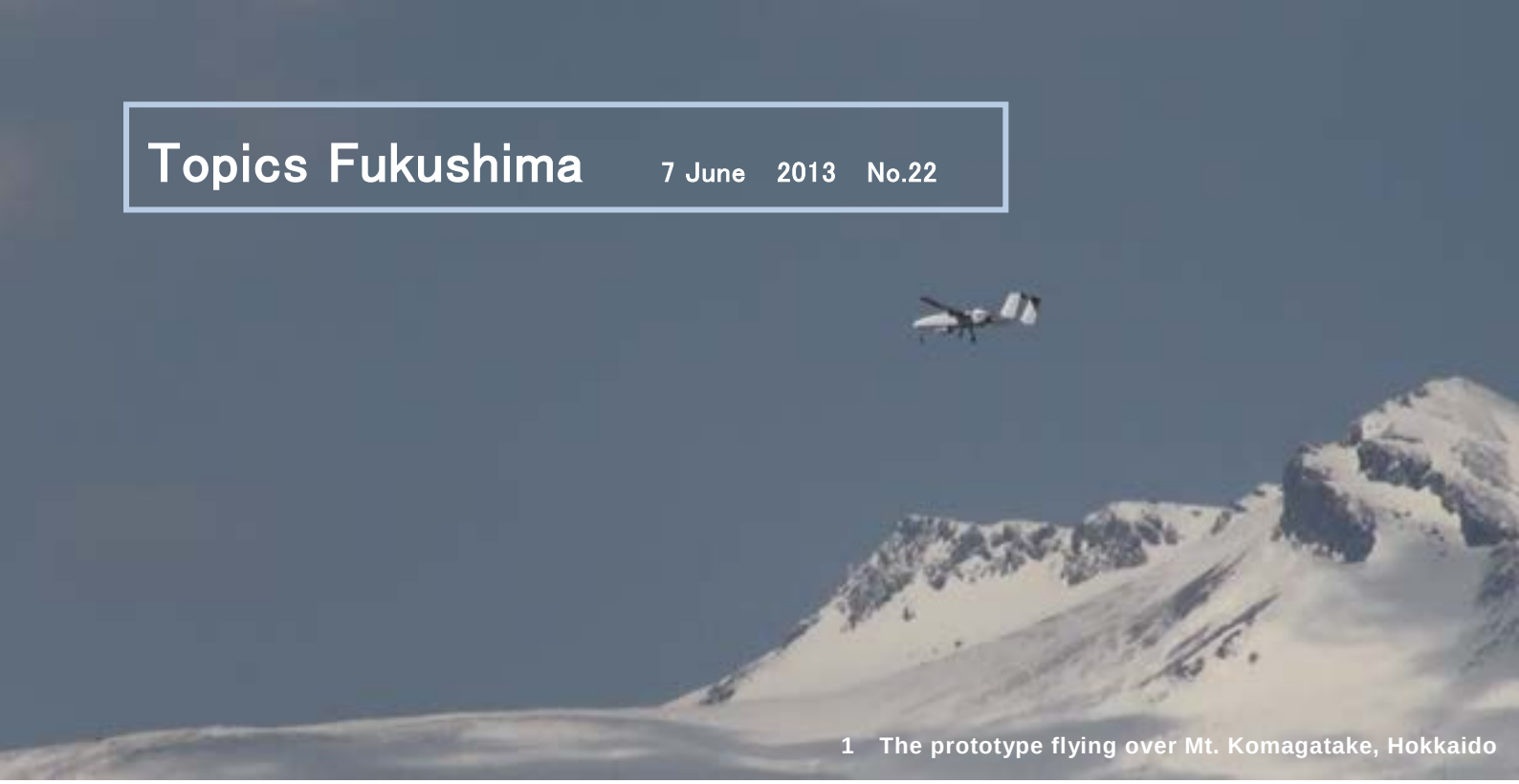


1 The prototype flying over Mt. Komagatake, Hokkaido

Small-sized Unmanned Radiation-Measuring Airplane Flies in the Sky

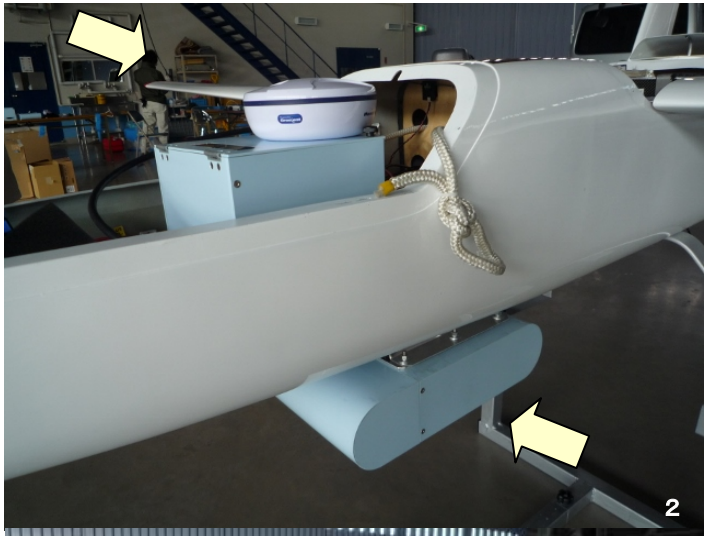
JAEA and JAXA conduct flight tests for radiation monitoring system

The First Unmanned Plane Equipped with a Radiation Measuring Device

On March 27th, the unmanned plane equipped with a radiation measuring device made first flight in the skies of Hokkaido (**Picture 1**). The Japan Aerospace Exploration Agency (JAXA) developed a prototype plane, which was equipped with a radiation measuring device developed by the Japan Atomic Energy Agency (JAEA) specifically for the prototype. To date, radiation monitoring has been conducted in Fukushima Prefecture using manned aircrafts and unmanned helicopters equipped with radiation measuring devices. The unmanned plane was developed jointly by JAEA and JAXA in order to achieve 1) more detailed monitoring than manned aerial-monitoring helicopters, and 2) wide-range monitoring spanning tens of kilometers, a feat which cannot be carried out by unmanned helicopters. JAEA and JAXA aim at realizing a practical application of a radiation monitoring system using unmanned planes within 3 years.

In response to the incident at the Fukushima Daiichi Nuclear Power Station, JAEA and JAXA commenced a joint research project on a radiation monitoring system in FY2012. The joint research targeted monitoring by unmanned airplanes in order to complement the existing monitoring systems, which use manned aircrafts or unmanned helicopters.

The purposes of the flight test in this stage were to confirm the basic functions of the unmanned airplanes and adjust the flight performance of the small-sized unmanned plane and to check the functions of radiation detectors. On March 27th, the unmanned plane took off from Shikabe Airport, a private airport located north of Hakodate, Hokkaido, and the flight test ended successfully. On March 29th, the entirety of the tests, which spanned 7 days, were completed as planned. The plane was built on site, and its flight performance and the functions of the radiation detector were investigated carefully. Malfunctions were recognized several times during the tests; each time, the cause of malfunctions was identified and improvements were made.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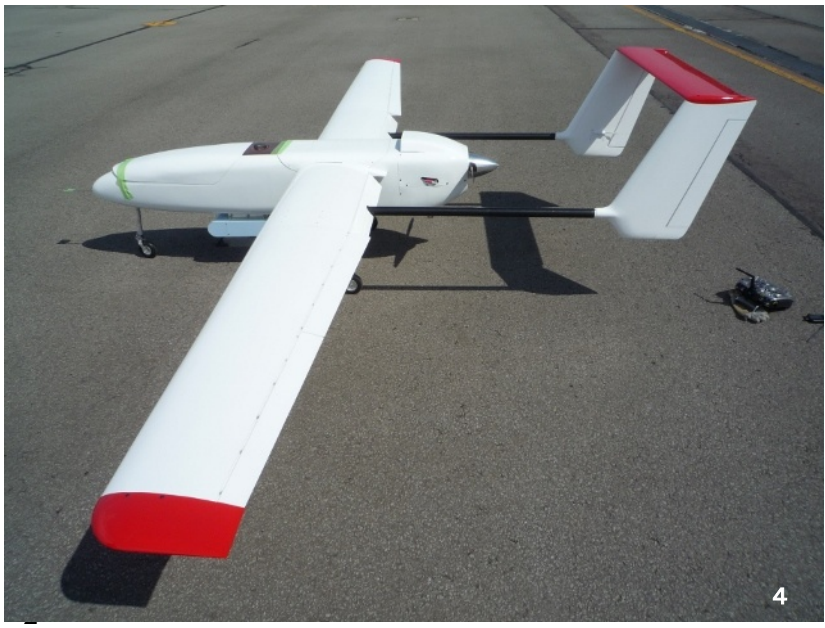
The radiation measuring device equipped on the unmanned plane consists of a radiation detector (length 25 cm, width 30 cm, height 8 cm), a data processing device (length 16 cm, width 16 cm, height 14 cm), etc. (**Picture 2**) The radiation detector consists of an NaI scintillator (2-inch cylindrical) and a plastic scintillator (20 × 20 × 3 cm), and is located outside the bottom portion of the body. The data processing device is located inside the body. These devices have undergone improvements, such as reduction in size and weight and optimization of the data sampling time, to be suitable for the unmanned plane.

"Made lighter for longer measurement range"

"Compared to the unmanned helicopters developed and introduced for measuring radiation in Fukushima Prefecture, this small-scale unmanned plane can fly much faster for a longer period of time, and thus for a wider range. It is also anticipated that much more detailed measurements will be available compared to manned planes. We developed a radiation measuring device taking advantage of the features of the lightweight, stable unmanned plane, developed by JAXA. It can also be employed for radiation monitoring in emergencies, as a tool for responding to forest fires in contaminated areas and nuclear disasters," said T. Torii of JAEA, one of the developers. (**Picture 3**)

JAXA was in charge of developing the unmanned plane itself. The plane is relatively small overall, with a length of 2.7 m, a width of 4.2 m, and a height of 1.3 m. A composite material (GFRP) has been used for the body in order to reduce the weight (**Picture 4**). The total takeoff weight including the radiation measuring device is as low as 50 kg. The plane is equipped with a reciprocating engine designed for unmanned airplanes and driven by petrol. It flies at a speed of 30 m/s, which is about three times faster than the unmanned helicopters. Taking off and landing are carried out by a radio controller, while the rest of the mission flight is conducted using an auto-pilot system; this is the same as unmanned helicopters.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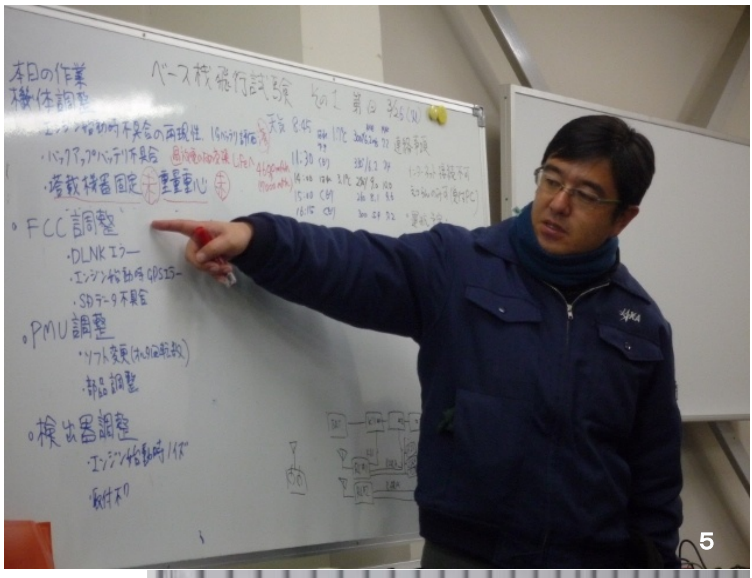
JAXA explained some features of the unmanned airplane.

"We made every effort to increase the plane's reliability and safety so that it won't affect ground in case of system failures, regardless of its small size. For that, we employed redundancy technologies in its flight system. It is also equipped with a parachute to recover the aircraft in case of an emergency, in order to minimize

damage of ground impact," said K. Muraoka of JAXA, who is in charge of the plane development. (**Picture 5**)



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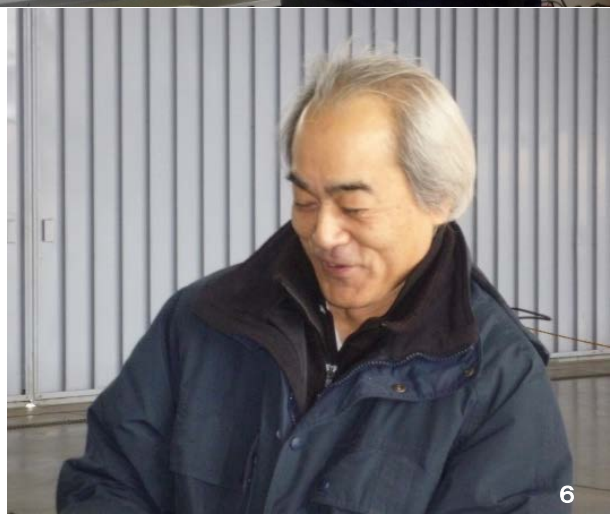
The structure of the plane is intriguing. The engine and propeller are located at the rear portion of the body. There are two booms behind the main wings, next to the propeller. What was the reason behind this structure?

"This structure enables shortening of the body, resulting in overall downsizing. It also allows having an adequate space in front of the engine to install cameras and radiation measuring devices so that the exhaust fumes from the engine do not interfere with these devices," said K. Hozumi of JAXA, the plane's designer. (**Picture 6**)

Torii added, "That certainly is a huge benefit when a dust-collecting system is installed."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Hozumi then elaborated on the reliability and safety of the plane. "Multiple safety functions are installed in addition to the main flight control system such as RTB (Return to Base) function, forced landing function, flight termination function and the parachute. The electric power is supplied by a generator, but backup batteries are also installed in case of emergencies."

He also mentioned that they were considering changing the fuel from petrol (which is volatile at room temperature) to petroleum heavy oils in the future. This is one of anti-fire measures in case of falling.

About 70% of the area of Fukushima Prefecture is forest, and radiation monitoring of the forests is necessary in order to track migration of radioactive cesium and to plan future decontamination projects. However, it is not an easy task to regularly monitor such a vast area. Therefore, early employment of a monitoring system using unmanned airplanes is anticipated, enabling more detailed monitoring than is possible with manned aircrafts, as well as wide-range monitoring up to tens of kilometers, which cannot be conducted by unmanned helicopters. The unmanned radiation-measuring airplane is a fusion of unique technologies from JAEA and JAXA. The researchers will continue making improvements to the unmanned plane and to the radiation measuring device in order to conduct monitoring tests in Fukushima Prefecture as early as possible.