Industrial-use unmanned helicopter (the RMAX G1 L201 model: full length 3,630mm, full height 1,220mm, full width 1,220mm, maximum takeoff weight 94 kg)
Photo: Yamaha Motor Co., Ltd.

Unmanned Helicopters Fly into New Fields: Control Devices Developed to Expand Utilization from Agriculture to Disaster Recovery

In the past, industrial-use unmanned helicopters did not become popular because they were difficult for unskilled people to operate. However, dramatic advances in control devices have made operation easier, and utilization has expanded at an accelerating rate. Recently, unmanned helicopters have made significant contributions to solve various social issues, such as volcano monitoring, as well as information gathering and transportation of materials in disaster areas.

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Industrial-use unmanned helicopters (hereinafter, "unmanned helicopters") were developed in the mid-1980s primarily for the purpose of spraying agricultural chemicals. Operating an unmanned helicopter requires a well-balanced control of the upward, forward, and backward forces that counteract the aircraft's gravitational pull. In the case of agricultural chemicals, a helicopter had to be operated from a distance of 150 meters to maintain a course with precision in the range of tens of centimeters while constantly keeping track of the impact of changes in wind and atmospheric conditions, in order to properly spray the chemicals. Thus, unmanned helicopters have been slow to catch on because they required expert skills to operate.

In the mid-1990s, ten years after their development, the operability of unmanned helicopters was greatly improved with the development of reaction control systems to properly maintain the aircraft's flight attitude. In addition, with the installation of GPS[1] sensors and the development of speed control systems that detect the position and speed of the aircraft in flight, unmanned helicopters evolved to the point where even beginners could easily operate them. These advances gave unmanned helicopters the advantage of being able to fly at lower altitudes than manned helicopters, and to carry more agricultural chemicals and fly longer than drones, which have a smaller body. Consequently, 40% of Japan's rice fields now employ unmanned helicopters to spray agricultural chemicals.

As a result of this advantage, the use of unmanned helicopters is also expanding overseas to include insect pest control and herbicide spraying. Manual spraying cannot keep up with pest reproduction rates, but manned

The eruption of Mount Usu in Hokkaido was the world's first to be observed using an autonomously flying unmanned helicopter.

Photo: hassii.noc / PIXTA

An unmanned helicopter carries equipment on its way to photograph Nishinoshima's volcanic crater.

Photo: Yamaha Motor Co., Ltd.

helicopters flying at high altitudes risk dispersing chemicals too widely into the surrounding area. So, spraying by unmanned helicopters is considered the preferred method. For example, unmanned helicopters are being used on Norfolk Island, an Australian territory in the South Pacific, to eradicate an invasive species of noxious ant, and in California, the United States, to eliminate phylloxera,[2] a pest that damages premium wine grapes.

In parallel with the improvement of the precision of operation control systems, development of control equipment for autonomous flight has advanced to enable unmanned helicopters to operate in places inaccessible to humans, such as areas affected by intense volcanic activity. The eruption of Mount Usu in Hokkaido in 2000 was the world's first to be monitored using an autonomously flying unmanned helicopter. When Nishinoshima, a volcanic island in the Pacific Ocean about 1,000 km south of Tokyo, erupted in 2013, an autonomous unmanned helicopter was successfully used to record, in precise detail, the process of land formation as eruption material accumulated.

In recognition of these achievements, four researchers and engineers who developed a series of technologies that contributed to the advancement of unmanned helicopters received the 2019 Award for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology (Development Category). The award recipients were Professor Sato Akira of the Shizuoka Institute of Science and Technology, Junior Associate Professor Nakanishi Hiroaki of the Kyoto University Graduate School, Okawa Hirohisa, President of IS Co., Ltd., and Nakamura Katsu, Senior General Manager of the Unmanned System Section, Robotics Business Unit, Yamaha Motor Co., Ltd. (All positions are as held at the time of receiving the award.)

Unmanned helicopters, which were first developed for agricultural use, could not initially carry much cargo. Today, however, by increasing the diameter of the main rotor, which is the key component of the loading and generates the helicopter's lifting power, unmanned helicopters can carry up to 50 kg of cargo. In the aftermath of the Noto Peninsula Earthquake in January 2024, which caused extensive damage in Ishikawa Prefecture, unmanned helicopters flew autonomously to survey the damage and quickly transport emergency supplies to isolated areas where the road network was cut off.

In this way, the utility of unmanned helicopters has increased significantly as the scope of their utilization has expanded to include disaster recovery and the transport of materials to remote areas.

An unmanned helicopter sprays agricultural chemicals evenly over rice paddies.

Photo: Yamaha Motor Co., Ltd.

1.GPS stands for "global positioning system." It is also called "global wireless positioning system." GPS is a satellite-based geographic information and measurement system. It is utilized as a mechanism that can identify the latitude, longitude, and altitude of any area on Earth.

2.An aphid-like insect that infests the roots and leaves of grapevines, stunting their growth or killing them