

STT074-04

Room: 201B

Time: May 26 09:45-10:00

## A review of the flights for autonomous unmanned aerial vehicle, Ant-Plane, at Syowa Station, Antarctica

Minoru Funaki<sup>\*</sup>, N. Hirawawa<sup>1</sup>, H. Asano<sup>2</sup>, S. Sakanaka<sup>3</sup>

<sup>1</sup>National Institute of Polar Research, <sup>2</sup>Tokyo University of Science, Yamaguchi, <sup>3</sup>Akita University

Unmanned aerial vehicle (UAV) is expected in respect of not only safety flight in the risky area, but also economical efficiency with flights. UAVs are more advantageous than the manned aircraft from the viewpoint of environmental pollution. Using UAVs in Antarctic research yields the benefit as the simple airborne operations by a few researchers without the grand facilities and technicians in addition to the easy transportations. Nevertheless, UAVs have not yet employed in Antarctic research until 2006. We established the Ant-Plane project in 2002, with the aim of developing a UAV using model airplane technology. Development of the Ant-Plane is based on its use under calm conditions with coastal regions during the Antarctic summer: lower than -15 degree centigrade and lower than 10 m per second wind speed.

The partly of 46th Japanese Antarctic Research Expedition (JARE) expedition took an UAV to Syowa Station in Dec. 2004. The first flight at Syowa Station, using a runway constructed upon sea ice, was carried out for aeromagnetic survey using Ant-Plane 2 (tractor type, span: 2370 mm, length: 2030 mm, engine: 86cc 2-cycle and 2-clinder gasoline, dry weight: 15 kg) on Jan. 28, 2006; however, the wing and propeller were broken during takeoff due to rough snow on the runway.

The summer party of JARE48 carried out meteorological survey at Antarctic continent near the station (altitude: 300 m, 30 km NE from Syowa Station) on Jan. 20, 2007 using Ant-Plane 4-2 (pursuer type, span: 2600 mm, length: 2060 mm, engine: 86cc 2-cycle and 2-clinder gasoline, dry weight: 15 kg). However, the UAV was crashed after 10 seconds from the takeoff due to mistake of transfer of the waypoint data from the PC to the onboard computer.

The party of JARE49 took 2 UAVs, namely Ant-Plane 4-3 and 4-4, to Syowa Station for the metrological and magnetic field surveys. Ant-Plane4-4 took off up to 150 m in altitude by manual control, and then it flew by autonomous control system. However, the plane suddenly fell dawn and was crashed due to the engine stop on the way to the survey area. The party succeeded in the autonomous flight by Ant-Plane 4-3 on Dec. 18, 2008. The flight was planned with onboard meteorological devices in the area of 1.5x1.5km at altitudes of 200, 400, 600, 800 and 1000 m. The plane faithfully followed the planned course and measured the temperature and humidity. As the course was fairly disturbed in the descending process from 800 to 600 m, the plane was landed by the manual control. The total flight time is 1 hour and the distance was 110 km in this flight. This success is the first UAV flight in Antarctica, and means applying of the various airborne geophysical surveys by Ant-Plane.

Keywords: Ant-Plane, JARE, UAV, Magnetometer, Meteorological devices, Syowa Station