CONTRIBUTING ORGANIZATIONS

Japan Aerospace Exploration Agency (JAXA)

UAS ACTIVITIES OF JAXA'S AVIATION PROGRAMME GROUP

APG's Mission in JAXA

The Aviation Program Group (APG) in Japan Aerospace Exploration Agency (JAXA) was organized on 1st October 2005, with the objective to promote aviation programs to demonstrate key system technologies of airplanes.
The visions of the Aviation Program Group are:

1. *Responding to needs from society by acting as a technological leader in the Japanese aviation community.* In response to needs from industry and governmental organizations, strategic research & development of APG cover all aspects throughout an airplane life cycle, ranging from marketing, design, manufacturing to operation.
2. *Pioneering the next generation of aviation by conducting innovative technology development projects*.

Based on the core technologies of JAXA, APG leads Japanese aviation technologies through innovative technology development projects to pioneer future aviation, such as supersonic/hypersonic transport technology demonstration projects.

Outline of UAS Research and Development in APG

In JAXA, research and development of Unmanned Aircraft Systems (UAS) has been mainly focused on actual flight tests and/or demonstration of new aerospace technologies. However, APG is also developing UAV system technologies for actual UAS usage like meteorological observation under severe weather conditions and so on. As one of the applications, the Unmanned and Innovative Aircraft Team of APG started to survey and research technical challenges for disaster observation and telecommunication for a long endurance autonomous flight systems, as soon as natural disaster such as large earthquake or large forest fire occurs.

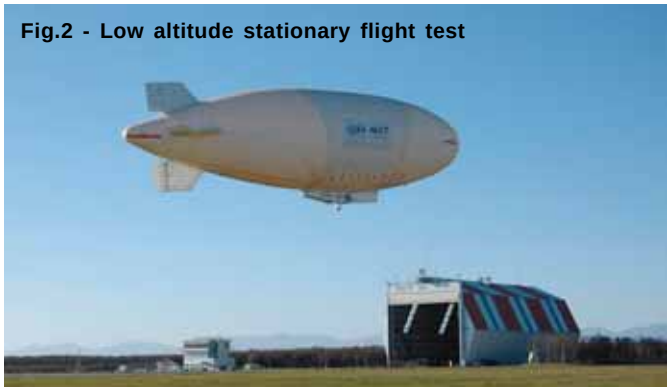
Stratospheric Platform

The Stratospheric Platform (SPF) is the network base needed to create an advanced communication and broadcasting radio relay, which will allow the observation of the global environment by an unmanned airship in the stratosphere. The airship would be positioned at an altitude of about 20 km, where climatic conditions are relatively stable.
JAXA's APG has been involved with the research and development of the SPF project since March 1998 in cooperation with MIC (Ministry of Internal Affairs & Communications). In order to advance steadily, two flight tests were carried out.
The ground to stratosphere flight test was carried out in August 2003 (Fig.1) during which, a 47m long unmanned airship with a fiber reinforced envelope material was flown up to the stratosphere (alt. 16.4km, for 30 minutes). The actual proof of the material, structural technology and the thermal control technology of SPF was completed by the success of this flight test.

Fig.1 - Ground to stratosphere flight test

Another flight test, the low altitude stationary flight test, was conducted from May to November, 2004. (Fig.2) The test vehicle was a 68.4 m long unmanned airship that flies remotely piloted, or autonomous. The vehicle made a total of eight flights and successfully conducted autonomous geo-stationary flight at 4km altitude. The earth environment and traffic observation missions, and telecommunications & broadcasting missions were also conducted. The flight testing was successful with the objectives fully achieved and the actual proof of the control and guidance technology, the operation technology, buoyancy control and thermal management technology and the tracking technology of SPF was successfully demonstrated during this flight test.
Besides these flight tests, development of the Component-Engineering for the SPF has been conducted. For energy technology, a 1kW RFC (Regenerative Fuel Cell) system has been developed and environment test charge/discharge cycle testing by the power system comprising power Solar Cell (SC) arrays and a 1 kW RFC. The development of stronger and lighter membrane structures and the propeller system suitable for use in the stratosphere has been also conducted. In parallel with this work, system studies for a 150 m class test vehicle, that is to prove the SPF technology totally, has been conducted.

Fig.2 - Low altitude stationary flight test



Multi-Purpose Small UAS

JAXA is progressing research and development of a multi-purpose small UAV, which has been under development since 2003 for meteorological observation, surveillance and monitoring missions under the request of Japan Meteorological Research Institute (JMRI). (Fig.3)

A radio controlled prototype-I aircraft was first made, and the feasibility of the requested specifications was confirmed through wind-tunnel tests and flights tests. The prototype-II aircraft was made to investigate the reality of its performance

Fig.3 - Multi-purpose small UAV

such as the cruising speed of 35m/s, cruising altitude 1500m, maximum endurance of 8 hours, etc. This aircraft has 1.85m fuselage length and 3.32m wing span and its major structure is made of CFRP (Carbon Fiber Reinforced Plastics). The power plant is 25.4cc, 1.2PS/8000rpm 2 cycle engine used for radio / programmed control model aircraft. Its maximum take-off weight is around 20kg and its payload capacity is around 5kg (including fuel).
Meteorological observation flights requested by JMRI were carried out in June and July 2005. The main objective of the observation is to improve and verify the Non-Hydrostatic Model by assimilating the detailed observation data of the Baiu Front over the west of Kyushu and heavy rainfall systems associated with the front. JAXA delivered flight and meteorological data of the front into JMRI.

As a joint research project with National Maritime Research Institute (NMRI), JAXA has been operating observation flights in Hokkaido with a real-time video transmission system developed by NMRI. Furthermore, flight tests to extend the flight envelope and ground tests to simulate take-off from and landing on a ship are considered.

JAXA's Experimental UAS Safety Standard

JAXA has been conducting several flight experiments using unmanned aircraft systems. As there was no safety standard for UAS design and operation, those for spacecraft were used. Most of past UAS activities concerning flight proof of new technologies took place over low-populated areas. More interest is now focused on UAS activity near populous areas for applications like observation flights.
A task force to deal with this problem was organized within JAXA, and produced the Experimental UAV Safety Standard in 2005 for JAXA's UAS flight tests, after studies of existing UAS standards, a survey of ongoing UAS activities from a safety management point of view, and interviews with oversea authorities and various organizations (CASA, JAA and etc.).

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