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New National Capability in NIMR: Rational, Development and application of meteorological sensors for HALE UAV

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Joint Civilian-Military Committee, under Advisory Council on Science and Technology, awarded an ambitious technology demonstration project to build a HALE (High-Altitude Long Endurance) UAV (Unmanned Aerial Vehicle) till 2017. NIMR (National Institute of Meteorological Research) is responsible for developing a payload for meteorological observation, which the committee welcomed not only for technological challenges but also for scientific advances for all parties. NIMR is also responsible for providing numerical weather predictions for flight safety for overall project.

HALE UAV is an aircraft that aims to operate at lower stratospheric altitudes for days and weeks. It is an altitude where air becomes thin to prevent operation of conventional jet engines and only military reconnaissance aircrafts have reached at this high or above around 18$\sim$21km

Since only a couple of unmanned aircraft demonstrated its potential scientific value, atmospheric research at stratospheric altitude offers unique opportunity of monitoring complete troposphere at close range. With advantages from both satellite (consistent observation) and airborne platforms (spatial flexibility), i.e. pseudo-satellite, water content monitoring in the atmosphere enables us to improve prediction of entire life cycle of tropical storms and torrential rains and snows, in addition to better understanding of tropopause dynamics and its prediction capability.

This meteorological instrument challenges very limited payload design requirements, i.e. 4kg of weight and 50W of power consumption. With such constraints, NIMR determines to develop passive microwave radiometers (15$\sim$100GHz) onboard in the interest of 3D water vapor profiles, along with optical camera for cloud observation.

There are number of technical challenges to achieve the goal, such as 1) mechanical and electronic design that works in -75°C and 60hPa with weight and power constraints, and 2) miniaturisation of conventional meteorological instruments with similar or better performance. Safety features and contingency plans, such as power management and maintaining operational temperatures, are also considered. Applications of observation data for numerical simulations and validation plan are also being developed.