

## Promotion of Scientific Research on Climate and Earth System Sciences Using Aircrafts

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The aim of this proposal is to promote climate and earth system research in the area of atmospheric science, oceanography, glaciology, volcanology, and ecology by introducing a dedicated aircraft for Earth observations.

The Earth's environment has been changing rapidly, particularly as manifested by global warming, and the changes are imposing large impacts on the fundamental structures of our lives, including socio-economic activities and supplies of water and food. It is critically important to fully understand the current status of the changes and to investigate the controlling processes, in order to predict future changes and protect human society and ecosystems from serious damage. At present, direct atmospheric observations by aircraft are lacking in important geographical regions; they are needed for understanding greenhouse gases, aerosol-cloud interactions, and the hydrologic cycle, including predictions of typhoons and torrential downpours. Japan lacks an aircraft dedicated to scientific measurements, so Japanese scientists have been obliged to charter commercial aircraft for their experiments. Therefore it has been difficult to plan and conduct systematic aircraft experiments, which are indispensable for studies of climate and Earth system science.

In this study, we plan to acquire a dedicated aircraft and outfit it with an observation system that will be designed and utilized by scientists from a variety of fields and institutions on a long-term basis. Our aim is to enable the systematic planning of next-generation Earth observations and research activities by operating instrumented aircraft platforms on a long-term basis and attaining the highest levels of scientific outcome and impacts. We plan to provide today's scientists and the next generation of scientists with exciting opportunities to use aircraft platforms to pursue new scientific ideas and to develop and use new technologies and methodologies. It is also planned to extend these new research opportunities to foreign scientists so that this Japanese system serves as a center of research and promotes Earth observations throughout Asia. The basic scientific knowledge obtained by this program will be made public in order to contribute to the welfare of world societies. All the processes involved in this research plan, including organizing scientists and activities, selection and scheduling of instruments, soliciting proposals, making field measurements, data archiving, and using the data, will be transparent to all scientific communities.

We plan to use the Gulfstream IV type aircraft as rental from a private company such as Diamond Air Service. The total cost is 15.5 billion Japanese yen for ten year project. The Institute for Space-Earth Environmental Research of Nagoya University has established the "Center for Orbital and Suborbital Observations" in order to play a central role in aircraft observations. This center will organize and manage activities related to aircraft observations in close cooperation with scientists from several institutions in Japan, such as the University of Tokyo, Chiba University, the Meteorological Research Institute, the National Institute for Environmental Studies, the National Institute of Polar Research, and the National Institute of Information and Communications Technology. We can receive advice and support aeronautical section of JAXA on determination of test plan and flight conditions in the flight test to realize more efficient and safety flight experiment. Through this study, we will contribute to SDSs and Future

Earth project.

Keywords: climate, Earth system, aircraft observations, atmosphere, ocean, ecosystem