R&D subject Application
PD's supplement (Moonshot Goal 8)

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The Moonshot Goal 8 program aims for the realization of a society safe from the threat of extreme winds and rains by controlling and modifying the weather by 2050.There are a great number of challenges that must be resolved in order to realize this goal, including developing more sophisticated weather simulations, establishment of weather control methods, and addressing ethical, legal, and social issues (ELSI).

In particular, methods of controlling the weather require a way to manipulate the weather in order to cause changes in the atmosphere. At this stage, it is not clear at all which manipulation method or combination of methods can effectively control what kind of weather, so it necessary to test as many different potential manipulation methods as possible and confirm their effectiveness. For this reason, in this call we are strongly encouraging applications for a wide range of manipulation methods, in particular, from people specializing in fields other than meteorology.

These manipulation methods are not limited to direct reduction of the water vapor in the atmosphere, which contributes to the development of heavy rainfall systems, to reduce the amount of rainfall, as technologies that have not been used in the meteorological field may also be effective.

In this call, we are soliciting wide-ranging applications for R&D subjects that demonstrate ideas or develop technologies that could cause some kind of change to the state of the atmosphere. As diverse manipulation methods are necessary, we welcome a wide range of proposals, from challenging idea-based research, to applied research in science and technology cultivated in fields other than meteorology, to research already under consideration in the field of weather modification, such as artificial precipitation.

（1）Promoting R&D projects after adopted (overview)

The researchers whose proposals are adopted in the selection process will be asked to carry out R&D as a performer in charge of manipulation methods in a previously adopted core research project, to work towards achieving a

target to be determined in consultation with a PM. For the R&D period and R&D costs, please see the Outline of Calls for Applications.

If all of the conditions below are met at the time when the R&D ends, you may continue your research as a performer in a core research project, for a period and expenditure which exceeds the R&D period and costs approved at the time of adoption. Note that if these conditions are met during the initially determined R&D period, the additional R&D budget allocation, etc. can be made at that stage.

① In principle, the achievement target for the R&D period must be attained.
② The core research project that the performer belongs to indicates that the proposed manipulation method has the potential to induce changes that lead to weather control.
③ The PD or PM recognizes that continuing the research is necessary to achieve the goals of the core research project the performer belongs to.

（2）The R&D in this call

This call for applications is for R&D aimed at verifying the feasibility of manipulation methods inducing some kind of change in the state of the atmosphere.

Below is a list of possible targets for manipulation that may be effective for weather control, and examples of methods. The call is not limited to applications for these manipulation methods. In addition, there are no restrictions as to the area where the phenomenon is induced, and all ground/water/structure surfaces, as well as the surrounding sky and the atmosphere within a city, etc. can be targeted. However, this MS Goal aims to control weather in order to minimize the damage caused by extreme weather such as typhoons and torrential rains, and weather control to effect lasting changes in the global or local environment is not within the scope of the R&D program. Therefore, this call is for technologies that cause temporary changes in weather phenomena, not long-lasting changes.

Examples of targets for manipulation and methods (not limited to the following)

Target	Examples of methods

Wind	Methods that change the volume or direction of kinetic energy in the atmosphere, etc. Includes methods to change ground/sea/structure surface friction.
Temperature	Methods to heat or cool the atmosphere, methods to control exhaust heat release, etc. Includes methods to change air temperature distribution.
Surface temperature	Methods to change the surface temperature of the ground, water, structures, etc. Includes indirect methods such as changing sunlight reflectivity.
Water vapor	Methods to increase or decrease the amount of water vapor, to change the flow of water vapor, etc. Includes indirect methods such as controlling or accelerating the amount of evaporation.

*Includes methods to remotely induce the above changes.

（3）Points to pay attention to when applying

① Formulating an achievement target and an R&D plan

The achievement target for the R&D period and the R&D plan (including R&D costs, structure, etc.) are to be determined after the selection process in consultation with the PM.

When submitting your application, please include an achievement target and an R&D plan leading up to achieving it in terms of your expectations at this stage, based on the level of maturity, technical issues, and theoretical limits of the proposed science and technology, etc. You can set a qualitative target for reasons such as the scientific and technological immaturity, no previous application in the field of meteorology, etc.

② Future potential and capacity for development

In the selection process, in addition to the plan for the R&D period, the capacity for future development of your proposal will also be evaluated. Therefore, in addition to the R&D, please include the currently conceivable estimates and expectations with regard to the following points in your application to the best of your ability.

a. The feasibility (from theoretical and engineering aspects)

b. The size and scalability of the changes to the state of the atmosphere that could be induced

c. Cost-effectiveness

d. Ethical, legal, and sociological acceptance

（4）Message from PM

The following are messages from the Core Research project PMs on the occasion of this call for applications.

① SAWADA Yohei PM

I am conducting R&D based on the theme of “Control Theory of Weather-Society Coupling Systems for Supporting Social Decision-Making.” We are using numerical simulations to establish a theory that will enable small amounts of energy to significantly change the future of extreme weather events, including typhoons, and minimize their adverse effects on society. Our R&D project has not been able to develop specific weather control methods at this point, and we feel that the door that leads to control methods that can be implemented in society is still firmly shut. Perhaps you are the person who holds the key. We look forward to your broad-minded and challenging proposals that are unfettered by existing meteorological concepts.

② FUDEYASU Hironori PM

I am conducting R&D to control typhoons, based on the theme of “Typhoon Control Research Aiming for a Safe and Prosperous Society.” We are currently considering several methods for controlling typhoons in our R&D project, but in order to boost the feasibility of typhoon control, we are keenly interested in novel ideas for control methods from a perspective that is completely different from the conventional way of thinking in the meteorological field. We look forward to your challenging R&D proposals.

③ YAMAGUCHI Kosei PM

The Moonshot program is something that sparks the spirits of scientists and engineers. In our project, “Heavy Rainfall Control for Living Together

with Isolated-Convective Rainstorms and Line-Shaped Rainbands," we are developing technologies to control guerilla heavy rainfall that will be the key to protecting people's lives and property from heavy rainfall. The guerilla heavy rainfall and linear and convective-type rainstorms we focus on are relatively small in scale, and therefore have high potential for manipulation. Why don't you join us in developing technology that could serve as an invisible embankment in the sky overhead?