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Promoting research, development and understanding of weather modification for beneficial uses

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PRESS RELEASE

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FOR IMMEDIATE RELEASE

The Weather Modification Association's Response to the National Research Council's Report titled "Critical Issues in Weather Modification Research"

The Weather Modification Association supports large-scale operational projects in contrast to a National Academy of Sciences, National Research Council panel report published last October. A recent report of the WMA in response to the National Research Council report (***see text and links below***) was critical of the NRC panel's conclusion that there was no convincing scientific proof of the efficacy of cloud seeding and that there was no scientific support for large-scale weather modification operational programs. The WMA response cites several long term winter operational projects that indicate strong statistical, and in some cases strong physical, evidence that provide positive results of cloud seeding for snow pack enhancement. The WMA believes large-scale operational programs have produced and continue to produce positive effects for society. The WMA also pointed out that the statistical and physical tests the NRC panel required for proof presented higher standards for weather modification than for either global climate change or inadvertent weather modification, neither of which could be supported under the NRC criteria.

The WMA panel report also presented the rationale for hail suppression operations, added information on

summer operational programs, additional information on the use of cloud models in operations and the understanding of cloud seeding effects, and commented on several other aspects of the NRC report. The WMA panel report provided additional recommendations on the direction of future weather modification research.

The primary conclusion of the WMA response was that "We support the NRC recommendation that a coordinated national program be developed to conduct a sustained research effort in the areas of cloud and precipitation physics, cloud dynamics, cloud modeling, laboratory studies, and field measurements designed to reduce the key uncertainties that impede progress and understanding of intentional and inadvertent weather modification. *But, we argue that the coordinated national program should also support exploratory and confirmatory field studies in weather modification. It should capitalize on operational cloud seeding programs, and use them as a basis for testing models, and developing new statistical methods for evaluating the efficacy of those operations.*"

The WMA panel was made up of six scientists and operational experts, all with 30 or more years experience in weather modification research and/or operations. The members were Harold Orville (chair), Bruce Boe, George Bomar, William Cotton, Byron Marler, and Joseph Warburton. The full text of the fifty-one-page WMA response to the NRC report can be found at www.weathermodification.org. For additional information please contact Mr. Byron Marler, President, Weather Modification Association at 925.866.5934 or by email: blm3@pge.com.

The Weather Modification Association's Response to

The National Research Council's Report Titled

"CRITICAL ISSUES IN WEATHER MODIFICATION RESEARCH"

Report of a Review Panel

Panel Members: Dr. Harold D. Orville (Chair), Bruce A. Boe, George W. Bomar, Dr. William R. Cotton, Byron L. Marler, and Dr. Joseph A. Warburton

To download the entire WMA Response in PDF format, click here. If you do not have the Adobe Acrobat Reader necessary to read PDF files, you can download it free here.

Executive Summary

The Weather Modification Association (WMA) is an association of scientists, engineers, economists, water management professionals, government and private business people, and others who have spent and continue to spend their careers working in the field of weather modification. The members, having read the National Research Council's report "Critical Issues in Weather Modification Research", issued last October 13, have helped prepare this response to that report. The NRC panel was asked to identify critical uncertainties limiting advances in weather modification science and *operations* and to identify future directions in weather modification research and operations for improving the management of water resources and the reduction in severe weather hazards, among other things. They were to do this even though the panel members collectively had very limited experience or knowledge in weather modification operations, especially in recent years.

This current panel was organized to prepare a WMA response to the NRC report concerning issues having operational impact or scientific consequences on operational projects and to provide additional information to the members of the WMA and the public. The national press seized on the conclusion of the NRC panel that there was no convincing scientific proof that cloud seeding worked, not realizing that the panel had opted for a definition of scientific proof that few atmospheric problems could satisfy. On the other hand, the NRC panel concluded, "there is ample evidence that inadvertent weather and global climate modification (e.g., Greenhouse gases affecting global temperatures and anthropogenic aerosols affecting cloud properties) is a reality". We think, however, that global climate change and inadvertent weather modification would both fail the level of proof applied to planned weather modification. We nevertheless strongly support the NRC's recommendation to establish critical randomized, statistical experiments along with the necessary physical measurements and modeling support to reduce the many uncertainties that exist in the science of weather modification.

In addition, the NRC panel cited a much earlier NRC report (NRC, 1964) which suggested that the initiation of large-scale operational weather modification would be premature. We think that it is inappropriate for a national academy panel, with very limited operational weather modification experience, to make such a judgment. Citation of the very dated 1964 report suggests that little has changed since that time. The NRC panel notes operational programs in 24 countries and at least 66 large-scale operational weather modification programs in the U.S. The WMA believes large-scale operational programs have produced and continue to produce positive effects for society. The WMA does not agree with the NRC suggestion that implementation of large-scale operational programs would be premature. This response details the myriad changes and advances that have been made, but that were largely neglected by the current NRC report.

This WMA panel has added information on hail suppression, winter orographic cloud seeding, summer operational programs, and numerical modeling of cloud seeding effects to fill in for obvious gaps and weaknesses in the NRC report. A few other topics are also commented upon.

We support many of the recommendations of the NRC panel, but add several of our own:

- We support the NRC recommendation that there be a renewed commitment to advancing our knowledge of fundamental processes that are central to the issues of intentional and inadvertent weather modification.

- We support the NRC recommendation that a coordinated national program be developed to conduct a sustained research effort in the areas of cloud and precipitation physics, cloud dynamics, cloud modeling, laboratory studies, and field measurements designed to reduce the key uncertainties that impede progress and understanding of intentional and inadvertent weather modification. *But, we argue that the coordinated national program should also support exploratory and confirmatory field studies in weather modification. It should capitalize on operational cloud seeding programs, and use them as a basis for testing models, and developing new statistical methods for evaluating the efficacy of those operations.*

- We support the NRC conclusion that a coordinated research program should capitalize on new remote and in situ observational tools to carry out exploratory and confirmatory experiments in a variety of cloud and storm systems.

- The Board on Atmospheric Sciences and Climate workshop report (BASC, 2001) recommended that a "Watershed Experiment" be conducted in the mountainous West using all of the available technology and equipment that can be brought to bear on a particular region which is water short and politically visible from a water resource management perspective. We strongly support this earlier recommendation that was not then included in the NRC report. Such a "Watershed Experiment" should be fully randomized and well equipped, and be conducted in the region of the mountainous West of the U.S. where enhanced precipitation will benefit substantial segments of the community, including enhancing water supplies in over-subscribed major water basins, urban areas, and Native American communities, for ranching and farming operations, and for recreation. This research should include "chain-of-events" investigations using airborne and remote sensing technologies, along with trace chemistry analysis of snowfall from the target area. Model simulations should be used to determine optimum positioning and times of operation for ground-based and aircraft seeding. The work should include evaluations of precipitation, run-off, and recharge of ground water aquifers. Also, it should include environmental impact studies including water quality, hazard evaluations such as avalanches, stream flow standards and protection of endangered species. Research is also recommended on seeding chemical formulations to improve efficiencies and on improving technology used in seeding aerosol delivery systems.

- We recommend the application of existing and newly developed numerical models that explicitly predict transport and dispersion of cloud seeding agents and activation of cloud condensation nuclei, giant cloud condensation nuclei, and ice nuclei, as well as condensation/evaporation and collection processes in detail, to the simulation of modification of clouds. We concur with the need to improve and refine models of cloud processes, but existing models can be used as a first step to examine, for example, the possible physical responses to hygroscopic seeding that occur several hours following the cessation of seeding. In addition, existing models can be used to replicate the transport and dispersion of ground-based and aircraft-released seeding agents and the cloud and precipitation responses to those seeding materials in winter orographic clouds. Existing models can also simulate static and dynamic seeding concepts for fields of supercooled convective clouds. Moreover, existing models can be used to improve the efficiency of the operation of weather modification research projects and operational programs, and be deployed in the assessment of those programs.

- We recommend that a wide range of cloud and mesoscale models be applied in weather modification

research and operations. This includes various microphysics techniques (both bin and bulk-microphysical models have their uses) and various approaches in the dynamics (all dimensionalities - one, two, and three dimensional models - offer applications). The application of hybrid microphysical models should be especially useful in simulating hailstorms and examining various hypotheses and strategies for hail suppression.

- We recommend that a concerted effort be made in the field and through numerical modeling, which includes simulations of hailstone spectra, to study hailstorms and the evolution of damaging hailstones as well as examine potential impacts of modified hailstone spectra on the severity of storms. Because operational programs regarding hailstorms are currently being conducted in the U. S., we encourage the "piggybacking" of research on such projects. We also encourage active cooperation with international hailstorm projects to elicit data and information concerning suppression concepts and technology.

- We recommend that an instrumented armored-aircraft capability (storm penetration aircraft, or SPA) be maintained in the cloud physics and weather modification community. This is essential for the in situ measurements of severe storm characteristics and for providing a platform for some of the new instruments described in the NRC report.

- We recommend that support be given for the development of innovative ways to evaluate operational cloud seeding projects. This is particularly important for the establishment of the physical basis of various cloud seeding methods and for establishing the possible range of cloud seeding effects.

- We recommend that evaluation techniques presently being applied to operational programs be independently reviewed, and as necessary revised to reduce biases and increase statistical robustness to the extent possible. Recognizing that randomization is not considered to be a viable option for most operational seeding programs, we acknowledge that there is much room for improvement in most present evaluations, many of which are presently done in-house.

- We recognize that much of the cloud seeding conducted today, and likely in the future, is done in situ by aircraft. A limited weather modification pilot training curriculum presently is in place at the University of North Dakota (two semesters). This program should be expanded under the auspices of the national research program to improve the breadth of training provided, emphasizing flight in IMC (instrument meteorological conditions) and including actual hands-on, in-the-cockpit seeding experience. Correct targeting is mission-critical, yet nationally, many pilots presently working on operational programs receive only limited training, many not having the benefit of any formal training whatsoever. When pilots are undertrained, project results are likely to suffer. A certification program for pilots by an organization such as the WMA, which, in addition to formal university instruction might include periodic recertification and/or recurrency training, would significantly improve the overall abilities and capabilities of the operational weather modification pilots.

We encourage the scientific and operational communities in weather modification to cooperate and work together whenever and wherever possible to solve the many problems slowing progress in the field. The future should not involve solely operational programs or research efforts. The two should be coupled

whenever possible, to work together toward the many common goals.

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