CRITICAL ISSUES IN WEATHER MODIFICATION

Statement of Michael Garstang, Ph.D.
Professor, University of Virginia and Chair, Committee on Critical Issues in Weather Modification Research
Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies, National Research Council,
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Good afternoon Chairmen Hutchison and DeMint, Ranking Members Bill Nelson and Ben Nelson, and members of the Subcommittees. My name is Michael Garstang, and I am a Distinguished Emeritus Research Professor in the Department of Environmental Sciences at the University of Virginia. I'm a fellow of the American Meteorological Society (AMS) and have served on numerous AMS committees. I was also the chair of the 2003 National Research Council's (NRC) Committee on Critical Issues in Weather Modification Research. The National Research Council is the operating arm of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology.

This afternoon I will give you a brief summary of the status of weather modification research, as described in our NRC report, the major uncertainties that exist, and convey the committee's conclusions and recommendations. We will also provide an Executive Summary of the report which lists the key findings and recommendations in greater detail. (See http://www.nap.edu/catalog/10829.html for free access to the entire report, including the executive summary.

Efforts to minimize harmful weather impacts go back far in time. In the last 30 years, significant evidence has accumulated that human activities unintentionally affect the weather on scales ranging from local to global. Many of the same fundamental principles underlie both intentional and unintentional weather modification. Yet during this 30-year time period, there has been a progressive decline in weather modification research. Research support related to weather modification in the United States had dropped to less than $0.5M per year in 1999 from a high of $20M in the late 1970s. During the same period, there have been significant advances in technology. This has greatly improved our ability to observe, understand, and predict the weather. These advances, however, have not been either collectively or persistently applied to the problem of weather modification.

This decline in research is likely the result of a combination of factors, including early overly-optimistic claims, unrealistic expectations, and failure to provide scientifically demonstrable successes. But despite these limitations, and because of considerable pressures resulting from drought, hail, floods, and storm damage, private and state agencies actually spend significant resources on attempts to modify the weather. In 2001, there were 66 operational weather modification programs in 10 states and much more activity overseas.

How do we overcome this disparity between our willingness to attempt to modify weather and our reluctance to fund research to understand such activities? The 2003 National Academies committee that I chaired was charged to provide an updated assessment of the current state and the future of weather modification research, from new technologies to advances in numerical modeling and operations. A summary of our report is included in my written testimony. In my comments, I want to focus on our conclusions and recommendations.

First, with a few exceptions, the committee concluded that there still is no convincing scientific proof of the efficacy of intentional weather modification efforts. In some instances encouraging results have been observed, but this evidence has not been subjected to adequate testing.

Second, despite this lack of proof, the committee concluded that scientific understanding has progressed on many fronts. For instance, there have been substantial improvements in the ice-nucleating capabilities of new seeding materials. Also, new technologies such as satellite imagery are giving us tools to better understand the microphysical processes that lead to precipitation, and these advances, in time can help focus and optimize weather modification research.

Third, the committee stated that if progress in establishing our capability to modify the weather is to be made, intellectual and technical resources must be brought to bear on the key uncertainties that hamper progress. For example, there are critical gaps in our understanding of the complex chain of physical processes that lead to rain, snow, and hail.

Finally, and most importantly, the committee called for the establishment of a coordinated national program of weather modification research designed to reduce these and other key uncertainties. The program should consist of a sustained research effort that uses a balanced approach of modeling, laboratory studies, and field measurements. Instead of focusing on near-term operational applications of weather modification, the program should address fundamental research questions. It should take full advantage of recent related research and advances in observational, computational, and statistical technologies, by:

• Capitalizing on new remote and in situ observational tools to carry out exploratory and confirmatory experiments in a variety of cloud and storm systems;
• Improving model treatment of cloud and precipitation physics;
• Improving the use of current computational and data assimilation methods; and
• Capitalizing on existing field facilities and developing partnerships among research groups and select operational programs.

In the committee's opinion, it is premature to initiate large-scale operational weather modification programs. However, a great opportunity exists to coordiate research efforts to address the fundamental questions that will lead to credible scientific results. Focused investigation of atmospheric processes, cou
pled with technological applications, will advance understanding and bring many unexpected benefits and results. In time, this research will place us in a position to determine whether, how, and to what extent weather and weather systems can be modified.

CLOSING THOUGHTS

The NRC Committee emphasizes that weather modification should be viewed as a fundamental and legitimate element of atmospheric and environmental science. Owing to the growing demand for fresh water, the increasing levels of damage and loss of life resulting from severe weather, the undertaking of operational activities without the guidance of a careful scientific foundation, and the reality of inadvertent atmospheric changes, the scientific community now has the opportunity, challenge, and responsibility to assess the potential efficacy and value of intentional weather modification technologies.

Thank you for the opportunity to testify. I would be happy to answer any questions the Subcommittees might have.