

NOAA'S NEW THRUST IN WEATHER MODIFICATION *

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I appreciate the opportunity to discuss some of my thoughts about weather modification. I know your time is limited and that makes me even more appreciative of your President's invitation to be a part of your agenda. I would like to take this opportunity to review recent NOAA activities of the National Oceanic and Atmospheric Administration in weather modification, to discuss the status of weather modification policy matters, and particularly to present my own ideas on what NOAA should be doing in the future.

The National Weather Modification Policy Act of 1976 required the Secretary of Commerce to conduct a study and submit a report to the President and the Congress. An Advisory Board, chaired by Harlan Cleveland, was established by the Secretary to conduct the study mandated by the Act.

The Board produced an excellent study. About 3000 copies of the Board's report have been distributed by NOAA. Among the consequences have been two Congressional bills, patterned largely after the Board's recommendations. As you know, hearings on these bills are scheduled in 2 weeks.

However, the Board's report had a very mixed reception in the Executive Branch. That is a euphemism, perhaps. In fact there were some quite negative reactions. It was partly in an attempt to win support and develop compromise that NOAA drafted a separate report for the Secretary. For over a year, the Secretary's Report has been written, rewritten, reviewed, and commented upon. At this time we still await clearance by the Executive Office of the President. The issues of centralization, autonomy, basic vs. applied research, funding, regulation, etc., are critical to several agencies, the Office of Management and Budget and the Office of Science and Technology Policy. The Administration's decision or guidance on these problem areas has been slow and has delayed release of the Report.

During this period it has been difficult for NOAA to take definitive actions in weather modification. However we have recently been more active and have made commitments to move ahead on the national and international scene.

For example:

- o We supported the WMO Precipitation Enhancement Project of the World

* Talk given to the Weather Modification Association, October 9, 1979, Banff, Canada

Meteorological Organization together with the National Science Foundation. NOAA contributed nearly \$200K to the field program in Spain from March through May 1979 and has led efforts to implement the program.

- o We stimulated collaborative research with Canada. NOAA organized two meetings among principals from both countries which led to a memorandum of understanding for Canadian participation in the Bureau of Reclamation HIPLEX project in Montana beginning July 1979.
- o We produced a program plan to collaborate with state operational seeding projects to help evaluate their effectiveness and to add to the research base in weather modification.
- o We worked toward the development of a constituency for NOAA programs and closer contacts with user groups. House and Senate action to add \$1M to NOAA's FY 1980 weather modification budget (for projects in Utah, N. Dakota, (\$600K) and PACE (\$400K) in Illinois) reflects this effort.
- o We allocated \$780K from the Administrator's Distribution Fund and \$420K from Environmental Research Laboratory reprogramming for 1979 and 1980 to enable the Florida Area Cumulus Experiment (FACE) to complete its confirmatory stage.
- o We are developing a major new initiative for FY 1981 in cumulus dynamics and microphysics to address the fundamental questions concerning these cloud systems identified by the Board as obstacles to understanding their seedability.
- o We have monitored and measured the recent Atlantic hurricanes and gained extensive physical data to critically examine the concepts behind Project STORMFURY. Also we have worked toward an agreement with Australia for joint experiments on tropical cyclones in that part of the world.

In budgetary terms, NOAA's base funding for weather modification in FY 1979 was approximately \$2.8M (mostly for FACE AND STORMFURY). To augment these funds NOAA has reprogramed almost \$1M to support activities just described. This represents a significant commitment.

New opportunities have been provided by Congress for FY 1980 in the form of an additional \$1M to develop cooperative Evaluation Projects in Utah and North Dakota and to continue the pre-experiment phase of PACE (Precipitation Augmentation for Crops Experiment). We will take advantage of this opportunity to re-examine NOAA's future in weather modification and to realign our management of these activities. Our plans are founded on several principles:

1. There should be a balanced program of activities utilizing NOAA laboratories and outside talents.
2. The program and management should be accorded a high-level of attention consistent with political and scientific realities.

3. The management has to be directly responsive to the Assistant Administrator for R&D.
4. It must be done with limited Federal personnel increases.
5. The NOAA management structure should be amenable to transition into a leadership role for a national program in weather modification.

On the programmatic side, the focus of our work will be on research. Therefore, environmental, legal, and social aspects of the problem will be addressed in greater detail after more progress has been made in laying a basis for understanding the physical aspects. The research effort will be guided by the external community and conducted largely by contract.

We intend to take full account of the good research being conducted outside of NOAA and to tailor our efforts toward rounding out a coherent national program in weather modification.

The signals I get from the scientific community is that there is a strong need in weather modification to return to basics. Past attempts to jump many gaps in understanding to achieve a practical result have not provided effective progress. There is always room for a gamble here and there. But we need to re-examine more carefully the physical linkages between the introduction of seeding material and the hoped for end-result. Tools are becoming available to do much that was previously impossible in measurement and modeling. Renewed efforts to understand clouds and cloud systems are necessary to advance weather modification significantly -- and incidently will also support other atmospheric science objectives in weather forecasting, air quality, and climate.

NOAA cannot move very far in these directions by itself. I fully recognize that most of the talent in cloud physics and weather modification resides outside NOAA. But NOAA does have broad capabilities and with your help I believe we can use them to good advantage to advance this field.

We intend to call several workshops in the near future to help NOAA plan its future course in weather modification. Outside participation must extend beyond planning to the execution of programs. We intend to use the best available talent and facilities to conduct future research and a significant fraction of NOAA's funding in weather modification will go outside of NOAA's own laboratories.

For another step, we hope to establish an advisory panel of 5-9 highly respected, distinguished scientists, who will provide general guidance on NOAA initiatives and will review all program development plans and proposals -- external as well as those from NOAA laboratories. They would also review NOAA's program and provide guidance for NOAA's role in shaping a national plan for weather modification. The panel concept can readily be enlarged toward the larger concept of a weather modification council as NOAA's area of responsibility is widened.

I close my remarks with a reminder that actions by the Administration and the Congress will determine the future of Federal weather modification activities. The plans I have outlined are highly dependent on such actions. Nevertheless NOAA intends to move ahead as effectively and as rapidly as possible in weather modification research.

ANOTHER ITEM OF HISTORIC INTEREST

Weather Bureau Topics and Personnel

October 1947 ---- Pages 180-182

MORE RAINMAKING

Cloud seeding experiments, reflecting man's age-old yearning to control the weather, continue to multiply, sponsored by newspapers, civic groups and others with a desire to produce rain artificially. The role of the Weather Bureau has been to advise experimenters of what is known about the use of dry ice for this purpose, and on occasion for Bureau personnel to participate as observers. Two such tests in Illinois during August are reported by Dr. H. R. Byers, Director of the Thunderstorm Project, and Wayne A. McDaniel, OIC at Peoria, Ill.

The test in which Dr. Byers participated took place near Chicago on August 21, and was sponsored by a Chicago newspaper in cooperation with the Liquid Carbonic Corporation, manufacturers of dry ice, and the Illinois National Guard. Two National Guard planes were used, one to do the actual seeding and the other to fly beneath the cloud to observe results. Radio contact was to be maintained to prevent mistakes. Dr. Byers, with several newspaper reporters and photographers, rode in the seeding plane, piloted by Brigadier General Frank Allen of the Illinois National Guard.

The planes took off at 1400 C.S.T., and after about 45 minutes located a suitable cloud, a cumulus with a hard cauliflower top towering to 21,000 feet, about 20 miles northwest of Aurora, Ill. The Joliet radiosonde had indicated temperatures 0°C. at 15,000 feet and -10°C. at 21,000 feet, so it was decided to make a traverse through the cloud at 19,500 feet.

At 1455 C.S.T., 50 pounds of dry ice particles of assorted sizes were released within the cloud. As the plane passed through the cloud an accumulation of what appeared to be liquid water in the form of rime was observed on the wings, indicating that this portion of the cloud consisted of super-cooled water. Five minutes after the seeding the plane flew through the cloud at 17,000 feet. Moderate turbulence and what appeared to be a mixture of snow, rain and snow pellets was encountered. At 19,500 feet at the time of seeding no turbulence had been observed.

Communication with the other plane had failed, so the seeding plane let down slowly, circling the cloud, to observe the effects at low level. At 4,000 feet it flew under the cloud base through an area of light rain 3 miles in diameter. This was at 1515 C.S.T., exactly 20 minutes after the cloud had been seeded.

It was Dr. Byers' belief that the seeding had caused the rain. But the sponsoring newspaper was not content with such a modest claim. On the day following the experiment, August 22, occurred a break in the heat

which had held Chicago in its grip. Temperatures fell so sharply that a break in corn prices occurred. The newspaper took complete credit for causing the temperature drop.

The other experiment, which took place near Peoria, Ill., on August 19, was also sponsored by a local newspaper. No Weather Bureau personnel took part, other than to brief the pilot, and the results are those reported to Mr. McDaniel by the pilot and by inhabitants of the area over which the experiment was performed.

The pilot reported that he located a towering cumulus with top at 21,000 feet which appeared favorable for the test. Freezing level at the time was at 17,000 feet and the temperature at 21,000 was -6°C . No noticeable turbulence was observed at the cloud top, nor had an anvil shape or crystal ice haze yet begun to form. At 1430 C.S.T., 30 pounds of dry ice in the form of shavings was seeded directly on top of the cloud.

The plane quickly made a descent to 14,000 feet where a rainbow was observed against the side of the cloud. The remainder of the descent, made as close to the cloud as possible, was through light rain. The pilot did not fly under the cloud for he said that at the base, turbulence and the intensity of the rain made such a flight inadvisable. He reported that 45 minutes later heavy rain was continuing with visibility below the limits of safe contact flying. Other reports from inhabitants of the area indicated that the rain covered an area approximately 8 miles long by 4 miles wide and was accompanied by thunder and lightning. None of the precipitation fell in a rain gauge, but several eye-witnesses described the rain as heavy and estimated the amount at 1 to 2 inches.

In preparing for the flight the Peoria newspaper sent a telegram asking for advice, to an Arizona paper which had previously carried out such a trial. The reply carried dire warnings of the generous nature of the experiments. It claimed there had been reports of as much as 7 inches of rain falling within 14 minutes and advised that tests be carried out over uninhabited areas. The telegram also warned that the seeding plane must not fly through the cloud once it had deposited the dry ice, as there was likelihood of "a heat blast comparable to that of an atomic bomb!"

All such exaggerated and unauthenticated reports should be treated with caution. Observations by Bureau scientists have so far given no indication that such extreme phenomena have occurred, or even can occur, under the circumstances.