

MINUTES OF THE ICAS - NHRE MEETING
National Center for Atmospheric Research
Boulder, Colorado
10 February 1971

This meeting, suggested by Mr. Peter Wyckoff of NSF and called by the NHRE office, had two purposes: (1) to explore the areas where the different agencies could participate in and contribute to the goals of the National Hail Research Experiment; and (2) to receive, where possible, firm commitments on the contributions of the several government agencies to NHRE.

The participants to the meeting were the following:

Captain Hugh Albers, Department of Defense, OSD

Dr. R.G. Baughman, Department of Agriculture, Forest Service

Dr. Robert W. Beadle, AEC

Mr. Robert L. Houghten, NASA

Mr. John H. McGhee, FAA, Air Traffic Branch

Mr. Gerald G. Pettibone, FAA, Air Traffic Branch

Mr. Byron B. Phillips, NOAA

Dr. H. Rex Thomas, Department of Agriculture

Mr. Clement J. Todd, Bureau of Reclamation, Division of Atmospheric
Water Resources Management

Mr. Peter H. Wyckoff, NSF

Dr. James Young, Battelle Northwest

Attending from NCAR were the following:

Dr. John W. Firor

Dr. Guy G. Goyer

Mr. W. John D. Kennedy

Mr. Richard W. Sanborn

Dr. William C. Swinbank

After a brief word of welcome from Dr. Firor, Director of NCAR, Dr. Swinbank, Director of NHRE, presented a brief discussion on the history and the plans of NHRE. Following this exposé, Dr. Thomas of the Department of Agriculture stressed the importance of establishing a firm coordination

mechanism to permit the incorporation of the funds necessary to participate in NHRE in the budget of individual agencies wishing to do so. He reiterated his conviction that the coordination at the OMB level mentioned by Mr. Wyckoff does not insure a smooth mechanism at the working level of the Federal agencies.

After this discussion each agency representative in turn was questioned about the areas of their possible contribution and about firm commitments for summer 1971 and the following summers.

A. DOD

1. Helicopters -- Mr. Albers mentioned the impossibility of obtaining any helicopters from the Army for the program in summer 1971. He also recommended that we request a five-seat helicopter because they are more readily available and cheaper to operate. He suggested the possibility of obtaining one or two of these for summer 1972 from the Navy or the Air Force.

2. Rawinsondes -- A firm commitment for one rawinsonde team for summer 1971 was given. It was also mentioned that chances are good for obtaining a second one for this first summer. For summer 1972 a firm commitment can be made for two rawinsonde crews with a good possibility of obtaining three. Mr. Albers suggested that if NHRE requires three teams that it should request the three teams. However, the probability of obtaining three is still undetermined.

3. Drones -- Mr. Albers stated that the Army does not have the necessary hardware to supply drones to the project but that the Navy and the Air Force can be approached for that purpose. He mentioned that the survival probability of a drone in a severe storm is questionable. Mr. Todd also mentioned that the safety of flying a drone in an operation involving several other aircraft may be very marginal and that aircraft crews might refuse to fly under such conditions. Mr. Albers agreed to discuss the problems of operating a drone in severe storms with the Navy and the Air Force and to explore the possible availability of drones from each department.

4. WRB-57 -- Mr. Albers suggested that the availability of the WRB-57 should not be difficult to solve. He suggested that we contact the Assistant Secretary of the Services for further inquiries. Mr. Albers suggested very strongly the WC-130 and WC-135 instead of the WRB-57. In his opinion, the prospect of obtaining either of these would be much better than for obtaining the WRB-57. The C-130 and C-135 both have capabilities for seeding with droppable flares, but are limited in altitude to 30,000 ft. and 40,000 ft., respectively.

5. Multiple aircraft tracking radar -- Mr. Albers mentioned that these are permanent installations which are extremely difficult and costly to move. Moreover, they require a big crew for their operation. They are capable of tracking more aircraft than we envision in the national experiment. Mr. Albers confessed that he had not looked into that area but that he would make the necessary inquiries on his return to Washington.

B. NOAA

1. DC-6 -- Mr. Phillips gave a firm commitment for one DC-6 for a period of 30 to 40 days in summer 1971. For the following summers, the probabilities appear good of obtaining two DC-6's for the same period of time. Both DC-6's carry the same instrumentation except for the Grote Plotter which is still in the testing stage in one aircraft.

2. Doppler radars -- It had been agreed between NHRE and NOAA personnel that the two 3 cm Doppler radars would be most profitably used in Oklahoma this summer, and would probably be available to NHRE for the following years.

3. Ground crews and network -- For summer 1971, the proposal from NOAA to NSF for this work is under advisement at NSF at the present time. Mr. Wyckoff stated that this proposal will most likely be funded by NSF, Weather Modification Group.

4. Cloud seeding -- Mr. Phillips mentioned the capabilities of the RFF RB-57 for seeding clouds with droppable flares.

5. Electrical studies -- Dr. Kasemir of NOAA will be carrying out electrical studies around thunderstorms in the summer of 1971. No plans have been made as yet for the following summers.

C. Department of Agriculture

1. Economic evaluation -- Dr. Thomas mentioned that there were no resources in the 1971 budget for an economic evaluation. Several members of the meeting stressed the importance of economic studies and proposed the Department of Agriculture as the most qualified to make such a study. Mr. Wyckoff suggested a cooperative effort between NSF and the Department of Agriculture for getting an economic evaluation of hail suppression underway. The suggestion was well received by Dr. Thomas. Dr. Thomas suggested the possibility of using already established Department of Agriculture stations at Fort Collins, Akron and Cheyenne as crop damage evaluation stations. Lots of different crops could be established at these stations or on cooperating farmers' land where hailpad damage could be hopefully correlated with crop damage. Goyer and Phillips enthusiastically received that suggestion. Dr. Thomas suggested that a Department of Agriculture representative from the local area be appointed as the leader of this effort and the contact with the NHRE.

2. Social factors -- Dr. Thomas stated that no social factor studies are contemplated by the Department of Agriculture. Mr. Kennedy discussed briefly the project funded by NCAR and carried out by Dr. Haas of Colorado University on this subject.

3. Forest Fire Laboratory -- Dr. Baughman stated the position of their organization with respect to hail. Their first priority is the study of forest fires and forest fire prevention. Project Skyfire consists of four research people funded at the level of \$180,000 a year. Consequently, their participation in NHRE would have to be based on electrification studies rather than on hail studies. Dr. Baughman expressed his conviction that Project Skyfire would greatly benefit by its participation in NHRE. They could

contribute in the field of electrostatic studies which can be carried out from a van or from an aircraft. They have a cloud seeding capability based on the use of skyfire burner generators used on aircraft or at the ground. They have used that type of cloud based seeding for the last 10 years. They also have a capability for airborne mapping of hailswath with a Barnes Scanning Radiometer. However, Dr. Baughman expressed doubts that this same equipment, designed for the detection and location of forest fires, could be used for the mapping of hailswath.

Dr. Baughman agreed to discuss the areas of mutual interest discovered at this meeting with Drs. Fuquay and Barrows and inform the NHRE office of the decision of their organization to participate or not in summers 1972 and following. No active participation is planned for the summer of 1971 by the Forest Service.

D. NASA

1. Satellites -- Mr. Houghten discussed the several satellites that are now in orbit and the availability of satellite pictures either from NASA or from NOAA at the present time. He also mentioned the launching of a stationary satellite SMS in 1972 which should be located south of here. He suggested that pictures from that satellite might be appropriate for the purposes of the NHRE. A second SMS satellite is scheduled at a later date. Also in 1972, the ARTS polar orbiting satellite will be launched. It would fly over the area every day returning at the same position once every 16 days. Observations and photographs would be obtained in three visible and five infrared bands.

2. Convair-990 -- The Convair-990 carries the prototypes of the satellite instrumentation as a platform to obtain ground truth in the testing of the satellite instrumentation. It has been used in BOMEX for that purpose. Mr. Houghten mentioned that it would most probably not be available for any three-month period in the future years. The high cost of flying the Convair-990, \$3,000 per hour, is another limitation to its use. It flies out of Ames

but could also fly out of Cheyenne or Laramie. It has a ceiling of 40,000 to 45,000 ft., good instrumentation and navigation instruments. It is most probably committed for this year although the possibility exists of obtaining it for four or five days in summer 1971. The best contact may be Dr. Tepper but Mr. Houghten will look into that problem.

E. FAA

1. Experimental area -- Mr. Pettibone described two possibilities:
(1) A restricted area where all non-project aircraft are forbidden to fly. The responsibility of keeping non-project aircraft outside of this area resides with the FAA. This type of restriction is very difficult to obtain.
(2) A controlled firing area where the responsibility of keeping non-project aircraft out resides with the NHRE. This type of area is easier to obtain since it can be released when not in operation. No decisions can be taken until further trajectory data is obtained on the airborne cloud seeding rockets contemplated by the project.

2. Aircraft controllers -- Mr. Pettibone said that the possibility for the FAA to supply aircraft controllers to NHRE depends very strongly on the present staffing of aircraft controllers within the FAA. He agreed to make the necessary inquiries to answer that question and to study the radar facility at Greeley to establish the possibility of using FAA personnel with that particular equipment. Future inquiries on that subject should be directed to Mr. Pettibone's office.

3. Ground-based rockets -- Both Mr. Pettibone and Mr. McGhee agreed that in terms of FAA regulations, the use of ground-based frangible rockets would be easier to permit than that of airborne rockets. No decision can be taken until greater details on the type and the performance of ground-based rockets are obtained from the NHRE office. In answer to Dr. Swinbank's question, Mr. Albers said that it might be possible to obtain Army personnel to man ground cloud seeding rocket stations. It was suggested that NHRE look into the existence of State regulations controlling the firing of rockets.

F. AEC

1. Tracer experiment -- Dr. Beadle of AEC described briefly the tracer experiment planned by Battelle Northwest within the NHRE program. Tracers will be dispensed from aircraft at different levels and at different times during the life of a thunderstorm and the precipitation from it analyzed for these products. Battelle Northwest presently has seven non-radioactive and non-toxic tracers available for such studies. In summer 1971 lithium and indium tracers are to be used. The flares will be manufactured by Olin Corporation. Battelle Northwest has no aircraft and consequently an aircraft would be required for that work. It is unclear yet if the AEC or NHRE will supply the aircraft for that program. The Queen Air was equipped and used for such studies in Illinois in summer 1970. Dr. Young of Battelle Northwest agreed to participate in the forthcoming NHRE planning meeting and discuss in greater detail their requirements and their plans for the 1971 season.

G. Bureau of Reclamation

Mr. Todd presented the philosophy of the Bureau with respect to hail. Precipitation management includes hail and they are indeed very much interested in hail suppression projects. Mr. Todd suggested a multi-lateral cooperation with all participants of the NHRE program. One area where the Bureau might contribute is in their time sharing computing system for the calculation of cloud models as a tool for real-time forecasting. This system is used in the Bureau's project and is available to NHRE. In addition, the Bureau is now obtaining their own rawinsondes which might be of use in NHRE. They will be located in North Dakota, South Dakota and Texas. Finally, the Bureau is greatly interested in data from a synchronous satellite and proposes sharing the cost of such data with NHRE or other interested programs. Mr. Todd agreed to meet with the NHRE office later this month to discuss this proposition in greater detail. Finally, Mr. Todd mentioned the capability of the Bureau in seeding clouds with hygroscopic nuclei. A capability is being developed to permit seeding at the rate of 10 gallons per minute with particles in the range of 10 to 15 microns diameter.

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The meeting was most useful in delineating the areas in which each agency can participate in and contribute to NHRE. Although firm commitments were not obtained in most cases, the mechanism for pursuing them has been clarified by the agencies' representatives.

The meeting adjourned at 2:00 p.m.

- END OF MINUTES -