COMMENTS ON TECHNOLOGY TRANSFER IN WEATHER MODIFICATION

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Abstract. The transfer of technology in the field of weather modification has suffered from a long series of misunderstandings and misconceptions. Included in these misconceptions are the actual definitions of technology and methodology. Attempts are made to clarify some of the present uncertainties related to the terms, identify some of the technologies which have actually been transferred, and once again emphasize the need to bring the scientific community and user groups closer together in planning for future weather modification programs.

1. INTRODUCTION

The precise origin of technology transfer is not specific but it has certainly been with us for a very long time. One of the earliest examples of technology transfer was probably best illustrated in the introduction to the film, "2001, A Space Odyssey". You will recall the opening early-man scene where one of the creatures was poking around in a pile of old bones when, by a marvelous experience of serendipity, he discovered the ability to break one bone by striking it with another. The next scene shows he and his colleagues, each with a good size piece of bone, advancing on a neighboring group, ultimately producing substantial skull fractures.

The origin of "weather modification technology transfer" is less clear. Even the term itself suggests a multiplicity of concepts. Should an idea by itself, spoken to another person, be considered a transfer of technology? Probably not, even though the idea may lead to the development of a technology, and even to its practical use. What about specific thoughts which evolve to the production of a scale model of some particular instrument. Is the showing of the scale model, and the description of its possible use, a transfer of technology? And how about an improved weather forecasting scheme, or conceptual cloud model, passed along to an applications group. Is this technology transfer? Obviously there are some grey areas so a few definitions may be useful.

I believe we all recognize and accept that technology is a branch of knowledge that deals with industrial arts, applied science and engineering. From this basic concept perhaps we can agree that:

> "the technology of our society is the sum of the ways in which the social groups provide themselves with the material objects of their civilization".
>
> Technology should not be confused with methodology -- a set or system of methods, principles and rules for regulating a given discipline.

Some strong examples of technology development are:

- club
- hammer
- knife
- .45 automatic
- computer
- nuclear powered submarine

The concept of a club in the film "2001" was not a technology in itself, but shaping the bone and demonstrating its use was certainly the development of a technology and a very rapid transfer.

2. TECHNOLOGY AND METHODOLOGY

For the purpose of these introductory comments on the transfer of weather modification technology, I will make a distinction between technology and methodology as specified above. The key to this distinction is "material objects" in the case of a technology, and "methods, principles and rules" in the case of a methodology. Of course, if we were exploring the history of a technological development and its transfer, we could not ignore a persons original thoughts which led to the development of some useful material object, ultimately conveyed or transferred from one place or person to another.

What are some of the subjects not included in this concept of technology and its transfer.

- general ideas, dreams, aero-dynamic principles, ice crystal growth rate equations.
- weather forecasting schemes
- cloud models and their application
- guidelines for mobilizing a cloud seeding program.
- seeding opportunity recognition
- operations suspension criteria and and safety considerations

- application of nucleation theory
- program operations plans

These, and many other similar subjects, more appropriately fall into the category of "methodology". Much of this methodology comes from a broad range of very serious scientific investigations, and even some non-scientific discoveries through serendipity, but none can be transferred as a "technology".

Some of the subjects which clearly fall into the technology category are:

- silver iodide ground generators -- both manual and radio controlled
- airborne silver iodide generators
- pyrotechnic cloud seeding devices
- aircraft hardware necessary for the transport and delivery of pyrotechnics.
- artillery shells and rockets for delivery of nucleating materials
- measurement instrumentation (e.g. PMS probes, J-W liquid water detector, reverse flow temperature sensors, nuclei counters, orthogonal anemometers, icing rate detectors, doppler radar).

3. CONCLUSION

It is customary to either begin or end a series of comments with a blockbuster statement. This one is saved for the end. It is:

> "Most of the weather modification technology transfer during the past 35 years has been from the industrial and operations areas to the scientific arena, not from scientific investigations to the user group!!"

This observation is largely the reason why some of us have been working so hard to bring the researchers and operator/user groups much closer together, especially in the initial phases of new programs. The closing of this gap may be the single most important aspect of all future weather modification efforts in the United States.

3. REFERENCES

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