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In Deflecting Hurricanes, Where Do We Aim Them?

ON NOV. 13, 1946, Dr. Vincent Schaefer, working with Dr. Irving Langmuir of the General Electric Research Laboratory, first demonstrated that a natural cloud could be seeded with dry ice. Since then, many efforts to demonstrate a useful manipulation of the weather by seeding with various kinds of ice-nucleating particles have resulted in more controversial heat than proven rainfall.

These technical uncertainties have given us almost 25 years in which to work out the political and legal framework of weather management. However, our channels for social wisdom are so overloaded that we cannot realistically expect an appropriate level of public interest until the flood is upon us.

Dr. Myron Tribus, formerly dean of the Dartmouth School of Engineering and now Assistant of Commerce for Science and Technology, has been deeply concerned with the analysis of weather technology from its beginning. In a comprehensive overview in *Science* magazine, he suggests that cloud-seeding research is ready to proceed to larger-scale demonstrations.

DR. TRIBUS' remarks will elicit further rebuttal,

and my purpose is not to follow every detail of the technical controversy. It is rather to echo his concern for public understanding that "meteorology is too important to be left only to the meteorologists." This principle is also recognized in the initiation of social and legal research projects by the National Science Foundation under its mandate to coordinate and report weather research information.

The redistribution of rainfall has its most obvious applications as a support to agriculture, where it has already generated conflicts based on vital interests. What social mechanism should we establish for the fair treatment of owners of land whose value may be drastically altered by encouraging or preventing

In principle, the situation resembles the evaluation of reclamation and water redistribution projects. But we will face even greater difficulties of measurement and correspondingly pressing fantasies about the potential value of the rain that might have fallen.

The portent of weather modification also bears on water resource projects that may be prematurely made obsolete. Where dams and canals damage the environment, we have even more reason to look into the advantages of future innovations.

A MORE immediate opportunity is the modification of destructive hurricanes. To illustrate a moral dilemma, a hurricane might be predicted to smash New Orleans with a loss of 1,000 lives and \$1 billion in property damage. Recent studies (the "Stormfury Project") suggest the possibility of weakening such a hurricane. But what if it should also veer toward Houston or Tampico, Mexico? We might never know whether it did so on its own account or in response to a seeding.

When the path of a hurricane is an "act of God," we can do little more than post storm warnings and grieve at the losses. Once we can intervene, we face an inescapable social decision: Who should bear the brunt of the hurricane? The possibility of intervention seems to require that the whole burden of hurricane damage be socialized—which is easier for property than for human life.

THIS IS, of course, being obliged to "play God," but it is only a pale shadow of the control over human destinies that the state has always exercised. What is new is merely that our national defense here is against natural rather than political adversaries. What is most awkward is that we probably have better foresight about the consequences of intervening in a hurricane than in a social revolution.

It is futile simply to turn our backs on the violence in the universe. But we must take care that these most vital decisions are made by representatives who know our social will as well as they profess to know the short-run technicalities of the battle.

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