

A LEGAL REGIME FOR ARTIFICIAL CYCLONE MODIFICATION*

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It is with considerable trepidation that I, as a mere lawyer, take the rostrum to address such a distinguished gathering of scientists. I know that many of you will have come to this session with an attitude of healthy scepticism towards lawyers as a profession and a sincere concern that cyclone modification experiments should not be unnecessarily impeded by legal technicalities. Is this yet another example of lawyers casting their avaricious eyes out to another area of potentially profitable activity to the ultimate disadvantage of all except the well-lined pockets of the lawyers?

In the short time available to you I hope to stimulate you to an awareness that cyclone modification experiments do give rise to legal problems and that lawyers can assist you in resolving these problems. In the course of my talk, I shall be putting to you the elements of a legal regime for the conduct of cyclone modification activities.

Let me endeavour to explain why, in my view, a proper legal regime is necessary before cyclone modification activities are undertaken in the field. Cyclone modification research is at a very early stage. Predictions concerning the effects on cyclones of seeding are essentially hypotheses, based on computer modelling. Already, a number of reservations have been expressed concerning the computer modelling technique. Field experiments that have been undertaken are too few for any sound scientific conclusions to be drawn. A small number, perhaps two, of a total of four experiments in the Stormfury project give some grounds for optimism. It cannot be overlooked, however, that in a much earlier experiment in 1947, when a mature cyclone was seeded as it moved seaward 400 miles off the coast of Florida, the storm reversed its course and ultimately caused extensive damage in Georgia. I suggest it is only reasonable to proceed on the basis that the effects of cyclone seeding are at this stage uncertain.

From a lawyer's perspective, cyclone seeding can give rise to a range of potentially harmful consequences. The intensity of a seeded cyclone could be increased rather than diminished, either generally or over a particular area. The cyclone could be diverted from its natural path, causing damage to areas that might not otherwise have been affected or

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might have been affected to a lesser degree. More or less precipitation might result in a particular area. An increase in rainfall could cause flooding that might not otherwise have occurred. Any diminution in rainfall can also have adverse economic consequences, particularly in areas that rely on seasonal cyclonic activity for their rainfall. In some cases, cyclone modification may have mixed effects - beneficial to some, but adverse to others. Since cyclones travel over long distances, seeding may have effects beyond national boundaries. A seeded cyclone may cause damage to another state or to ships at sea. Cyclone modification may therefore have international as well as domestic ramifications.

In short, cyclone seeding carries with it a risk of adverse consequences. Although it is arguable that the risk itself is a small one (a matter for expert scientific judgment, on which I am obviously not qualified to express any view) it is abundantly clear that the potential damage is on a very large scale indeed. It is necessary to bear in mind, also, that where a seeded cyclone causes damage, the general public and foreign states will be quick to attribute that damage to the seeding operation.

Legal regulation of areas of technical complexity is never easy. The difficulties are compounded when it is necessary to add scientific uncertainty to scientific complexity. In the area of artificial cyclone modification, the major difficulty for the lawyer turns on the uncertainty about the effects of artificial seeding of cyclones. From a lawyer's perspective, it is difficult to establish a causal link between a cyclone seeding operation and the subsequent behaviour of the cyclone. In other words, there is not that degree of certainty, linking damage caused by a seeded cyclone with the prior seeding of that cyclone, which one would wish to see for the development of a set of legal rules regulating the consequences of seeding and subsequent damage. Indeed, there is a strong school of thought that, having regard to the present early state of scientific knowledge about cyclone modification, the development of legal principles relating to this activity is premature. Thinking in the World Meteorological Organization, with which many of you here are I know closely associated, is generally along these lines. On the other hand, the fact remains that, whether or not we are in a position to predict with precision the consequences of cyclone modification, the activity itself is potentially hazardous. The risk will not go away merely because we do not fully understand it. My own view is that it is essential to develop at least a rudimentary framework before any public authority conducts or authorises a potentially hazardous activity of this kind. That legal framework should address the circumstances in which the activity is to be conducted and the legal consequences of any adverse results.

I shall deal first with the elements of a suggested legal framework at the domestic level. So far as Australia is concerned, I see nothing inherently unlawful in the conduct of cyclone modification activities by either the Australian Government or any State Government. Legislative authority is not, as a matter of law, required. In my view, however, it is highly desirable that an inherently hazardous activity of this kind should be able to be carried out only pursuant to statutory authority. Enabling legislation should establish, among other things, the objectives of the activity, broad criteria according to which it is to be conducted, and who is to have responsibility for decision-making. I attach particular importance to this last mentioned factor. Seeding involves a multitude of

scientific and political judgments. It may be necessary to balance the prospects of advancing scientific knowledge against potential risks to the community. Legislation should clearly establish who is to be responsible for authorising a particular seeding operation. Final responsibility should not, in my view, lie at a technical, scientific, or operational level, or indeed with anyone having a vested interest in the conduct of an experiment. Rather, the authority for approving cyclone modification should, I suggest, be with a senior member of the Government. The Minister concerned will of course have access to the best specialist advice. His decision will, however, be sensitive to wider public policy considerations.

Even with these procedural safeguards, it can never be guaranteed that there will be no adverse consequences. A seeded cyclone will still proceed with destructive force. I have already mentioned the nature of the risk of cyclone damage. An Australian victim of damage from a seeded cyclone has access to the ordinary courts. But he faces a number of formidable legal obstacles in the way of recovery of compensation. He must establish in a legal sense a causal relationship between the seeding operation and his subsequent damage. Even in the United States of America, where the fertile minds of judges are much more imaginative in manufacturing novel legal principles to assist plaintiffs than is the case in Australia, weather modification suits have generally failed because of the inability of the plaintiff to establish to the satisfaction of the court this causal link between seeding and subsequent damage. The victim must also establish that the cyclone seeding was conducted negligently. This requires him to show that there was a departure from an appropriate professional standard of care. Even if this had occurred, it is unlikely that the plaintiff would ever have access to sufficient evidence to be able to prove it in court. In short, as I see it, our existing law does not provide an adequate legal remedy for the victim of cyclone damage. Common law principles are quite inadequate in areas of such technical complexity.

I suggest that the conduct by a public authority of a potentially hazardous activity of this kind without satisfactory advance arrangements to cover liability and compensation for any potential damage is socially unacceptable. One way of meeting the problem would be to provide compensation on the same basis on which governments normally provide disaster relief. But I do not think this is enough. We are dealing here not with a natural disaster but with circumstances to which a public activity has contributed. In my view legislation to facilitate recovery of damage is called for. Such legislation would need to address the basic legal obstacles in the way of recovery under the ordinary law. It could, for example, provide for strict liability, that is liability independent of fault or negligence, thereby relieving the victim of the obligation to establish that the seeding operation was conducted negligently. It should also establish some form of statutory presumption of causation where a seeded cyclone subsequently causes damage. That is, the law should provide that it is to be presumed, at least in certain circumstances, that the seeding caused the subsequent damage. I shall develop, a little later, some thoughts on the circumstances in which such a presumption might apply.

I turn now to the legal ramifications of cyclone seeding at the international level. Is cyclone seeding lawful under international law? Traditional international law of the air is based on the notion that a state enjoys sovereignty over its superjacent airspace. Beyond territorial

limits, airspace belongs to no one. This approach has been developed primarily in the context of transit through airspace. The concern has been with the legal ability to control overflight by foreign aircraft. Cyclone modification activities that did not involve incursions into foreign airspace would not, in my view, be contrary to these principles. Provided that no adverse consequences result, cyclone seeding is not, therefore, unlawful.

But the traditional approach to international air law is at present undergoing close scrutiny. We are beginning to understand how a range of atmospheric activities can have international as well as purely domestic consequences. Phenomena with which this gathering of scientists will be thoroughly familiar, such as acid rain and the possible effect on the ozone layer of supersonic flights and the everyday pressurised spray can, have cast doubt on the continued suitability of the traditional sovereignty approach. International lawyers are developing new approaches that seek to recognise the atmosphere as a global resource. As these approaches are developed, activities with the potential to affect the atmosphere beyond national boundaries, and cyclone modification is clearly such an activity, will increasingly become the subject of international legal regulation.

What should be the ingredients of this regulation?

At the outset, I would suggest a relatively loose regime. The starting point should be the conduct of cyclone modification activities pursuant to international agreement rather than on a unilateral basis. A number of procedural requirements will assist in achieving international consensus.

First, a state proposing to conduct cyclone modification activities should be under a legal obligation to notify neighbouring states, to provide them with information about the proposed activities and enter into consultations with those states. The mechanisms of notification and of consultation will lay the foundation for the conduct of cyclone modification activities on a co-operative basis.

Notification and consultation procedures must be meaningful. The state proposing a cyclone modification program should, among other things, carry out thorough environmental studies and should make scientific data available. Analysis and explanation of scientific data may also be necessary. In appropriate cases, the criteria for selecting cyclones for seeding, including such matters as proximity to populated areas, should be agreed between states.

Notification and consultation may seem elementary requirements. They lay the basis for the avoidance of conflict and the resolution of disputes. Just as scientific opinion is not always unanimous, so too judgments about what are reasonable risks may vary. The interests of neighbouring states will not always coincide. A particular operation with enormous potential benefits for one state may be seen as creating a substantial risk for a neighbouring state. Notification and consultation procedures, if properly pursued, provide a framework for problems of this kind to be resolved on a co-operative basis. No state should unilaterally undertake cyclone modification activities that may adversely affect the environment of other states.

As on the domestic level, so also at the international level, procedural safeguards cannot guarantee that there will be no adverse consequences. Agreement should therefore be reached, between states, on liability and responsibility for any damage that occurs and on procedures for the assessment and payment of compensation. In my view, the state having the carriage of the cyclone seeding operation should be fully accountable. In other words, that state should be strictly liable, without proof of fault, to pay compensation for damage caused by seeding. This is a common approach in international law to liability in respect of hazardous activities. Its effect is to put the risk wholly on those conducting the activity, who are normally those most likely to benefit from it. Other examples of strict liability regimes include those in respect of liability for damage from nuclear and outer space activities and from oil pollution from tankers.

I should add that there are strong arguments to support the view that a state is already strictly liable, in international law, for damage caused to another state by cyclone modification activities. But in the absence of any treaties on the subject the law is uncertain. Such an important element of cyclone modification activities should not be clouded in obscurity. Moreover, existing principles of international law do not provide satisfactory mechanisms for the expeditious assessment of damages and payment of compensation. International agreements on the conduct of cyclone modification activities should therefore cover responsibility for damage and procedures for the assessment and payment of compensation.

As in the case of domestic liability arrangements, a particular difficulty in the negotiation of international liability arrangements will be the problem of causation. Indeed, this question of attribution, the causal link between a cyclone seeding operation and subsequent damage caused by that cyclone, is the most troublesome aspect of any liability regime, whether at the international or domestic level. As I have said before, it is necessary for those seeking to develop legal rules in this area to bear in mind that the general public, and foreign governments, will be quick to attribute any damage to the seeding operation. I have earlier suggested a legal presumption in favour of the victim. That is, it should be assumed that damage caused by a seeded cyclone is attributable to the seeding operation without the need for the victim affirmatively to establish the causal link. Some form of presumption of this kind seems essential if victims are to have a prospect of recovery. At the same time, any presumption along these lines, if too wide, could confer a right to compensation in undeserving cases. The problem is to develop a presumption that provides sufficient assistance to genuine victims without exposing those conducting cyclone modification activities unreasonably to unmeritorious claims. I want to suggest an approach that might meet this objective.

Cyclone modification experiments will be conducted in accordance with agreed safety precautions. For example, it may be agreed that a cyclone will be seeded only if there is less than a certain statistical likelihood of that cyclone crossing a populated area within a specified period, say 24 hours. Any presumption of causation could be limited to those cases where that prediction was not fulfilled, on the basis that in those circumstances there was a reasonable likelihood that seeding did in fact affect the subsequent behaviour of the cyclone. A presumption, limited along these lines, could be applied both in domestic legislation and in international

agreements. The result would be that the victim of a cyclone which, after seeding, behaved differently from the behaviour predicted by those having the carriage of the seeding operation, would have his prospects of recovery substantially assisted. Since the predictions on the basis of which the cyclone was seeded had not been borne out it seems reasonable that there should be a right to recovery. If suitable precautions are observed in selecting cyclones for seeding and the presumption of causation is applied but limited along the lines suggested, it seems to me that a reasonable balance is achieved between the need to provide compensation for genuine victims and the need to minimise exposure to liability in respect of undeserving cases.

CONCLUSION

These it seems to me are the essential elements of a legal framework for cyclone modification. You will notice that I do not suggest any substantive legal rules or any international technical standards with which compliance should be necessary. Having regard to the present state of understanding of cyclone modification techniques, I do not think that technical requirements can yet be a matter for legal regulation. Nor do I favour, as some have suggested, complex new international institutions. I do not, for example, think that cyclone modification activities should require authorisation from some new international body. I doubt, moreover, whether any new international compensation fund is required. The framework I favour is loose and flexible: at the domestic level, the establishment of machinery for authorisation of cyclone modification activities at an appropriately senior government level and legislation facilitating the recovery of compensation for damage in proper cases; at the international level, procedural obligations of notification and consultation, an acceptance of liability and procedures for the assessment and payment of compensation. The international framework can probably best be implemented through regional agreements.

I do not pretend that implementation of even such a modest framework will be easy. States will be reluctant to give open-ended indemnities to other states. Treasuries can be expected to oppose generous domestic compensation arrangements. Yet I suggest our community will accept nothing less. Recent events such as the Three Mile Island incident and major liquid natural gas explosions have sharpened our awareness of the need for special regulation of exceptionally hazardous activities. A satisfactory legal framework, once adopted, by allaying community concerns will facilitate rather than hinder the conduct of cyclone modification activities.