

Analytical Summary

**POSSIBLE INTERNATIONAL RESTRAINTS
ON ENVIRONMENTAL WARFARE***

The immediate question is whether to give favorable consideration to General Secretary Brezhnev's suggestion in March that the summit communique include agreement to enter into discussions regarding possible restraints on using environmental modification techniques as weapons of war.*

To facilitate the near-term decision, this paper examines the advantages and disadvantages of no restraints on "environmental warfare," and two different levels of restraints which could be the bases for international discussions.

As discussed below, the concept of environmental warfare could cover modification of the weather, climate, ocean, terrestrial, and the ionosphere for military purposes.

US Policy

NSDM 165 (May 1972) established guidelines for certain international aspects of US civil weather modification activities; deferred decision on military applications; and directed that no climate modification activities be undertaken without specific Presidential approval. The Administration stated subsequently that it would not use climate modification techniques for hostile purposes should they come to be developed.

Under civilian authorization, military rain augmentation experiments and operations were carried out in Southeast Asia from 1966 to 1972. These represent our only significant operational experience in the military use of weather modification under combat conditions.

Military Programs and Considerations

Weather Modification. The range of conceivable weather modification

* Such announcement could, if desired, be coupled with a proposal to explore international cooperation in beneficial modification techniques and/or to explore with other countries the need for international guidelines for civil environmental modification activities having cross-border effects.

OSD and JCS reviews
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activities includes forming, stabilizing, or dissipating fog and low clouds; increasing or decreasing precipitation; moderating, intensifying and steering of severe storms such as hurricanes and typhoons; and suppressing or augmenting lightning and hail.

Only dissipation of certain types of fogs and some modification of the type and amount of precipitation can be considered operational or near operational today. Positive but unsubstantiated assessments best describe efforts in hurricane moderation and hail and lightning suppression. The possibility of intensifying or steering storms is mostly a theoretical possibility only.

DOD currently has only two operational weather modification programs, both dealing with fog dissipation. DOD's R&D programs are relatively small and are designed primarily for (1) protecting personnel and resources against natural hazards to improve operational capabilities and (2) guarding against technological surprise.

Possible militarily useful applications include:

- Rain enhancement could be used to wash out tactical bridging equipment, disrupt airborne operations, channelize or block enemy attack or logistic routes, or shield friendly activities.*
- In limited circumstances, fog or low cloud stimulation or stabilization might be useful; and fog dissipation could be used to facilitate launching of air strikes or to clear target areas.
- Hurricane or typhoon intensification or steering, if ever feasible, might be used for inflicting damage, denying areas for a limited time, or avoiding storm damage.

However, militarily useful weather modification would require the conjunction in place and time of a tactical opportunity to be gained by using modification techniques, suitable meteorological conditions, and an operational capability in place. While a deployed operational capability could be made available with necessary investment, training, and doctrine, the coincidence of the other two factors—suitable natural meteorological conditions and tactical

* The rain augmentation activities in Southeast Asia were designed to make North Vietnamese infiltration more difficult by increasing rainfall in selected areas to soften road surfaces, cause landslides, and wash out river crossings. These events normally occur during the height of the rainy season. Seeding was intended to extend the period of occurrences and to supplement the natural rainfall. While this program apparently had an effect on the primitive road conditions in these areas, the results were certainly limited and unquantifiable.

opportunity—would be fortuitous. For this reason, weather modification would be essentially a "weapon of opportunity."

Climate Modification. Climate modification would involve alteration of long-term climate (as contrasted with short-term weather). Climate modification is still in the research state (e. g., computer "models" but not experimentation). DOD has only one computer research program.

Climate modification would have limited military application, and the difficulty in predicting the totality of effects could mean the user's own climate could suffer unforeseen and possibly irreversible deleterious effects.

Ocean Modification. Ocean modification would involve alteration of the physical characteristics of the oceans (e. g., currents, waves, temperature, chemical composition, coastal and bottom topography). At present, no capability or technical basis for a capability exists to modify the oceans environment in a controlled, militarily useful manner, and DOD has no oceans modification programs.

Even if feasible, ocean modifications would have at best limited military application.

Terrestrial Modification. Terrestrial modification would involve the alteration of the earth's physical characteristics [e. g., inducing earthquakes beneath land surfaces or inducing earthquakes or generating tsunamis (tidal waves)]. Scientific understanding of earthquake mechanisms is increasing. At present, no capability or theoretical base for a capability to alter the inner earth environment in a controlled, militarily useful way exists. DOD has no present programs although research on earthquakes has been sponsored in connection with underground nuclear test detection.

If terrestrial modification techniques should become feasible, a military application might involve modification of the earth's subterranean geomagnetic field to affect navigation techniques based on geomagnetic bearings. The effects of efforts to induce earthquakes or tsunamis would not be controllable. Consequently, significant military applications are not foreseen.

Ionospheric/Geomagnetic Modification. Ionospheric/geomagnetic modification would involve creation or intensification of new radiation belts around the earth through high altitude nuclear bursts or through non-nuclear means. Relevant DOD programs include studies of the impact of ionospheric variations on communications, surveillance capabilities, and ABM "blinding."

If controllable ionospheric/geomagnetic modification techniques should become feasible, they might have significant military applications.

Military Alternatives. Although the purely military advantages to an adversary inherent in the use of some conceivable but not yet possible modification techniques could be significant, these advantages, if detected, could be countered by selected utilization of other military forces to prevent or hamper his efforts. The effectiveness of his techniques can also be reduced through all weather systems.

Programs of Other Countries and Cooperative Efforts

Soviet Union. The Soviet Union maintains a very large civil weather modification program. The scope of the known Soviet effort is generally comparable to that of the US, but they are weak in such areas as instrumentation, data processing, and computer equipment.

The nature and degree of military participation in the Soviet civil weather modification program is unknown. The civil program is of interest to the military and many of the techniques being developed could be applied to military purposes. There is also reasonably good evidence that the military is carrying out an independent classified program, particularly in fog and cloud dispersal in the Arctic region.

There is no information to suggest that the Soviets have a climate modification program at present.

The Soviet Union ranks first in the volume of oceanographic data being acquired, but they are believed to trail the US by 5 to 7 years in the quality of their effort.

The Soviets have a well-balanced research program in the earth sciences and a broad-scale program aimed at developing a method for forecasting earthquakes. Their overall understanding of geophysical processes is probably about on a par with the US although the quality of their effort is somewhat less.

The Soviet experience and understanding in ionospheric studies are believed to be about equal to our own.

US-Soviet Cooperation. Scientific exchanges have taken place in the field of weather modification, and additional exchanges are planned. No joint projects are currently contemplated.

Under the US-USSR Agreement for Cooperation in the Field of Environmental Protection, cooperation in earthquake prediction research and in basic research possibly applicable to weather modification is planned. Also, the Soviets have informed us that they have decided to move into the field of large-scale weather modification and are interested in cooperating with the US. We are supplying information on the kind of aircraft and instrumentation

we plan for such activities. Soviet participation in our large-scale storm moderation efforts would unquestionably arouse suspicion and antagonism on the part of the PRC.

Domestic and International State-of-Play

The environmental warfare concept has not been the subject of extended or highly publicized international debate. However, in July 1973, Senate Resolution 71, sponsored by Senator Pell, was adopted by an 82-10 vote of the Senate. This resolution expresses the sense of the Senate that the USG should seek an international agreement to prohibit the use of any environmental or geophysical modification activity as a weapon of war, or the carrying out of any research or experimentation directed thereto.

Verification

There has been no extensive study of possible verification techniques for restraints on use. Since many of the modification techniques are conceptual in character, there is presently little basis for seeking to define technical detection systems.

However, detection of weather modification efforts might be accomplished through chance observations coupled with changes in weather conditions. The chance of detecting separate, scattered events would be low except for fog modification. The chance of identifying repetitive or large-scale seeding operations would be higher.

Efforts to carry out climate and ocean modifications or to trigger earthquakes or generate tsunamis would probably be observable, although identifying particular efforts as being related to modification purposes might be difficult. Another important inhibition against such modification would be the unpredictability and uncontrollability of the effects.

Certain types of ionospheric/geomagnetic anomalies could be recognized as having been artificially created, but preparations would probably not be detected.

Policy Options

Of the several possible categories of environmental modification techniques previously described, ionospheric/geomagnetic modification techniques are not considered here in connection with the examination of possible international restraints, but may warrant further study. Possible questions regarding the compatibility of some applications of environmental warfare with existing laws of warfare are also not addressed in connection with the options.

The options below deal with possible restraints on use of weather modification, climate modification, ocean modification, and terrestrial modification (in particular, efforts to trigger earthquakes or generate tsunamis). The possibility of restraints on relevant military research and development are not considered.

Option 1. Not accept any international restraints on military uses of weather, climate, ocean, or terrestrial modification techniques.

Advantages. This would (1) preserve maximum flexibility to determine further how useful militarily possible modification techniques might become, and (2) retain full flexibility in the use of current and potential operational weather modification techniques which could have tactical advantages in some situations.

Disadvantages. This could (1) lead to the emergence of arms competition in the environmental modification area and to increased concern that advances in relevant scientific and technological fields might be used to wage war; (2) hamper future international scientific cooperation in the environmental modification area; and (3) hamper the development of and certainly US participation in developing guidelines for civil environmental modification activities having cross-border effects.*

[The JCS recommend this option. However, should restraints be desired, the JCS consider the following option acceptable, noting that its adoption would present no serious damage to our national military posture.]

[Comment. This option would provide no basis for discussions with the Soviets, and would retain military use options in areas where there would be only very limited if any military application (that is, in climate, ocean, and terrestrial modification techniques should they come to be developed).]

Option 2. Be willing to accept international restraints prohibiting "environmental warfare" defined as any military use of weather, climate, ocean, or terrestrial modification techniques having long-term, widespread, or especially severe effects.

*The scientific and technological advances which provide the basis for the environmental warfare concept derive in large part from civilian programs, especially in the area of weather modification. Weather modification activities may prove beneficial in a variety of situations. However, for many countries, disputes arising from civil applications which have cross-border effects may prove of greater practical concern than "environmental warfare." The need for international guidelines for civil weather modification activities having cross-border effects has been raised in the United Nations Environmental Program (UNEP) and other bodies.

This would preclude the following military uses of modification techniques: (1) any climate modification; (2) any significant ocean modification; (3) efforts to trigger earthquakes and generate tsunamis; (4) intensification or steering of severe storms (e. g., hurricanes or typhoons) or deliberate generation of tornadic types storms to cause damage; and (5) continuous and extended precipitation modification. It would not prohibit localized (tactical) fog modification or precipitation modification; nor preclude efforts to moderate storms solely for protection against natural hazards.

Advantages. This would (1) rule out the most dangerous and destructive possibilities (most of which would have limited if any military application), (2) allay some of the domestic and international concerns; and (3) limit an area of possible competition; and (4) be verifiable within reasonable limits of error.

Disadvantages. This could (1) be criticized internationally since we would propose to rule out everything except the things we know how to do and have done (rainmaking in Southeast Asia); (2) be much more difficult to negotiate on a multilateral basis than Option 3 below; (3) present more problems of determining whether or not particular actions were permitted; and (4) hamper US participation in the development of international guidelines for civil environmental modification efforts having cross-border effects, since these would probably proceed on a "peaceful purposes only" premise.

[OSD recommends this option and, as noted above, the JCS consider that it would have no serious adverse military implications.]

Option 3. Be willing to accept international restraints prohibiting "environmental warfare" defined as precluding—in addition to those activities precluded under Option 2—precipitation modification for harassing, blocking, and damage inflicting purposes; and precipitation or fog modification to facilitate harassing, blocking, or damage inflicting actions implemented by other capabilities.

Regarding modifications having effects over or in enemy territory, this option would not preclude the use of weather modification techniques solely to protect forces from natural hazards or the use of fog modification for search and rescue missions.

Advantages. This would (1) probably meet with more general acceptance as a definition of "environmental warfare," as use of modification techniques for all clearly hostile purposes would be prohibited; (2) be less ambiguous than Option 2, and be easier to negotiate on a multilateral basis (since Option 2 would not rule out some hostile uses of weather modification); and (3) enable us to affirm that environmental modification techniques would be employed for "peaceful purposes only," thereby enhancing US participation in developing international guidelines for civil applications.

Disadvantages. This would (1) foreclose existing and prospective weather modification options which might be employed to gain tactical advantage in a variety of conflict situations (should natural meteorological conditions permit); and (2) present greater verification problems than Option 2 because it includes restraints on tactical employment of weather modification techniques.

[State and ACDA strongly support this option.]

My View. The fundamental difference between the agencies is that OSD and the JCS wish to retain the right to use precipitation and fog modification techniques for hostile purposes.

This difference need not be settled now in order to decide (1) to enter into discussions with the Soviets on possible international restraints on environmental warfare, and (2) to announce this decision in a summit communique. If State and ACDA concur, we could initially conduct such discussions on our side on the basis of OSD's preferred position, and defer decision on any broader restraints pending developments in these discussions.

Once we began such discussions, particularly if and when a multilateral agreement were desired, we would in all likelihood have to address the question of "peaceful uses only" policy or prohibitions along the lines recommended by State and ACDA. This prospect does not appear particularly troublesome since the military case, including our operational rainmaking experience in SEA, for preserving the option for hostile uses of fog and precipitation modification techniques does not appear very strong. State's argument for a multilateral agreement along the lines of prohibiting all clearly hostile uses may therefore be in our long-run interest, but that question can be addressed later.

If we conduct the discussions initially on the basis of the position supported by OSD, there may well be some criticism by the Soviets or in the public airing of the decision that we are not including in these discussions the only things we know how to do and have done. Indeed, our use of rainmaking in Southeast Asia from 1966-1972 has been controversial. However, this problem should prove manageable until such time as we need address the question of broader restraints.