Bibliography


CJCSI 3810.01, Meteorological and Oceanographic Operations, 10 January 1995.


Hume, Capt Edward E., Jr. Atmospheric and Space Environmental Research Programs in Brazil (U), March 1993. Foreign Aerospace Science and Technology Center, AF Intelligence Command, 24 September 1992. (Secret) Information extracted is unclassified.


Notes

1. The weather-modification capabilities described in this paper are consistent with the operating environments and missions relevant for aerospace forces in 2025 as defined by AF/LR, a long-range planning office reporting to the CSAF [based on AF/LR PowerPoint briefing "Air and Space Power Framework for Strategy Development (jda-2lr.ppt)]."


13. CJCSI 3810.01, *Meteorological and Oceanographic Operations*, 10 January 95. This CJCS Instruction establishes policy and assigns responsibilities for conducting meteorological and oceanographic operations. It also defines the terms widespread, long-lasting, and severe, in order to identify those activities that US forces are prohibited from conducting under the terms of the UN Environmental Modification Convention. Widespread is defined as encompassing an area on the scale of several hundred km; long-lasting means lasting for a period of months, or approximately a season; and severe involves serious or significant disruption or harm to human life, natural and economic resources, or other assets.

14. Concern about the unintended consequences of attempting to "control" the weather is well justified. Weather is a classic example of a chaotic system (i.e., a system that never exactly repeats itself). A chaotic system is also extremely sensitive: minuscule differences in conditions greatly affect outcomes. According to Dr. Glenn James, a widely published chaos expert, technical advances may provide a means to predict when weather transitions will occur and the magnitude of the inputs required to cause those transitions; however, it will never be possible to precisely predict changes that occur as a result of our inputs. The chaotic nature of weather also limits our ability to make accurate long-range forecasts. The renowned physicist Edward Teller recently presented calculations he performed to determine the long-range weather forecasting improvement that would result from a satellite constellation providing continuous atmospheric measurements over a 1 km2 grid worldwide. Such a system, which is currently cost-prohibitive, would only improve long-range forecasts from the current five days to approximately 14 days. Clearly, there are definite physical limits to mankind's ability to control nature, but the extent of those physical limits remains an open question. Sources: G. E. James, "Chaos Theory: The Essentials for Military Applications," in *ACSC Theater Air Campaign Studies Coursebook*, AY96, 8 (Maxwell AFB, Ala: Air University Press, 1995), 1-64. The Teller calculations are cited in Reference 49 of this source.


17. Ibid.

19. A pilot program known as Project Popeye conducted in 1966 attempted to extend the monsoon season in order to increase the amount of mud on the Ho Chi Minh trail thereby reducing enemy movements. A silver iodide nuclei agent was dispersed from WC-130, F4 and A-1E aircraft into the clouds over portions of the trail winding from North Vietnam through Laos and Cambodia into South Vietnam. Positive results during this initial program led to continued operations from 1967 to 1972. While the effects of this program remain disputed, some scientists believe it resulted in a significant reduction in the enemy's ability to bring supplies into South Vietnam along the trail. E. M. Frisby, "Weather-modification in Southeast Asia, 1966-1972," *The Journal of Weather-modification* 14, no. 1 (April 1982): 1-3.


21. Ibid.

22. Ibid.

23. Ibid., 367.


34. Robert A. Sutherland, "Results of Man-Made Fog Experiment," *Proceedings of the 1991 Battlefield
Atmospherics Conference (Fort Bliss, Tex.: Hinman Hall, 3-6 December 1991).

35. Christopher Centner et al., "Environmental Warfare: Implications for Policymakers and War Planners" (Maxwell AFB, Ala.: Air Command and Staff College, May 1995), 39.


37. Facts on File 55, no. 2866 (2 November 95).


39. Ibid., 140.


44. Ibid.


46. Capt Mike Johnson, *Upper Atmospheric Research and Modification-Former Soviet Union* (U), DST-18205-475-92 (Foreign Aerospace Science and Technology Center, AF Intelligence Command, 24 September 1992), 3. (Secret) Information extracted is unclassified.

47. Capt Edward E. Hume, Jr., *Atmospheric and Space Environmental Research Programs in Brazil* (U) (Foreign Aerospace Science and Technology Center, AF Intelligence Command, March 1993), 12. (Secret) Information extracted is unclassified.


49. Ibid., 17A-7.

50. Ibid., 17A-10.


52. Hall.


59. Referenced in ibid.