

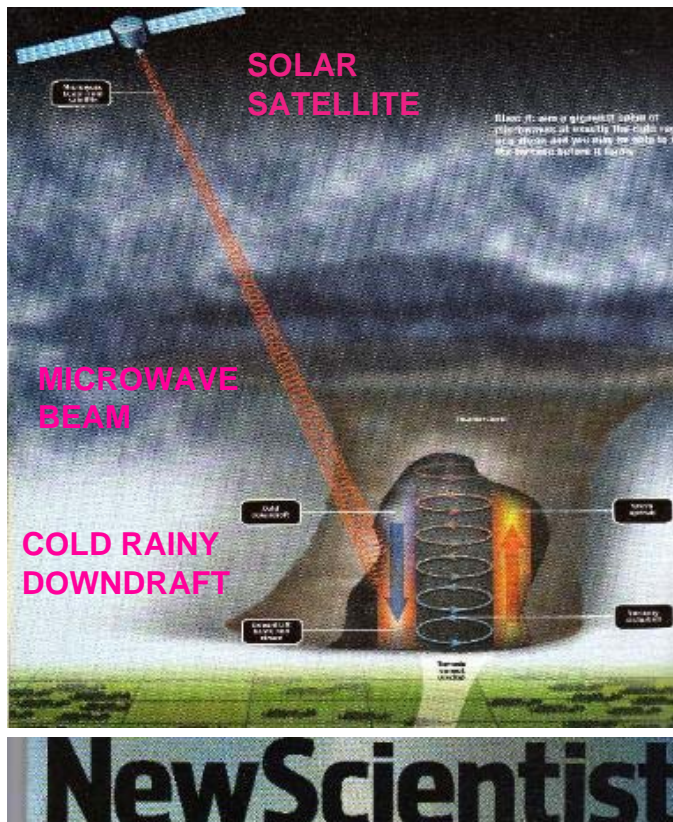
THUNDERSTORM SOLAR POWER SATELLITE- TSPS

INTRODUCTION

A [solar power satellite](#) is a concept for placing large arrays of solar cells on satellites and beaming the electrical power to earth via microwaves, and converting the microwaves to electrical power for distribution. The [Thunderstorm Solar Power Satellite](#) (TSPS) is a concept for also applying microwave power beamed from solar power satellites to heat a sensitive region of a mesocyclone and eliminate the "hook echo" that is associated with the formation of tornadoes. The hypothesis is that destabilization of the sensitive region of the storm that leads to a tornado can eliminate formation of the tornado.

NEW LAND BASED SYSTEM

A new concept for a land based system in the MidWest based on the same physics of heating a cold rainy downdraft with microwaves is described on the [TORNADOES](#) page.



GLOBAL WARMING MITIGATION WITH DUAL USE SOLAR POWER SATELLITES

THAT SUPPLY CLEAN ELECTRICAL POWER WITHOUT CO2 AND ALSO MITIGATE SEVERE WEATHER BY ELIMINATING TORNADOES AND POSSIBLY HELPING MITIGATE HURRICANES

THE EUROPEAN SPACE AGENCY
The research into this concept by Dr. Bernard Eastlund, was funded by a contract from the European Space Agency and the work was presented at the "Explospace Workshop" Space Exploration and Resource Exploitation, WPP-151, Cagliari, Sardinia, Italy, October 20-22, 1998

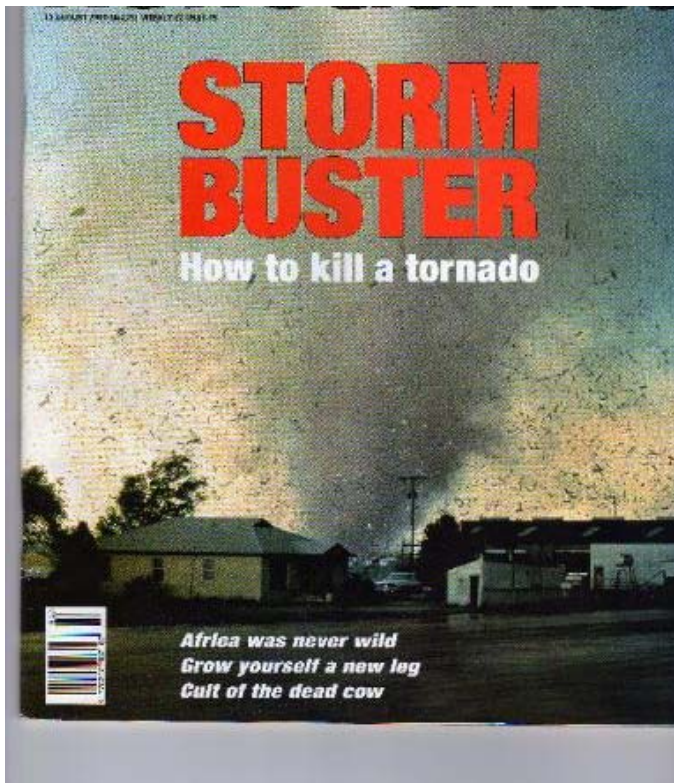
TSPS DESCRIPTION

The figure shows a cross section diagram through a mesocyclone supercell. The cold rainy downdraft is hypothesized to contain the vorticity that migrates into formation of a tornado. The concept of the [TSPS](#) is to [beam microwaves](#) from a solar power satellite into that region, heating it and destabilizing the vorticity.

This TSPS is conceived as a dual use facility that demonstrates operational parameters as well as advancing SSP technology development and demonstration. Additional satellites provide more power and capability for intervention operations.

NUMERICAL SIMULATION

Tornadogenesis is too complicated to be treated with "back of the envelope" calculations. The ESA funded use of a supercomputer based computer code, the Advanced Regional Prediction System (ARPS) at the University of Oklahoma. This code had been previously used to simulate tornado formation. It could simulate the development of a "hook echo" which is an indicator of a tornado formation region that is found using the WRS-88D Doppler weather radar. The code was modified to include heating from a microwave beam from a satellite. It is shown that the "hook echo" was made to vanish, thus indicating the possibility that tornadoes were eliminated.



CONTINUED RESEARCH

Dr. Eastlund has collaborated with Lyle Jenkins, a former NASA engineer to write a series of papers published by the IEEE describing the systems, engineering and global aspects of the TSPS concept.

PROPOSAL FOR FUTURE WORK

The capability of advanced numerical simulations has improved by a factor of more than 10,000 since the TSPS paper was written. [Ming Xue](#), who helped modify the ARPS code for the TSPS ESA paper has recently published increasingly explicit simulations. We would like to team with a university of corporation to use this code or codes like it, to study the effect of microwave heating beams on mesocyclones. We would also like to team with interested individuals who would like to study the potential benefits of a dual use solar satellite. We would also like to team with individuals or institutions that would like to design a feasibility experiment utilizing the solar panels on the International Space Station as a power source to design a demonstration before the U. S. Shuttle program is terminated.

SAFETY

The ESA paper describes the system and discusses the important issues concerning safety, societal and legal that would be necessary to ensure safe development.. These concerns will continue to be important in the refinement of the concept.

This proposed system is based on combining state-of-the-art technologies of numerical weather simulation, weather diagnostics, electromagnetic generators, antenna systems, antenna control systems, satellite design, and systems control. These tools are now available to implement a new science of severe-storm intervention.

OTHER REFERENCES

CAN IT WORK?

A paper regarding the system performance requirements was presented at a joint NASA-FEMA conference to obtain peer review of the practicality of building such a system. In particular, it was important to know if components of the storm as small as 50 meters could be measured with a satellite. Comments at the conference indicated that it was possible to do this.

["MESOCYCLONE DIAGNOSTIC REQUIREMENTS FOR THUNDERSTORM SOLAR POWER SATELLITE CONCEPT"](#), Published in the Proceedings of "The Second Conference on the Applications of Remote Sensing and GIS for Disaster Management", January 19-21, 1999."