SECONDARY **ARTICLE: Controlling Hurricanes**

Aerial photo of Hurricane Ivan over the Gulf of Mexico.

A hurricane is a huge rotating storm called a tropical cyclone that forms in the Atlantic or eastern Pacific Ocean. If similar storms form in the western Pacific, they are called typhoons; if they develop in the Indian Ocean they are called cyclones. The following characteristics define a tropical cyclone:

They are tropical; they form in the ocean near the equator.
They are cyclonic; storm winds swirl around a central eye.
They are associated with low-pressure systems.
They have sustained wind speeds of 74 miles per hour or more.

Hurricanes have massive amounts of energy within their systems; the average hurricane contains energy equal to 200 times the world's electricity generating capacity, by one estimation. They also cover vast areas. When hurricanes approach populated areas, they can cause extensive devastation to buildings and human and animal life. When the latest string of hurricanes hit Florida and the Gulf of Mexico, 107 people lost their lives and at least $20 billion of insured damage was reported. It is estimated that at least $20 billion more in uninsured damage occurred.

There are three basic pieces of information that are needed in the effort to control the path and severity of a hurricane. First, the predicted path of the hurricane needs to be extremely accurate. Second, physical changes, such as air temperature, that affect the path and strength of the hurricane need to be understood. Third, ways that humans can make those physical changes happen economically need to be explored.

Hurricanes are researched in a variety of ways. Satellite images of clouds and storms provide information about the stages of hurricane formation and path direction. Aircraft or ships can enter the hurricane area to collect data or release airborne sensors that travel through the storm while transmitting data to a land based computer. Buoys can have weather stations that transmit data throughout the hurricane as well. More recently, computer simulations and models play an important role in hurricane research.

In the past, attempting to control hurricanes was not successful. In the 1960s, the plan was to seed clouds with silver iodide particles to encourage precipitation formation in the higher altitudes of the hurricane. It was assumed that greater precipitation formation would cause the eye to increase in size and therefore weaken the strength of the hurricane. The trial did not accomplish its goal in part due to the fact that there is not enough water vapor present at the higher altitudes in a hurricane.

Current research into controlling a hurricane has utilized computer simulations. By using current weather forecasting technology, in conjunction with past hurricane information, meteorologists can test the impact of changing certain variables that contribute to a hurricane's path and intensity. The variables that seem to have the most impact upon the storm are temperature and wind.

By initiating planned disturbances in the temperature or wind in and around a hurricane, meteorologists believe they can shift the path or decrease the intensity of the storm. But how can humans impact the temperature and wind around a hurricane? There are several possible options. One is to use solar powered satellites that can concentrate microwaves from the sun and direct them to specific areas in the ocean. Since water readily absorbs energy from microwaves and solar energy is abundant in space, this is a potentially viable option. Another idea is to limit the ability of the storm to accumulate water vapor, by spreading a thin film of biodegradable oil across an area of water over which the hurricane will pass. Since hurricanes are fueled by the heat released when water vapor condenses, this could decrease the energy available to the storm.

There is also a possibility of controlling hurricanes by directing jets to specific flight paths that would cause the contrails (the condensation trails left behind jet engines due to warm, moist exhaust mixing with cool, dry air) from aircraft to interact with and impact the storm.

While computer simulations are not perfect, initial tests show promise. Tested models of past hurricanes showed changes to the path and wind velocity of the storms. It appears that even small atmospheric changes have the potential to greatly decrease the amount and severity of damage done by hurricanes.

For more information about hurricanes and controlling weather, visit the National Hurricane Center, **www.nhc.noaa.gov**, and the National Oceanic Atmospheric Administration Hurricane Research Division **www.aoml.noaa.gov/hrd/**.

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