METEOROLOGY

At War With the Weather

As hurricanes batter U.S. coasts, scientists are trying to fight back, armed with everything from satellites to tiny crystals of silver iodide—By Barbara Tufty

➤ A 360,000-SQUARE-MILE "laboratory" southeast of Florida in the Atlantic Ocean is being readied for tests with this year's crop of hurricanes.

The carefully designated area was chosen because any hurricane moving through it will not be able to strike any populated area within 36 hours.

When a hurricane enters this football-shaped ocean area that lies across the Tropic of Cancer, scientists will be prepared to fly overhead and release quantities of silver iodide crystals in an effort to diffuse the storm's powerful destructive energy. When the crystals are dropped into clouds, moisture gathers on them and they may fall out as rain, or else freeze and then evaporate into cloud-free air at the edges of the hurricanes.

By seeding the hurricanes with crystals, scientists hope to reduce the difference in temperature between the interior and exterior of the storm, and thus decrease the wind intensity.

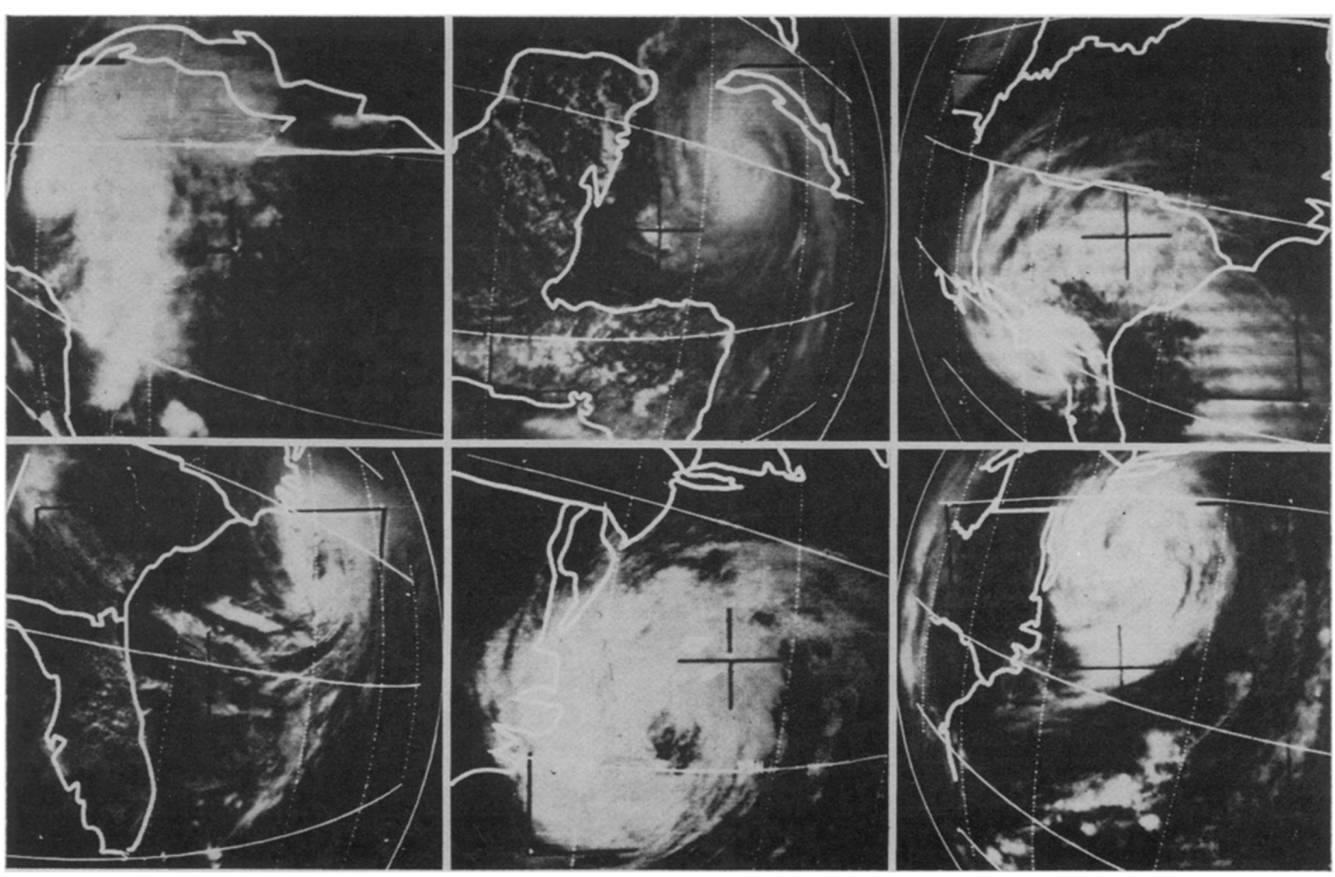
This year, from Aug. 1 to Sept. 15, men and planes of the Stormfury Program, run jointly by the U.S. Weather Bureau's Experimental Meteorological Branch and the Navy, will be on the alert for hurricanes passing through the immense Atlantic laboratory. If plans go well, iodide crystals will be dropped in two places: close to the cloud wall of the hurricane's "eye," and in the rain band clouds that lie about 75 to 100 miles from the storm center.

Equipment in follow-up planes will compile extensive data on any changes in cloud formation, temperatures, pressures and wind velocities.

Hurricanes have been seeded only twice before—the first time with Hurricane Esther in 1961 and later with Buelah in 1963. More hurricanes were not seeded because they were either in an uncertain state of development or else an unfavorable location, such as too close to land. After the 1961 seeding in particular, scientists noted definite changes in the cloud walls of the eye and apparent reduction of wind speeds.

Much more data is needed, however, to learn how to control these furious storms that rage out of the ocean at this time of year.

A hurricane is essentially a huge revolving mass of air, shaped somewhat like a doughnut spinning around its center, or "eye," as the hole of the hurricane is called. This eye is a circular area of very low pressure, vary-



ESSA

LIFE STORY OF A HURRICANE—The life cycle of Hurricane Alma, first hurricane of 1966, was photographed by weather satellite ESSA 1. Alma was born in the western Caribbean south of Cuba (top left); grew into a tropical storm and matured into a full fledged hurricane as it neared Cuba (top center). With winds up to 100 miles per hour she swept into the Florida panhandle (top right) and began to lose energy as she passed over the southeastern United States into the Atlantic (bottom left). Turning north, Alma moved up the Atlantic coast (bottom center) and finally died out after turning northeast (bottom right).

ing from a few miles in diameter to 25 and even 40 miles. It is an amazingly calm area, with gentle winds, sometimes topped with clear blue skies and filled with dazzling sunlight.

Birds and even butterflies and other insects fly in this eye, around which whirl hurricane winds at speeds of more than 150 miles an hour. Tropical storms become designated as true hurricanes only when their circular winds reach speeds of 75 miles an hour.

Huge Heat Engine

The hurricane is a huge heat engine. Its interior is warmer than the environment, with the warm core as the heat source. Air flows into this core, rises, expands, cools and sinks. As it cools, heat is released. This circulation produces kinetic energy in the form of wind. In one day, a large hurricane can release as much energy as a 13,000 megaton nuclear bomb.

The whole doughnut-shaped mass of hurricane is several miles high, and sometimes covers an area 600 miles in diameter. It moves forward at speeds of only a few miles a day when it is first starting, and later can move as fast as 100 miles a day. Hurricanes usually start to form in late June or July, and the worst storms are generated in August, September and October.

The first full-fledged hurricane of the 1966 season, Alma, hit the United States coast June 8, earlier than any other hurricane in history. Abnormally low pressures and high amounts of moisture near the Atlantic Ocean equator resulted in the creation of this early storm that spun over Cuba, slammed into the Florida coast and then blew out into the Atlantic. Hurricanes have been generated as early as January, but they blow themselves out and disappear in the sea without hitting land.

Those affecting the coast of the United States and the Caribbean islands start in the waters north of the equator in the Atlantic Ocean, the Caribbean Sea or the Gulf of Mexico.

Hurricanes are formed in other parts of the world, but they are called by different names: cyclones in the Bay of Bengal and the Indian Ocean, typhoons in the west or northern Pacific, baguios in the Philippines, and willy-willies in Australia.

As the sun's rays pour maximum heat on the tropical areas of the Northern Hemisphere at this time of year, enormous amounts of warm moist air are drawn upward from the oceans toward the sun. Gradually the heat energy is converted into rotating winds that are spun even more by the Coriolis force, an effect of the earth's rotation.

This year three series of satellites now in orbit are keeping photographic watch on the birth and path of hurricanes—the Tiros, ESSA and Nimbus satellites. Land-based, high-powered radar stations, each with a range of more than 200 miles, along the 3,000-mile stretch from Texas to Maine, are ready to pick up storm tracks as they approach land.

U.S. Navy and Air Force airplanes will track these storms and collect vital data on their shape, growth, direction, speeds and other behavior.

Already watch is underway for the next hurricane of the season, to be named in compliance with the system that uses girls' names in alphabetical order. These names are short, clearly pronounceable and easily recognized in the thousands of fast communications sent during the hurricane season.

• *Science News, 90:26 July 9, 1966*

Nature Note

Lightning

➤ BRILLIANT in beauty and frightening in power, a lightning stroke in a summer thunderstorm soars upward from earth at speeds of 80,000 miles per second. One of these spectacular lightning bolts can contain as many as 345,000 amperes of electricity—enough to light more than 100,000 homes.

Here's the way lightning works: as a huge cumulonimbus thundercloud billows several miles high in the sky like a giant cauliflower, the top of the cloud becomes positively charged, and the bottom negatively. The earth is normally negatively charged, but beneath the cloud an area of positive charge builds up. This mirror-image of the negative charged cloud above follows along under the moving cloud like a shadow, racing across fields and climbing church steeples, chimneys and other prominences that bring it nearer to the cloud.

When enough charge has been built up, a faint luminous streamer shoots downward in a series of steps, each about 150 feet long, pausing for about 50 millionths of a second between each step, and thus giving lightning the characteristic zig-zag effect. Other streamers push other channels through the charged air. Finally a streamer reaches earth, and instantly an intensely brilliant flash of lightning surges back along the path. Thus lightning is actually the return stroke, from ground to cloud, from positive to negative.

• *Science News, 90:27 July 9, 1966*

CONSERVATION

River Flows Clear Of Paper Mill Wastes

➤ WASTES from a commercial paper mill are being constantly scooped up by a large mechanical arm instead of being dumped into the nearby river.

In a $2.5 million effort to keep the Coosa River clean from what will soon be the nation's largest newsprint mill, engineers for Kimberly-Clark Corporation have put a water pollution control unit into operation at the mill in Coosa Pines, Ala.

The unit consists of a 274-foot diameter saucer-shaped basin where radial mechanical arms slowly move around to push the settled solid wastes to the center. Such basins, or clarifiers, are usually only 80 feet in diameter.

Up to 50 million gallons a day of water will be cleared and 60 tons of cellulose fiber wastes removed.

Researchers are looking for ways to reuse this waste. It cannot be dumped in the river, for it chemically takes on oxygen from the water, causing fish to die from suffocation. It cannot be used as soil fertilizer immediately, for it takes up valuable nitrogen from the soil. Only after the fibers have been left to "rot" for about 10 years, could they become useful as fertilizers.

• *Science News, 90:27 July 9, 1966*