Smog chasers flying by night

Researchers pursue plumes

By John J. Monahan
TELEGRAM & GAZETTE STAFF

WORCESTER — Hoping to unlock remaining questions about one of the costliest pollution problems in the country, federal scientists have been chasing plumes of smog during unusual night flights out of Worcester Regional Airport this week.

The flights and the multimillion-dollar national study they are part of mark one of the first times scientists have explored the chemical reaction of smog-causing pollutants at night. They are being funded by the Department of Energy and the National Oceanic and Atmospheric Administration, and performed by scientists from the Department of Energy's Pacific Northwest National Laboratory and Brookhaven National Laboratory.

The research project, which began with a series of daytime flights over the last several weeks, will end in mid-August, after a series of night flights aimed at giving scientists a better understanding of the chemical changes that take place in the soup of hydrocarbons, nitrogen oxides and particles that are emitted from cars, power

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Stephen R. Springston, a Brookhaven National Laboratory scientist, points out features of air-sampling inlets on a plane used to study the chemical reactions of pollutants at night.

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plants and industry around Boston.

Project scientist Carl Berkowitz said scientists know a lot about how air pollutants react with sun, humidity and warm temperatures to form health-threatening smog, or ozone pollution. But by taking samples of plumes of smog released around Boston as they move out to sea, over Cape Cod and the Islands at night, he said, they will produce data showing what chemical reactions occur on the other side of the ozone pollution cycle.

Mr. Berkowitz said the plan is to better quantify changes in those pollutants when there is no sunshine, and the use of the aircraft allows a close-up view of the chemical changes as they occur.

One hope is that they may find new answers to which pollution reductions might have the biggest effect in blocking formation of ozone pollution during the daytime.

Data from the project will be used to improve air pollution models used to determine air pollution regulations and what type of clean air equipment is needed at power plants and in automobiles, and to develop national anti-smog strategies.

The crew of the custom-equipped Gulfstream twin-prop aircraft and a team of four or five scientists have made several night monitoring flights so far, including a dual flight that began at 10 p.m. Tuesday and brought them back to Worcester Airport at 5 a.m.

The aircraft, packed with computers, air sampling devices, a mass spectrometer and other testing equipment, leaves little room for the scientists on board.

"It's hot and it's noisy, and we spend most of our time watching red numbers change on dials and twiddling with equipment and writing down numbers. Some people might have trouble with it, but I love it," said Stephen R. Springston, a Brookhaven National Laboratory scientist.

A typical sweep done as part of the mission begins with release of a 15-foot-diameter helium and oxygen filled tetroon, or five-sided balloon, from Nahant toward the end of the day. The balloon, which is designed to stay at a specific altitude, 700 to 1000 feet, is freed to drift along with the air pollutants from the Boston area.

A couple of hours later the scientists lift off from Worcester and chase down the balloon, which is fitted with a GPS radio transmitter, and sample the air, noting an array of changes in levels of various pollutants in the plume.

Tuesday night, after leaving at 10 p.m., the scientists caught up to the balloon south of Hyannis, and after taking a series of air samples returned to Worcester for coffee and doughnuts. Then they set out again to get a second set of samples as the balloon drifted south of Nantucket.

The air sampling, done using forward-facing exterior nozzles on the right side of the plane that lead to racks of sampling cylinders crammed inside, includes tests for five different nitrous oxide compounds, sulfur dioxide, ozone, sulfuric acid, nitric acid, ammonium nitrate and ammonium sulfate. Tests are performed from close to 500 feet to the upper levels of the smog layer, sometimes approaching 10,000 feet.

The scientists have also been able to conduct real-time comparisons of pollution levels at ground level and those high in the air, by coordinating sampling sweeps last week with the NOAA research vessel, Ron Brown, which is docked in Boston.

Mr. Springston said the chain of events from the release and combination of pollutants and reactions caused by the sun and water is a complex one, and following the plumes in an aircraft will enable the scientific team to track those changes as they occur.

"We have spent billions trying to eliminate hydrocarbon pollutants," he said, by installing catalytic converters in cars, vapor recovery systems at gasoline service stations, and costly pollution-scrubbing devices on factory and power plant smokestacks. It is hoped that continuing research to understand the way pollutants act in the atmosphere will lead to the discovery of ways to spend anti-pollution funds more effectively, he said. The research may also identify certain pollutants that generate higher smog levels so special attention may be paid to controlling those pollutants.

Mr. Berkowitz said the team has studied smog using the aircraft in many areas of the country. He said, however, that Boston was chosen because the ocean drift allows the scientists to make low flights to study pollution close to the ground, and because once the plumes move out over the ocean, no additional pollutants are added, giving them a chance to track a plume that is not changing with the addition of new pollutants, which occurs in land tests.