By James Schultz

HAMPTON — It’s a flier’s worst nightmare: an airplane headed straight into the guts of a monster thunderstorm.

But that’s exactly what a pilot will be doing in the coming days. It will be no ordinary commercial airliner, but a NASA Langley Research Center craft crammed with state-of-the-art electronics gear. The risky flight could save hundreds, perhaps thousands, of lives.

On Monday, Langley researchers will fly from Hampton to Orlando to spend two-and-a-half weeks scouring the Florida skies for the deadly phenomenon known as wind shear. Wind shear has been implicated in about two dozen aircraft crashes from 1964 through 1985, causing 500 deaths and 200 injuries.

Often — but not always — associated with thunderstorms, wind shear is caused when downdrafts of air, or “microbursts,” cascade to Earth like water rushing from a gigantic faucet. When these powerful torrents reach the ground, they spread in all directions.

If planes taking off or landing are caught in a wind shear’s downsplash, they can lose their aerodynamic lift and crash. That was the case on July 9, 1982, when a Pan Am Boeing 727 taking off from an airport at Kenner, La., outside New Orleans was ensnared by wind shear. All 145 passengers and crew were killed, along with eight people on the ground.

“That was a pretty significant event,” Langley wind shear program manager Roland L. Bowles said. “It took out two whole city blocks. It’s fortunate that more (on the ground) weren’t killed.”

A similar disaster on Aug. 2, 1985, at the Dallas-Fort Worth airport killed 113 on a Delta jetliner and a passing motorist. Incidents like these have spurred the Federal Aviation Administration to develop early-warning microburst sensors.

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NASA researchers Roland Bowles, left, and Mike Lewis will spend two- and-a-half weeks flying into storms in Florida hunting for wind shears to test new detectors for use by the airlines.

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The idea is to give pilots split-second information on wind speed, intensity and direction so they can fly out of or avoid potentially fatal encounters with wind shear.

A new generation of airport-based Doppler weather radars can also detect wind shear. Although they are scheduled to be installed at 40 of the nation's biggest airports by 1994, these systems alone won't do the trick.

Conditions in the vicinity of wind shear often change in the blink of an eye. And although microbursts range from one to four miles in diameter, they are relatively localized events. Wind shear may affect one end of a runway, for instance, but not the other. Langley researchers chose Orlando because thunderstorms in Florida are more frequent and intense than in Virginia.

While the new on-ground radars can detect microbursts once they occur, they're not foolproof. They're not good at wind shear prediction and can't warn each and every plane of impending hazards.

Because of those limitations, the Federal Aviation Administration in 1988 ordered all commercial air carriers to install wind shear warning devices on their airplanes by the end of 1993.

Two years earlier, in 1986, the FAA asked NASA to help develop new wind shear sensor technology. Langley is NASA's lead center in the project.

In Orlando, Langley scientists will wrap up a two-year flight research program designed to evaluate the effectiveness of three different sensors.

Based on the results, the FAA could certify up to three prototype systems.

The costs of installing a system is estimated at $75,000 to $100,000 - about the cost of current weather detection equipment.

Langley researchers hope to fly through about 20 microbursts. Safety is a big issue for Langley's 25-year-old Boeing 737 "flying laboratory," and the plane is inspected often.

The airplane's outer skin was recently re-riveted. Its gas tanks are routinely topped off to reduce the volume of combustible air, and the craft has also been "hardened" against lightning strikes.

The 30-person crew - three pilots, 12 wind shear researchers and 15 computer and video specialists - apparently feel safe, although stocks of air-sickness medication are usually down at the end of missions.

"There's a lot of yawning the airplane around," deputy program manager Michael S. Lewis said. "It can get pretty bumpy. Everyone definitely keeps their seat belt on."

Bowles said researchers will be poring over the results of the Langley experiments for years.

"We're working a real problem," he said. "We have good technology at the right time. We will be able to put this problem behind us.

"We will be able to minimize the risk and exposure to the threat. Airline passengers will be safer."

THE DEADLY MICROBURST

A plane flying through a microburst encounters extreme changes in wind speed and direction - first headwinds, then downdrafts, and then potentially deadly tailwinds.

FINDING DEADLY WINDS

The three microburst sensors developed and being tested by NASA Langley scientists are:

DOPPLER RADAR

Like its stationary airport cousin, this device transmits a microwave signal that bounces off raindrops. The returning signal is translated into wind speed.

Pros - Works particularly well in rain.

Cons - Falls short in picking up wind shear where rain is not present. Also, as a plane descends for landing, "ground clutter" - interfering signals from moving vehicles like trucks and cars - diminish its performance. Langley researchers are working on computer techniques to eliminate the interference.

DOPPLER LIDAR

A laser-based system - LIDAR stands for Light Detection and Ranging - this device sends out beams of concentrated light that reflect from minute particles suspended in the atmosphere. Information gleaned from movement patterns can give accurate wind speed readings.

Pros - Minimal ground clutter interference.

Cons - Doesn't perform well in heavy rain.

INFRARED RADIOMETER

A sort of glorified thermometer that measures temperature changes around an airplane. It seeks out cool air columns, which are associated with microbursts.

Pros - Cheapest and least technically complicated of all the candidates.

Cons - No moving parts means this device would last a long time. The system that doesn't directly measure wind speeds, but predicts it on the basis of other factors. It may not be reliable under all weather conditions.