Mountains loom above Alaska's Juneau airport, severely limiting departure routes and creating complex wind patterns. To take off safely, pilots typically have to execute a hairpin turn as the craft gains altitude. "It's one of the few airports where the pilots have to brief the passengers that they're going to be making a sharp 30° bank to the left and a sharp 30° bank to the right and then turn around," says Leonard.

Depending on the direction and speed of the prevailing winds, some turbulence is almost inevitable, he adds. Even veteran flier Cornman got sick to his stomach when his research craft flew in and out of the choppy air above Juneau for 2 hours.

To reduce the risk of accidents at the airport, the FAA and NCAR are attempting to develop a detection and early warning system. To measure wind speed more accurately, Cornman and Robert Barron of NCAR have set up a trio of ground-based devices known as Doppler wind profilers. These instruments gauge wind speed and turbulence, in 180-foot increments, from the ground to altitudes as high as 1.5 miles.

Scientists at Juneau are also examining a set of radar devices, normally used to detect turbulence at low altitudes in the presence of rain or snow, to test whether these instruments can also detect turbulence at higher altitudes. In addition, the team is testing a laser system to search for turbulence in clear air.

Cornman and other scientists are also working to improve long- and short-range forecasting of turbulence. To that end, they plan over the next few years to install devices on several hundred passenger planes that will automatically record and relay the severity of an encounter with turbulence. Rather than rely on subjective reports from the pilot, which may not be made until many minutes after the event, researchers will have immediate, precise data. The information will also warn other pilots of turbulent conditions and be used to refine forecast models.

At the same time, NCAR scientists are developing a fuzzy logic forecast system in which selected turbulence-related parameters are fed into a computer model. Data that work best to help predict mountain-induced turbulence, for example, will be restricted to forecasting choppy air under those conditions and might be ignored in calculating storm-related disturbances. Cornman hopes to have a version of the new model in widespread use by next winter.

"It's not hard to do a better job than what's out there," he says.

Turbulence may be scary, but encounters at cruising altitudes rarely cause serious injuries. The atmosphere provides a relatively stable platform for aircraft, says Cornman. "If you're at high altitude, there's very low probability of crashing. It would take an incredible amount of force to turn [a plane] over or put it out of control. The craft may go up and down like crazy; it does feel unstable, but if you look at the average motion, it's still zero.

"There's a continuum of turbulence encounters, from little bumps to pretty good bounces to very severe motion, where people get thrown to the ceiling, but most [encounters] are moderate," assures Cornman.

At considerably lower altitudes—below 1,000 feet—the probability that turbulence would affect the plane "to the extent that you lose control is a lot greater. There's less room to recover, and you're typically going slower at a lower altitude, so there's less lift," says Cornman.

Turbulence and wind shear at the lowest altitudes—during takeoff and landing—are much more dangerous than anything you encounter at cruising height, adds Cornman.

Oh, no. Takeoffs and landings. Something new to worry about. □

Earth Science

Seabed seismic scan shows melt zone

Most of the Earth's crust forms when partially molten rock oozes from the planet's interior, emerging at mid-ocean ridges where the sea floor is spreading. This internal process has been largely hidden from the eyes of researchers. Using seismic sensors, however, scientists now have produced detailed images of magma under an ocean ridge.

Results of the Mantle Electromagnetic and Tomography Experiment, reported in the May 22 SCIENCE, offer the first evidence that molten rock, called melt, occupies a wider and deeper area under the East Pacific Ridge than some researchers had predicted.

The seismic readings, together with data from electromagnetic sensors, will help researchers develop new models of how seabed crust forms, says Donald W. Forsyth, a geologist at Brown University in Providence, R.I. He coordinated the imaging project, one of the largest marine geophysical studies.

Researchers from seven institutions deployed 51 seismic monitors on the ocean floor traversing the East Pacific Ridge about 4,000 kilometers west of South America. For six months ending in May 1996, the detectors recorded waves from a series of earthquakes around the world. The waves tended to slow down as they passed through regions of melt, which is less dense than surrounding rock. This allowed scientists to map the melt, the seismic equivalent of medicine's CAT scan.

The imaging results suggest the melt area is as much as 600 km wide, at least 170 km deep, and skewed to the west of the ridge. The finding contrasts with theories that predicted the melt was located either in a broad but shallow horizontal plane or in a thin, vertical plane falling directly beneath the ridge. Some researchers have suggested that melt might rise from deep in the earth's mantle, but the findings tend not to support that view, Forsyth says. *—J.B.*

An ever taller Everest?

A team of American climbers last month launched an effort to measure whether the world's tallest mountain is growing higher and, if so, at what rate. Wally Berg of Copper Mountain, Colo., successfully planted a Global Positioning System (GPS) receiver within about 60 feet of Everest's summit. It recorded altitude data for 5 days until another climber retrieved it. Climbers will take a second measurement from the same spot, where Berg screwed in a metal plate, in a few years.

Using GPS measurements from other locations and conventional surveying methods, researchers have estimated that Everest is rising an average of 1 to 2 inches per year, pushed up by the collision of India's continental plate with Asia's. However, erosion of the summit may ensure that record books need not be revised, says Charles Corfield of Palo Alto, Calif., science officer for the American climbing team.

The most widely accepted estimate of Everest's height, 29,028 feet, is inexact because of the limits of traditional surveying techniques. Previous GPS readings from the summit were imprecise because the rocky peak is covered by a snowcap of unknown depth that grows and shrinks over the year.

The new data recorded near the summit are the most accurate to date because Berg activated the receiver at a rocky outcrop not covered by snow. In addition, the data were cross-checked against GPS readings at nearby, lower elevations, Corfield says.

Because they can indicate the buildup of seismic stress, the readings may help researchers predict the next earthquake in the Himalayas.

The climbing team that planted the receiver is affiliated with Bradford Washburn, a noted Himalayan cartographer and founding director of the Boston Museum of Science. *—J.B.*