How to Welcome Wireless Devices in the Friendly Skies
You’re sitting aboard a 737 awaiting takeoff when the pilot announces that the aircraft cannot go anywhere because someone’s portable electronic device is wreaking havoc with the navigational equipment. Passengers begin to check their laptops, cell phones and other electronic devices, and you’re shocked to discover that your cell phone, which you had accidentally left on, is the culprit.
Airplanes

Wave Propagation On

Measuring Electromagnetic

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use wireless computers on planes. While cell phones, wireless local area networks and

other portable electronic devices (PEDs) have improved trav-

elers' accessibility and productivity, they can also inadvert-
tently cause electromagnetic interference to aircraft

navigation and communication radio systems, thereby poten-
tially endangering all on board. According to Vahala, PEDs

may emit electromagnetic waves, with their signals detected by the various radio receiver antennas installed on the air-

plane. Electromagnetic waves, in certain frequency windows, can interfere with the GPS position detailing the plane's posi-
tion and direction, as well as its VHF system used for com-

munication.

"Phones, computers and other electronic devices must be turned off within 10,000 feet of the ground," Vahala

notes. "Antennas on top of the plane are important for take-

toff and landing and can be affected by radiation coming from those devices. Wireless cards inside a computer or per-
sontal electronic device can interfere with antennas on the plane." While cell phones cannot be used on board planes at

all, some companies in the United States and other countries are trying to find ways to install wireless computers on planes.

Measuring Electromagnetic Wave Propagation On

Airplanes

Vahala and Old Dominion electrical and computer

engineering Ph.D. students Madiha Jafri, Mennatoallah

Youssif and Genevieve Hankins have worked with NASA

Langley engineers under John Beggs to study radiation pat-
terns produced by wireless computers on board airplanes. The research conducted by Vahala and a group of Old

Dominion graduate engineering students is especially perti-
nent in an age where an increasing number of passengers

want to use wireless technologies while flying the friendly

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Random Wave Motion

The group also studied random wave propagation. “Research indicates that these waves fit some of the hot spot patterns seen in planes,” Vahala notes. “Waves bouncing back and forth off different objects have a higher intensity of electromagnetic power. There is also a higher intensity by windows where you find more waves.”

Plus, there are constant random changes within the cabin, making it an important medium for studying the effects of wave propagation. “People can affect the wave propagation as well as whatever it is they are holding. We changed the density across the rows and down the aisles so that puts a random effect into how the waves propagate.”

Vahala believes wireless radiation effects could be overcome by placing shielding made of a fine, virtually invisible mesh on a plane’s windows and insulating the doors between the cockpit and the cabin. The insulation would prevent electromagnetic waves from taking a direct path from the cabin to the pilot’s controls. The waves would then be routed outside the plane’s windows where they would lose intensity before hitting the antennas connected to the controls.

Wireless Antennas Used on European Airlines

The number and type of controls on the plane help determine the maximum number of wireless antennas that could be placed on an aircraft. No U.S. airplanes currently in operation have been fitted with wireless antennas; however, two European airlines – Lufthansa and Scandinavian Airlines System – recently began using wireless LANs to deliver Internet service to passengers. During three months of Internet testing on Lufthansa planes, researchers determined that the LAN did not interfere with this particular plane’s systems.

Financial constraints and continuing questions concerning interference with the airplane systems have kept U.S. airlines from jumping on board the wireless bandwagon, although Vahala believes that may change as more and more passengers clamor to surf the net.

“A lot of people want to use wireless computers. There’s no question of that, but we’re very safety conscious here. We want to make sure that something is not going to affect the plane’s function. In the next several years, a company may start coming out with something because wireless computers are very popular. Over the next 10 years, we expect to see more long-term solutions.”

“People have just started looking at the effects of wireless systems added to current aircraft. The airlines want models that predict things because the incidents they’ve been having with wireless computers are not very predictable.”

— Linda Vahala