Potential Liability from Electromagnetic Interference with Aircraft Systems Caused by Passengers' On-Board Use of Portable Electronic Devices

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I. INTRODUCTION

IT IS 11:00 a.m. as the crew of Flight 101 from Dallas to New York prepares for landing. The passengers on this three-hour flight use their time in a variety of ways. Some read books or magazines while others nap or talk to the person sitting next to them. Many of the passengers use laptop computers, calculators, dictaphones, or the seat-back cellular telephones to conduct business while in the air. The younger passengers entertain themselves with video games or listen to music on their portable cassette players or compact disc (CD) players. The man in seat 8J even goes to the lavatory for a quick shave using his electric razor.

The flight attendants walk the aisles to ensure that all seats are in their full upright position, that all tray tables are put away, and that the passengers’ seat belts are fastened. Anyone who has flown before is familiar with these airline mandates. Now the flight attendants have an additional directive—to prevent the use of computers, video games, CD players, or other portable electronic devices while the plane is taking off or landing. Accordingly, a crew member tells the man in the window seat in Row 2 to turn off his laptop computer. The flight attendant then walks down the aisle, not knowing that the man has ignored the attendant’s instructions. The man continues to use his computer while the plane makes its final approach, touches down, and then arrives at the gate.

The passengers who read, napped, or chatted have passed the time in ways that did not affect the operation of Flight 101. Those who used portable electronic devices, however, may have exposed the aircraft’s navigation and communication systems to potentially dangerous radio waves. The man in the second row, and as a result the airline, violated Federal Aviation Administration (FAA) regulations during one of the most critical phases of the flight.

This Comment examines the potential liability where passengers’ on-board use of portable electronic devices creates electromagnetic interference with aircraft navigation systems. After a brief description of the source of the problem, Part I reviews the anecdotal evidence and scientific studies conducted to determine whether and how such devices interfere with aircraft systems. Part II examines the current state of the law, including FAA and Federal Communications Commission (FCC) regulations, legislative history, and individual airline policies. Part III presents the existing case law on other passenger-created risks to
predict how the courts may handle airline liability where passengers are injured because: (1) one or more passengers ignore the airline’s policies; (2) the flight attendants enforce an inadequate policy; or (3) the flight attendants tell passengers to stop using their portable electronic devices, but fail to ensure that the passengers comply with their directions.

II. ELECTROMAGNETIC INTERFERENCE: THE PROBLEM AND ITS IMPLICATIONS

Concerns about electronic devices and their potential to interfere with aircraft systems date back at least to the 1950s when the commercial airline industry was in its infancy. The problem appeared settled in 1964 with the issuance of the FAA’s first formal directive permitting in-flight use of certain portable electronic devices (PEDs) and prohibiting the use of all others.\(^1\) In recent years, however, concern about possible interference has increased, along with the number of electronic devices in use during flight.\(^2\) During the 1980 presidential campaign, commercial airlines prohibited members of the press from using their laptop computers during flights between campaign stops because of concerns about electromagnetic interference (EMI).\(^3\)

Ten or fifteen years ago, few passengers, with the exception of journalists working on a deadline, routinely used such devices. As laptop computers, CD players, and a variety of other devices have become more affordable and easier to carry on-board, the devices have proliferated. The scene described in the introduction to this comment is a fairly typical description of the use of such devices in-flight.

The implications of the problem are evident. Interference with cockpit navigation systems increases the crew’s dependence on ground control to keep the plane on course. The ground


\(^3\) David Hunter, Cellular Phones & Aircraft, CELLULAR BUS., July 1991, at S12.
control crew must monitor and direct several aircraft simultaneously and must be confident that the cockpit crew will promptly and accurately follow its instructions. Interference with communication systems prevents pilots from obtaining critical information about the proximity of other airplanes or other hazards. Misdirection or miscommunication could result in injuries or fatalities, either as a result of a crash or sudden drastic maneuvers taken to avoid a crash.

Industry participants and observers agree that electronic devices emit radio waves. Their opinions diverge sharply, however, on whether the devices actually threaten cockpit system integrity and passenger safety and, if so, how the problem should be handled. The FAA, the federal agency charged with fostering and promoting civil aviation, has put the onus on airlines to study the problem and develop their own policies. While the National Transportation Safety Board (NTSB) has never addressed the subject, its investigators are examining the possible existence of EMI in connection with the fatal crash of a Boeing 737. In truth, the NTSB's interest in EMI as a cause of this crash likely stems from the complete lack of any preliminary sign as to what caused the crash.

In 1992, the Air Transport Association (ATA), a lobbying group representing most of the major airlines, asked the FAA to declare that electronic devices were a safety issue and sought a coherent, industry-wide policy. The FAA declined the invitation and has limited its participation in the debate to hiring an independent firm to conduct scientific studies of PEDs and their effect on aircraft systems. The ATA reasserted the importance of establishing an industry-wide policy in 1994. The Air Line Pilots Association recommended banning on-board use of all

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6 Id. at 3. The plane plunged 6,000 feet and crashed into the countryside. The weather was clear and there was no indication of engine trouble. All of the 127 passengers and 5 crew members died. George J. Church, Ripped From the Sky, TIME, Sept. 19, 1994, at 38.
9 Phillips, supra note 7, at 32.
PEDs until comprehensive tests are completed. At least one aircraft manufacturer publicly expressed concern that EMI is occurring, possibly as a result of on-board use of damaged PEDs.

The Cellular Telecommunications Industry Association (CTIA) asserts that cellular phones, which most airlines prohibit passengers from using at any time, have been singled out and unfairly attacked. Not content with FCC regulations and the FAA’s deliberate, slow pace on the cellular phone issue, the CTIA commissioned its own study of whether the on-ground use of cellular phones threatens aircraft avionics. Perhaps responding to CTIA complaints, the House Appropriations Transportation Subcommittee said that in its report on the fiscal 1994 Transportation Department budget bill “[it] is very upset with the FAA’s promulgation of a rule which is overly restrictive regarding the use of portable electronic devices, including cellular telephones.” The appropriations bill included a provision “which would prohibit the use of funds for the implementation, administration or enforcement of” the FAA’s only regulation on the subject.

The airlines have developed their own policies for electronic devices. Typically, passengers may not use devices such as laptop computers and CD players during take-offs and landings. A member of the House Appropriations Transportation Subcommittee declined to address whether airlines have sought to limit passengers’ use of their own portable, electronic devices in an effort to force them to use the airlines’ on-board equipment. All of the major airlines have announced plans to expand the availability of business and entertainment electronics on their

11 Boeing advises airlines not to allow any use of electronic devices during flight. Id. The recommendation by Boeing conflicts with the comments of Jim Boone, Boeing’s director of avionic/flight systems, that “[t]here is no problem” in reference to tests that Boeing conducted in response to inquiries from airlines. Corey Sandler, Terror at 66MHz, PC-COMPUTING, Oct. 1993, at 210.
12 Hunter, supra note 3, at S12. CTIA President Robert W. Maher stated that “there is no evidence to support a ban on the use of cellular phones while a plane is parked at a gate or backed up on a taxiway.” Id.
13 Id.
16 United to Prohibit Use of Portable Electronic Equipment Below 10,000 Feet, AVIATION DAILY, June 23, 1993, at 463.
planes, and some have begun to test interactive systems, albeit with limited success.

A. SCIENTIFIC BACKGROUND

Most aircraft navigation systems rely on a network of very high-frequency omnidirectional radio range (VOR) stations. The aircraft receives directional signals from ground-based VOR transmitters. Loran C is a widely used navigation system that "operates by measuring the difference in arrival times of synchronized radio signals from transmitters located hundreds of miles apart." The aircraft’s navigation computer processes the Loran C signals to provide "continuously updated, dead-reckoning navigation data."

All electronic devices, from electric shavers to hearing aids to cellular phones, emit radio frequency waves. To prevent interference, the FCC has allocated distinct bands of frequencies along the radio spectrum for specialized uses. The frequency ranges are measured in hertz. For example, VOR frequencies

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18 Julie Schmit, Just Plane Noisy, USA TODAY, Oct. 14, 1994, at 1B. GTE Airfone has introduced phones on which passengers can receive calls, not just make them. Id.

19 United Airlines also plans to install interactive passenger entertainment systems with faxes, video games, and shopping in the business-class and first-class sections of its Boeing 777s. Jennifer Lawrence, Will Interactive Fly on Planes? ADVERTISING AGE, Oct. 10, 1994, at 16. Singapore Airlines will invest $50 million to install an interactive video system from Matsushita Avionics Systems in 20 planes starting in early 1995. Id. at 18. The system will offer "movies, digital audio and videogames [sic], in-flight shopping and destination information via a video screen and handheld remote control." Id.


Northwest Airlines removed its interactive passenger entertainment systems because the system, which offered movies, video games, and shopping, was unreliable. Lawrence, supra note 18, at 16.

20 1 McGRAW-HILL, INC., ENCYCLOPEDIA OF SCIENCE & TECHNOLOGY 237-39 (7th ed. 1992). There are approximately 75,000 civil aviation users of Loran C worldwide. 10 id. at 186.

21 1 id. at 237-38.

22 Id. at 239.

23 Id. The system also aids pilots by providing course-to-steer data, distance-to-go to a selected destination, and latitude-longitude coordinates. 10 id. at 185.

begin at 108MHz, (millions of cycles per second), just above the band assigned to FM radio, and extend to 117.95MHz. While electronic devices emit most of their radio waves along the assigned band, they also generate harmonics, which are multiple emissions of the original frequency. For example, a personal computer running at 33MHz produces a primary radio frequency at 33MHz and weaker harmonic signals at 66MHz, 99MHz, and 132MHz. This phenomenon is commonly called electromagnetic interference or electronic noise, though these terms often refer more generally to the adverse effect on performance caused by unwanted voltages or currents. Airlines worry that harmonic signals could combine with other radio frequency waves to produce a signal strength equal to or approaching that of VOR frequencies used for aircraft navigation.

B. ANECDOTAL EVIDENCE

Voluntary reports by pilots are the primary source of anecdotal evidence of EMI. Information compiled by NASA’s Aviation Safety Reporting System indicates that between January 1986 and July 1993 pilots have reported 39 cases of possible interference in its database of more than 43,000 commercial flight incidents. These reports are difficult to verify because it is impossible to duplicate the original conditions with the same device, aircraft, location, radio frequency environment, and airborne systems' settings.

25 Sandler, supra note 11, at 213.
26 A harmonic is “a component of a complex vibration (note) which is a simple multiple of the frequency of the fundamental.” P. Hartmann-Petersen & J.N. Pigford, Dictionary of Science 127 (1984).
27 Sandler, supra note 11, at 213.
29 Sandler, supra note 11, at 213.
30 Id. All reports are voluntary, and reporting biases may lead pilots to attribute incidents to something other than pilot error. Electronic Devices Interfering With Cockpit Instruments, Crews Report, Aviation Daily, Feb. 11, 1993, at 237. Data gathering may improve, however, because the FAA has authorized airlines to collect and analyze data on mistakes and equipment malfunctions. Matthew L. Wald, F.A.A. Authorizes Airlines to Collect Data on Mistakes, N.Y. Times, Feb. 10, 1995, at A1. The FAA will have access to the information, but pilots and airlines will be immune from liability even if the “black box” system indicates that the airline or pilot violated FAA regulations. Id.
31 Special Comm., 156, Radio Technical Comm’n for Aeronautics, 1 Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard 5 (1988) [hereinafter Special Committee 156].
Even though unsubstantiated, some of the more recent reports have made their way into the popular press. In May 1992, a flight crew en route from Houston to New York reportedly experienced trouble with the plane's communications radio and asked the flight controllers for a different frequency. The crew switched frequencies and heard music on the new channel. The communication systems immediately returned to normal after the flight attendant asked passengers to turn off their FM radios. In February 1993, *Time* reported that a battery-powered CD player being operated in the first-class compartment had disrupted an instrument approach of a DC-10 autopilot, nearly causing the plane to crash. The cockpit crew of a wide-body jet was forced to use back-up systems right after take-off when the plane's navigational compass went berserk. On that flight, a passenger in the first-class compartment used a portable CD player during landing.

Another widely reported incident involved a plane full of football fans traveling from Denver to Newark. Apparently the aircraft's directional gyros suddenly veered far off the correct heading. The flight attendants' tour of the cabin revealed twenty-five passengers listening to a football-game on portable radios and one passenger using a laptop computer. The gyros did not return to normal until after the passengers turned off their devices, but they did so only after repeated announcements and threats of confiscation.

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52 Sandler, *supra* note 11, at 211.
53 *Id.*
54 *Id.*
55 Janice Castro, *Hazardous Music*, *Time*, Feb. 15, 1993, at 13. The article also overstated the strength of the available scientific data, claiming that "[e]xperts at NASA, the National Transportation Safety Board, and the Federal Aviation Administration have concluded that stray electronic emissions . . . can interfere with flight controls during takeoffs and landings." *Id.* (emphasis added).
56 *Time* repeated the story one week later, referring to (but not describing) "mounting evidence that ... these gadgets [cassette players, tape recorders and laptop computers] may be putting aircraft at risk." Philip Elmer-DeWitt, *Hazards Aloft*, *Time*, Feb. 22, 1993, at 61. The article also noted ominously that "[n]o planes have crashed and no lives have been lost—so far." *Id.*
57 Officials with the FAA and RTCA point out that the report has never been corroborated or substantiated. The FAA's associate administrator for regulation and certification, Anthony M. Broderick, has said "[T]here is no technical basis for what has been reported." Phillips, *supra* note 10, at H1. One RTCA official described the report in *Time* as a "bogus event." Moses, *supra* note 2.
58 Sandler, *supra* note 11, at 211.
59 *Id.*
60 *Id.*
The Malaysian Minister of Transport has announced that passengers may be required to surrender their portable electronic devices before boarding. The proposal is a response to four incidents of interference with aircraft navigation systems. In the United States, the issue arose most recently after the fatal September 8, 1994, crash of USAir Flight 427 near Pittsburgh. Investigators were baffled about what caused the crash but acknowledged that, among many other possible causes, they will investigate whether passenger-carried electronic devices may have been the culprit.

C. SCIENTIFIC STUDIES

There are few formal studies of EMI and its impact on avionics. The first study, conducted by the Radio Technical Commission for Aeronautics (now known as the RTCA) in 1963, was limited in scope, focusing primarily on AM/FM radio receivers. The report led airlines to ban the use of FM receivers at any time during flight and the FAA to promulgate Federal Aviation Regulation (FAR) section 91.19, which is essentially the same as the current regulation. Since the study was conducted, electronic devices have proliferated and aviation technology has changed dramatically. As a result, the study is of little use in assessing the risks today.

More than twenty years passed from the first RTCA study before EMI was again the subject of scientific studies. In conjunction with its development of fly-by-wire aircraft systems, Airbus Industrie’s Engineering Support Group tested portable

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40 *Id.* According to Malaysia Airlines officials, the incidents involved a cassette player, a CD player, a notebook computer, and a cellular telephone. *Id.* EMI allegedly resulted in lost flight information, navigation problems, and even a sudden, unplanned 30-degree bank. *Id.*

41 *USAir Flight 427*, *supra* note 5, at 3. When asked about the possible role of on-board electronic devices, NTSB’s investigator-in-charge stated that “[t]he seven-three is basically an old machine; it’s cable driven with hydraulics... We don’t see a major player there, but we’ll look into it; it’s not fly-by-wire or overly sophisticated by any means.” *Id.* *Time*’s report of the same crash also raised the specter of EMI as a possible cause, while acknowledging that there is no conclusive evidence that PEDs interfere with avionics. *Church*, *supra* note 6, at 39.


computers and electronic games. The company reported in 1985 that portable computers did not appear to threaten aircraft avionics even when operated in close proximity to the aircraft's antennae and cabling. The tests revealed that many other popular consumer devices—such as AM/FM radio receivers, walkie talkies, radio control units, electronic games, LEC and LCD calculators, and electric shavers—do generate emissions that exceed aviation-standard limits. These items were then tested in the cockpit of a fixed-based Airbus A310 simulator. Although program officials reported no detectable interference, they did caution that the walkie talkies and radio control units might pose a risk if they had sufficient power and were located near sensitive aircraft equipment.

The RTCA, a non-profit organization that acts as a technical advisory group for the FAA, the Department of Defense, and NASA, returned to the issue in 1983. Because of limited financial resources, the study did not include tests of all frequencies or of damaged devices. The study concluded that the probability of interference from PEDs operated on board aircraft is small and that eight unlikely conditions would have to occur simultaneously in order for EMI to result. Among other things, the PED would have to be in a "worst-case" position in the aircraft cabin, be pointed out the window, and be generating emissions within the aircraft receiver system's operational frequency band. After making a series of assumptions about the chance of a device being operated in this manner by a passenger seated at the window, and the probability of emissions strong enough to cause receiver disruption, the RTCA concluded that the chance of EMI during a typical flight is one in one million, or one incident every two years.

45 Id.
46 Id.
47 Id.
48 Id.
49 Special Committee 156, *supra* note 31, at 3.
50 Hunter, *supra* note 3, at S12.
51 Special Committee 156, *supra* note 31, at 89-90.
52 Id. at 89. In addition, objects outside the aircraft, such as the wing, would have to create a ricochet effect to maximize the EMI, and the receiver system would have to be operating at or near its minimum signal level. Id. at 90.
53 Id. at 90-91.
“Receiver disruption” of the kind measured in the RTCA’s study constitutes EMI but is far less severe than the kind of incident with which this comment is concerned. The analysis of liability in this comment is confined to incidents in which passengers suffer actual physical or emotional harm because the receiver disruption is severe enough to require sudden evasive maneuvers or, in the worst case scenario, causes a crash.

Since the RTCA is merely an advisory group, the FAA is free to adopt some, all, or none of the study’s conclusions. In addition to collecting and analyzing data, the 1988 study made several other recommendations. The RTCA noted that the diversity of PED policies implemented under current FAA guidelines may have confused some passengers about which devices are safe to use and when it is safe to use them. Thus, the RTCA recommended developing specifications for airlines to use as a guide for allowing in-flight use of portable electronic devices. The recommendation has languished, as has a proposed revision of the then-controlling FAR section 91.19. The revision would have prohibited use of PEDs during take-offs and landings when the seat belt sign is on, or whenever directed by a crew member. Several airlines have implemented such policies on their own.

An apparent increase in the number of reports of EMI led the FAA to revisit the topic a few years later. In addition, advances in aviation technology (such as a shift from metal to composite aircraft structures, fly-by-wire avionics, and smaller, potentially more vulnerable, aircraft electronics) coupled with the rapid growth and constantly changing technology of the consumer portable electronics industry made the 1988 study obsolete, prompting the FAA to investigate. The 1992 appropriations

54 Moses, supra note 2.
55 Special Committee 156, supra note 31, at 4.
56 Id. at 23. The RTCA recommended that the specifications meet the following three criteria: (1) recognition on the part of PED manufacturers that such standards are necessary; (2) specifications that reasonably assure that devices meeting the standard would not interfere with the limits and frequencies of aircraft systems; and (3) an easily visible indication of compliance with the standard such as a label or mark on the device. Id. at 23-24.
57 Id. at 96.
58 Id. at 97.
59 See infra notes 96-104 and accompanying text.
60 Bruce D. Nordwall, U.S. Probes EMI Effects of Carry-on Devices, Aviation Wk. & Space Tech., Mar. 8, 1993, at 32-33. The RTCA’s 1988 study tested neither composite construction, which has less inherent electromagnetic shielding than
bill for the Department of Transportation included funding for an update of the 1988 study. The FAA contracted with the RTCA to conduct the study, which was originally scheduled for completion in July 1994. The study had not been completed as of January 1996.

In anticipation of the RTCA study, PC-Computing magazine conducted its own tests on a variety of devices. Its study concluded that the potential for EMI does exist and is affected by the following: (1) the devices’ location in the cabin; (2) the number of devices generating exactly the same frequency that are in use at the same time; and (3) whether the devices and the avionics equipment are in proper working order. More specifically, PC-Computing’s lab study found that the use of many laptop computers at once does not pose a threat because two different devices rarely operate on exactly the same frequency.

In addition, the study described the chance of a passenger’s laptop computer causing navigational interference as “extremely slight.” This conclusion is based on a key assumption that the laptop is in the manufacturer’s original condition and the aircraft’s avionics are in proper working order. Nintendo “Gameboys” and Hewlett-Packard calculators appeared safe for in-flight use, but the study found that intentional radio frequency emitters such as cellular telephones and FM radios do pose a risk of EMI. Cellular phones, for example, produce signals 60,000 times stronger than those produced by laptop computers. When operated as an FM receiver, the Sony Walkman also produced much stronger emissions than the laptop computers—and at frequencies used by aircraft navigation.

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62 The study is comprised of three phases: (1) collection of emissions data for 30 PEDs operated in a screening room (a copper-shielded room free of outside emissions); (2) measurement of emissions by devices as they operate in the aircraft; and (3) measurement of effect on avionics in a lab simulation setting. Moses, supra note 2.
63 Sandler, supra note 11, at 210.
64 Id.
65 Id.
66 Id.
67 Id.
68 Id.
69 Id.
In summary, despite thirty years of intermittent interest in the topic, the FAA and the airline industry still cannot say with certainty whether passengers' use of video games, laptop computers, and the like threaten the integrity of aircraft navigation and communication systems. The available data indicate the possibility exists, particularly with respect to cellular telephones. But those who have studied the scientific and anecdotal evidence would likely concede that even passive emitters like CD and cassette players could cause problems if enough of them were in use simultaneously or were positioned too close to VOR receiver antennae.

None of the studies conducted over the years addressed the possibility that passengers may be using damaged or even homemade devices. While airlines carefully monitor the size of carry-on baggage and the use of seat belts, little attention is paid to the condition of electronics brought on-board. Electronics manufacturers install shielding to minimize radio noise, but an average laptop computer loses about half of its shielding within as little as two years. Humidity and poor case design can cause even faster deterioration.

III. CURRENT STATE OF THE LAW

The federal government's approach to the issue of EMI and aircraft systems has been fairly conservative. The FAA has specifically allowed a few devices to be brought on board and left it to the airlines' discretion to permit others. Similarly, the FAA has sought to maintain a low-key approach to the issue of whether EMI even exists, perhaps in an effort to avoid unduly alarming the traveling public. Cellular phones, which present a much more likely hazard than other consumer electronics, may not be used while airborne. Interestingly, the prohibition comes from

71 Id.
72 The FAA issued an advisory circular in February 1993 warning the public that portable electronic devices could cause interference but that the probability is small. FAA, *ADVISORY CIRCULAR 91.21* (Feb. 11, 1993). The FAA seeks to avoid an arbitrary ban of devices which are safe but prefers to err on the side of safety. *News: Are Consumer Products Interfering with Flight Control?* (CNN television broadcast, Feb. 18, 1993 (transcript no. 271-2).
the FCC, not the FAA, because of concerns that such use would interfere with the cellular system and users on the ground.74

Meanwhile, the transportation committees of the House and Senate appear to be at odds over whether it is appropriate to put the burden on the airlines to test devices and prove that they do not interfere with aircraft systems, or whether the FAA should take a more active role. The House appears to support the status quo and, in its version of the 1994 appropriations bill for the Department of Transportation, prohibited “the use of funds in the bill [for] implementing or enforcing regulations relating to the use of portable electronic devices on aircraft.”75 The prohibition was a response to the FAA promulgation of what the House felt was an “overly restrictive” rule regarding the use of portable devices, particularly cellular telephones.76

The Senate appears poised to require the FAA to take a more active role in testing and regulating devices, but only after completion of the RTCA’s latest study.77 The Senate Committee on Appropriations did not concur with the House’s proposed denial of funds for the implementation of the “FAA’s rule against using untested portable electronic devices on an airplane.”78 The Committee felt that the “traveling public’s safety” might be compromised if it is left to the airlines to test devices to determine whether they interfere with aircraft systems79 and recommended no further action be taken until the RTCA has completed its investigation.80

74 An airborne unit will have a transmitting range much greater than the land-based unit for which cellular systems are engineered. See 47 C.F.R. § 22.809 (1995).
76 Id. The Committee believed the FAA had provided misleading information regarding the status of 14 C.F.R. § 91.21 and had adopted provisions more restrictive than current research indicates is necessary. Id. Chairman Bob Carr noted:

This section [14 C.F.R. § 91.21] empowers the airlines to do what they are doing today. And it is our intent to focus attention that this section is not up to date, does not contain the best technical advice, was never intended to be applied to today’s situation . . . . We seek here to remove that authority to the airlines to do that.

78 Id.
79 Id.
80 Id.
A. Federal Communications Commission Regulations

The FCC's mission is to "prevent harmful interference to authorized radio communication services." Accordingly, the FCC has allocated frequencies to specific uses in an effort to prevent, for example, a CB radio transmission from interfering with television reception. To further enforce its mandate, the FCC sets maximum acceptable levels for both intentional and unintentional electromagnetic emissions and certifies equipment that satisfies the requirements. Manufacturers of digital electronics must obtain FCC certification that the devices do not exceed maximum emission levels. To meet the requirements, manufacturers usually minimize radio noise by installing shielding (normally a metallic coating inside the case). However, the shielding requirements are unrelated to use in aircraft. Rather, they are designed to prevent interference when used in home or business settings. The FCC did not act on the RTCA's call for a new, more stringent classification for radio frequency emitters that would allow the use of such devices during flight.

The only FCC regulation that addresses aviation directly states that cellular telephones carried aboard airplanes must not be operated while such aircraft are airborne. When any aircraft leaves the ground, all cellular telephones on board that aircraft must be turned off. The FCC regulation is motivated by concern that the airborne use of cellular telephones would interfere with cellular operations. The FCC is willing to allow the on-

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81 Industrial, Scientific, and Medical Equipment, 47 C.F.R. § 18.101 (1994). The FCC defines "harmful interference," as it applies to radio frequency devices, as "[a]ny emission, radiation or induction that endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radio communications service." Radio Frequency Devices, 47 C.F.R. § 15.3(m)(1994).


84 Radio Frequency Devices 47, C.F.R. § 15. This section sets out the regulations under which an intentional, unintentional, or incidental radio frequency device may be operated without an individual license. Id. It also contains the technical specifications, administrative requirements, and other conditions relating to the marketing of part 15 devices, including CB radios, televisions, and personal computers. Id.

85 SPECIAL COMMITTEE 156, supra note 31, at 1.


ground use of cellular telephones in aircraft because of the "public interest benefits" but has deferred to FAA regulations on the subject.\textsuperscript{88}

Passengers used the permanently installed phones an average of 50,000 times a day during 1993.\textsuperscript{89} Given that those phones are prohibitively expensive for at least some airline passengers, there probably is pent-up demand for cellular service on aircraft. The cellular telephone industry is anxious to secure the right for its customers to use their cellular phones while parked at the gate or during long delays prior to take-off. In 1991, the industry commissioned its own study of whether the use of cellular phones while parked at the gate during passenger loading and unloading threatens avionics.\textsuperscript{90} The study reported that "comprehensive examination of reports of portable electronic device interference with aircraft electronic systems [indicates] that many of these reports are circumstantial and unsubstantiated."\textsuperscript{91}

B. Federal Aviation Administration Regulations

The FAA's involvement in the dispute has been fairly limited. No statute or regulation requires passenger-operated devices to be interference-free when used on-board, and the FAA has not developed technical standards for determining whether devices are interference-free.\textsuperscript{92} Rather than developing detailed regulations for the use of electronic devices on board aircraft, the agency instead has prohibited the use of any device except portable voice recorders, hearing aids, heart pacemakers, and electric shavers.\textsuperscript{93} In addition, the regulation authorizes the operator of the aircraft to use its discretion in allowing the use of devices "that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft on which it is to be used."\textsuperscript{94}

The agency issued an advisory circular in February 1993 warning that computers, CD players and the like could cause interference but that the probability is small.\textsuperscript{95} Another advisory

\textsuperscript{88} Id.
\textsuperscript{89} Schmit, supra note 18, at 1B.
\textsuperscript{90} Hunter, supra note 3, at S12.
\textsuperscript{91} Id.
\textsuperscript{92} SPECIAL COMMITTEE 156, supra note 31, at 4.
\textsuperscript{93} Portable Electronic Devices, 14 C.F.R. § 91.21 (1995).
\textsuperscript{94} Id. § 91.21(b)(5).
\textsuperscript{95} F.A.A., ADVISORY CIRCULAR 91.21, supra note 72.
circular effective January 1, 1994 clarified the meaning of FAR 91.21 and recommended that the airlines prohibit the use of any intentional radiators or transmitters, including CB radios, cellular phones, and remote control devices.96

The FAA's stance on cellular phones appears to be softening somewhat since it issued FAR section 91.21, perhaps as a result of pressure from industry groups and, to a lesser extent, from the FCC. Since 1991, the FAA has been developing guidelines for passenger use of their own cellular phones. Government regulations and airline policies may eventually allow passengers to use their own phones when the plane is at the gate or during extended ground delays when the captain has specifically authorized use.97

C. INDIVIDUAL AIRLINE POLICIES

As noted previously, the airlines have developed their own approaches to EMI over the past several years and their policies continue to evolve. Though there is no industry standard, airline policies are fairly similar. American Airlines' approach is typical. The airline has divided devices into two categories: those that are prohibited at all times and those permitted for use only after the aircraft reaches an altitude of 10,000 feet.98 Devices in the first category are AM/FM or VHF radios, TV sets, TV cameras, cellular telephones, electronic toys or games with remote control, and cordless computer mouses.99 Devices in the second category are voice recorders, CD and tape cassette players, electric shavers, camcorders and video recorders, electronic games or toys without remote controls, computers, calculators, electronic typewriters with attached mouses, and global positioning system receivers.100

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96 An intentional radiator is "a device that intentionally generates and emits radio frequency (R/F) energy by radiation or induction. Radio Frequency Devices, 47 C.F.R. § 15.3(o) (1994). Incidental radiators are devices that generate RF energy when used although the device is not intentionally designed to generate or emit RF energy such as mechanical light switches. Id. § 15.3(n). Unintentional radiators are devices that intentionally generate RF energy for use within the device, or that send RF signals by conduction to associated equipment via connecting wiring, but which are not intended to emit RF energy by radiation or induction. Id. § 15.3(z).
98 AMERICAN AIRLINES, FLIGHT MANUAL § 91.21 (1994).
99 Id.
100 Id.
Since mid-1993, United Airlines has banned the use of portable electronic devices when a plane is below 10,000 feet.\textsuperscript{101} When they announced the new policy, airline officials were quick to point out that they had "not experienced any safety problems with these devices" and that the measure was purely precautionary.\textsuperscript{102} Northwest Airlines implemented a similar policy in March 1993.\textsuperscript{103} As mentioned previously, Malaysia is considering prohibiting passengers from even taking these devices on-board.\textsuperscript{104}

All major carriers impose restrictions on the use of electronic devices during takeoffs and landings, but there are no guidelines on how to implement the restrictions. Northwest Airlines wants to use an indicator light to notify passengers when the plane is below 10,000 feet so they can stop using the devices.\textsuperscript{105} Delta wants to allow use as soon as the plane is off the ground while American would prohibit use when the seatbelt sign is illuminated.\textsuperscript{106}

IV. AIRLINE LIABILITY FOR ELECTROMAGNETIC INTERFERENCE

This section begins with a brief description of the standard of care imposed on airlines and a note on the current preemption controversy. Since the issue of EMI and PEDs has never been litigated, the third part of this section examines how the courts have handled airline liability in analogous situations. For example, those situations in which it is a passenger's activity, rather than an external force such as weather, mechanical failure, or pilot error, that endangers passengers. These situations primarily include mishaps involving baggage handling and seat belts, the most common causes of passenger injury short of a crash.\textsuperscript{107}

\textsuperscript{101} United to Prohibit Use of Portable Electronic Equipment Below 10,000 Feet, supra note 16, at 463.
\textsuperscript{102} Id.
\textsuperscript{103} Id.
\textsuperscript{104} Malaysia Mulls Tough New Rules on Portable Electronic Devices, supra note 39, at 3. At present, the airline bans on-board use of six PEDs: cellular phones, pagers, CD players, remote control devices for toys, CB radios, and amateur radio transmitters. Id.
\textsuperscript{105} Phillips, supra note 10, at H6.
\textsuperscript{106} Id. at H1.
\textsuperscript{107} For example, in 1987, United Airlines received 135 reports of items falling from the overhead bins. Andrews v. United Airlines, Inc., 24 F.3d 39, 40 (9th Cir. 1994). As a result, the airline added a standard arrival announcement warning
This section also briefly discusses claims of injury caused by exposure to passengers' tobacco smoke.

A. Note on the Standard of Care

It is well settled that the special relationship between a common carrier, such as an airline, and its passengers imposes a duty on the airline to use the utmost care and diligence in protecting its passengers from harm. An airline is "responsible for any, even the slightest, negligence and [is] required to do all that human care, vigilance, and foresight reasonably can do under all the circumstances." Proof of injury to a fare-paying passenger on a common carrier and failure to safely reach the passenger's destination establishes a prima facie case of negligence. The common carrier then has the burden of showing that the incident did not occur, that it was not negligent, or that any negligence on its part was not the legal cause of the plaintiff's injury.

The airline's duty is broad but not without boundaries. An airline does not insure the safety of its passengers. Rather it "must exercise the highest degree of care consistent with the practical operation of its plane for the safety of the passengers." Common carriers have been found liable for failure to act when one passenger intentionally harms another. Common carriers generally are not liable for harm resulting from

the passengers that items stored in the overhead bins may have shifted during flight. Id.

108 A common carrier "holds itself out to the public as willing to carry all passengers for hire indiscriminately . . . either by advertising or by actually engaging in the business of carriage for hire." Arrow Aviation, Inc. v. Moore, 266 F.2d 488, 490 (8th Cir. 1959).

109 Lopez v. Southern Cal. Rapid Transit Dist., 710 P.2d 907, 915 (Cal. 1985); see also Moore, 266 F.2d at 491.


112 Id.

113 Lopez, 710 P.2d at 909.

114 Arrow Aviation, 266 F.2d at 491.

115 See, e.g., Lopez, 710 P.2d at 912-14 (bus company and driver have duty to do more than stand by while one passenger assaults another). See also Ricci v. American Airlines, 544 A.2d 428, 431 (N.J. Super. Ct. App. Div. 1988) (airline liable where it failed to protect against a foreseeable "flareup between a militant non-smoker and an intransigent smoker in [a] situation [the airline] created").
passengers' negligence unless there is evidence that the carrier failed to guard against such foreseeable negligence.

B. Note on Preemption Issues

A major controversy is brewing over whether Congress has preempted all state common law tort causes of action for wrongful air carrier conduct. Simply put, the dispute is about the viability of the saving clause of the Federal Aviation Act of 1958, the scope of the preemption provision of the Airline

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117 Brosnahan v. Western Air Lines, Inc., 892 F.2d 730, 733-34 (8th Cir. 1989) (holding that allegations of airline crew's inadequate supervision of passengers' stowing of luggage in overhead bins is a question for the jury); Rodriguez v. New Orleans Pub. Serv., Inc., 400 So. 2d 884, 887-88 (La. 1981) (holding that in a street car accident where one passenger negligently injures another, with respect to a hazard associated with the transportation of passengers, the carrier breaches its duty of care if it or its employees fail to take practicable action to prevent reasonably foreseeable injuries).


119 A savings clause is defined as a "restriction in a repealing act, which is intended to save rights, pending proceedings, penalties, etc., from the annihilation which would result from an unrestricted repeal." BLACK'S LAW DICTIONARY 1343 (6th ed. 1990).

Deregulation Act of 1978, and the interpretation of “services” as that term is used in the deregulation legislation.

The 1978 Act removed federal regulation of airline industry economics and included a preemption provision which Congress intended would prevent states from essentially undoing the deregulation achieved by the Act. Airlines regularly raise a preemption defense to defeat claims of negligence, breach of the covenant of good faith and fair dealing, and other state law claims. They contend that such lawsuits have a regulatory effect on airline conduct. Some courts have accepted the airlines’ arguments and have interpreted federal law to preempt all state common law claims relating to rates, routes, or services. Along with this reading of the statute has come a broad interpretation of “services” to include almost anything an airline does. Other courts have held that federal law neither ex-


123 Starry, supra note 118, at 660.


125 West v. Northwest Airlines, Inc., 923 F.2d 657 (9th Cir. 1990), cert. granted and judgment vacated, 504 U.S. 968 (1992), and superseded by, 995 F.2d 148 (9th Cir. 1993). West was vacated in light of Morales v. Trans World Airlines, Inc., 504 U.S. 374 (1992). The plaintiff in West sued for breach of the covenant of good faith and fair dealing after the airline denied him a seat on an overbooked flight for which he had purchased a ticket.


127 Morales, 504 U.S. at 375 (preemption of claims under Deceptive Trade Practices Act); O'Carroll, 863 F.2d at 13 (discussing preemption of state common law claims arising out of allegedly wrongful exclusion from a flight).

128 Stewart v. American Airlines, Inc., 776 F. Supp. 1194, 1197 (S.D. Tex. 1991) ("those cases which have held that a [p]laintiff’s claims were . . . [related] to ‘services’ and therefore pre-empted . . . all involved services provided by individual airline employees directly to passengers, such as ticketing, boarding, in-flight service, and the like").
pressly nor impliedly preempts common law claims.\textsuperscript{129} For the purposes of this Comment, the author assumes that the latter view will prevail and that federal law does not preempt state common law claim for injuries resulting from passengers’ on-board use of personal electronic devices.

C. AIRLINE LIABILITY FOR INJURIES CAUSED BY ELECTROMAGNETIC INTERFERENCE

When passengers use portable electronic devices, they expose everyone on the plane to risk, assuming that electromagnetic interference (EMI) is a real threat which appears to be the case with cellular phones. This section will extend the analysis of baggage, seat belt, and smoking injuries to PEDs and EMI and examine an airline’s liability for injuries sustained in three scenarios: (1) one or more passengers negligently fail to follow the airline’s policy on the use of PEDs, (2) the airline’s policy is inadequate and allows the use of PEDs that interfere with aircraft systems, and (3) flight attendants instruct passengers to stop using their PEDs but fail to ensure that the passengers comply.

1. Where the Passengers Negligently Fail to Follow the Airline’s Policy

From the moment passengers enter the airport terminal, they are subject to a wide variety of regulations governing their conduct.\textsuperscript{130} They cannot smoke, and jokes about guns at the security check may result in a baggage search.\textsuperscript{131} Once on the plane, passengers must remain seated during take-offs and landings and any other time the captain deems it necessary.\textsuperscript{132} Before take-off, the flight attendants make the standard safety presentation, covering everything from how to fasten a seat belt to how to use the

\textsuperscript{129} Cleveland v. Piper Aircraft Corp., 985 F.2d 1438, 1444-45 (10th Cir.), cert. denied, 114 S. Ct. 291 (1993) (holding that no preemption of claim of negligent aircraft design where design met all FAA standards); Ravreby v. United Airlines, Inc., 293 N.W.2d 260, 263 (Iowa 1980) (no preemption of claim for harm and discomfort suffered as a result of smoking by fellow passengers); Kiefer v. Continental Airlines, Inc., 882 S.W.2d 496, 503 (Tex. App.—Houston [1st Dist.] 1994, writ granted) (no preemption of state laws merely having an effect on airline services, e.g., of a duty of good faith and fair dealing imposed on all persons entering into contracts).

\textsuperscript{130} See AMERICAN AIRLINES, FLIGHT MANUAL § 91 (1994).

\textsuperscript{131} Id.

\textsuperscript{132} Id.
A seat cushion as a flotation device. A survey of the passengers during this routine reveals that few passengers actually listen. Most have already heard this information. Besides, passengers believe that the chances of a plane crash are minimal. Perhaps it is not surprising that this nonchalant attitude often extends to the use of portable electronic devices. In their defense, passengers may not be disobeying the rules intentionally. Airlines have different PED policies and they implement them in different ways. Confusion about when and what devices are acceptable is understandable. In addition, passengers simply may not realize that many airlines have added restrictions on portable electronic devices to their standard safety speech.

The standard safety announcement also includes warnings about the danger of falling luggage. One passenger’s carelessness in storing or retrieving luggage in the overhead compartment is a common cause of harm to other passengers. In the typical scenario, passengers who are anxious to avoid delays at the baggage carousel bring luggage onto the plane and store it in the overhead bins. As the plane fills up with passengers, overhead and under-seat space becomes scarcer. The flight attendant then comes along to help passengers stow every last briefcase, suitcase, and garment bag in the remaining space. The trip proceeds uneventfully until the plane arrives at the gate and passengers and flight attendants begin retrieving luggage from the overhead bins. The unfortunate person sitting in the aisle or center seat may then be injured by falling luggage. The injured passenger may sue not only the person who dropped the luggage, but the airline as well.

In the above scenario, courts naturally have examined the flight attendants’ role in the chain of events. Did a flight attendant stow or retrieve the luggage? Did the flight attendant supervise the passengers’ stowing and retrieval of baggage? Was the “Fasten Seat Belt” sign on when the passenger removed or stored the luggage? If so, did the attendant warn the offending passenger to remain seated? What other safety announcements did the flight crew make regarding the overhead bins?

133 Id.

134 For example, when asked if she had heard the flight attendant’s warning to use care in removing items from the overhead bin, one passenger stated, “I really wasn’t paying any attention to what they were saying about the overheads . . . . They may have said it. They may have not. I really don’t remember.” Bravis v. Dunbar, 449 S.E.2d 495, 497 n.4 (S.C. Ct. App. 1994) (ellipsis in original).

135 See supra notes 98-103 and accompanying text.
In cases where a passenger both stores and removes the luggage from the bin, the airline may avoid liability by making the standard safety announcements. These announcements include warning passengers to remain seated until the plane is at the gate, reminding passengers that luggage in the bins may have shifted during flight, and advising the passengers to take caution when opening the bins. The airline may successfully avoid liability by making such warnings and by quickly stopping passengers who ignore the "Fasten Seat Belt" sign and begin to remove their bags while the plane is still taxiing to the gate.

*Rodriguez Pardo v. Delta Airlines, Inc.* is typical in its handling of a passenger's claim of injury caused by another passenger's negligence. In *Rodriguez Pardo*, the plaintiff was injured when a camera case fell on her as another passenger removed it from the bin. The pilot had instructed all passengers to remain seated by illuminating the seat belt sign, and there was no evidence that the flight attendant had enough time to warn the offending passenger to sit down before the incident occurred. The court granted summary judgment for the airline because the plaintiff had "completely fail[ed] to establish any negligence of the defendant."137

Similarly, in *Haley v. United Airlines, Inc.*, the plaintiff was injured when another passenger, Ronald Weems, opened the overhead compartment and dropped a briefcase on her head. The court granted summary judgment for the airline because its employees had warned passengers to remain seated until the plane had arrived at the gate.139 Moreover, flight attendants immediately attempted to intercept Weems when he got out of his seat while the plane was still taxiing.

Even in cases where a passenger stores and removes the luggage but does not violate airline policies, such as retrieving luggage while the seat belt light is on, the airline may not be relieved of liability. A court may still find an airline negligent for failure to supervise the boarding process or for failing to do more than simply warn passengers about the possibility of shifting baggage.

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137 Id. at 29.
139 Id. at 376-77.
In *Brosnahan v. Western Air Lines, Inc.*, a fellow passenger injured the plaintiff when he dropped his carry-on bag on the plaintiff's head while struggling to stow the bag in the overhead compartment. The plaintiff established at trial that a flight attendant should have been, but was not, at the "bulkhead" to assist passengers with carry-on luggage. The Eighth Circuit held that "[a]n airline's duty to supervise the boarding process for the protection of its passengers continues until boarding is completed, and the danger created by an airline's breach of that duty does not abate until all passengers are seated with their carry-on luggage properly stowed." The appellate court ordered the district court to reinstate the jury's verdict for the plaintiff, holding that a jury could reasonably conclude that the harm was both a foreseeable and probable consequence of the attendants' failure to supervise the passengers as they stowed their luggage in the bins. Given that one of the reasons flight attendants are stationed throughout the cabin is to protect the safety of the passengers, the flight attendants' absence in the bulkhead could be a "substantial factor" in causing the plaintiff's injuries.

Failure to specifically warn the passengers about the risk of falling luggage will very likely lead to defeat for the airline. In *Schwamb v. Delta Air Lines, Inc.*, flight attendants directed the passengers to ensure that all items were stowed either above or below the seats and to call for assistance in stowing their luggage if necessary. The jury found that the announcement did not adequately guard against passengers' foreseeable negligence in stowing and removing items. The appellate court upheld the finding of Delta's sole liability and awarded the plaintiff $885,000 in damages.

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140 892 F.2d 730 (8th Cir. 1989).
141  Id. at 732 (the bulkhead is the wall dividing the first class cabin from the coach cabin).
142  Id. at 733.
143  Id. at 734.
144  Id.
145  516 So. 2d 452 (La. Ct. App. 1987) (describing the cause of plaintiff's injury as a falling briefcase from an overhead bin).
146  Id. at 462-63 (describing Delta policies which did not require flight attendants to check inside the bins or open those that were already closed and not requiring crew members to redistribute the luggage if the passengers had over-stuffed or improperly loaded a bin).
147  Id. at 468. The final award represented a $100,000 decrease in the general damages that the jury had awarded. Id.
In *Andrews v. United Airlines, Inc.*, the court acknowledged that the facts were unclear concerning who had stored the falling briefcase, what caused it to fall, or who had opened the bin. The plaintiff's only claim was that her injury was foreseeable and the airline did not prevent it. United Airlines follows standard industry practice and warns its passengers to be cautious when opening the overhead bins at the end of the flight. Instead of relieving the airline of liability, the standard warning was evidence that objects falling out of overhead bins endanger the passengers, and the defendant was aware of the danger. The court deemed summary judgment inappropriate because a jury could have reasonably concluded that United Airlines had a duty to do more than warn passengers about the possibility of falling baggage.

The *Brosnahan* Court's broad formulation of an airline's duty to supervise its passengers' activities and the *Andrews* and Schwamb courts' reluctance to rely on standard industry practice as evidence of the appropriate standard of care appear likely to lead to a finding of airline liability in most of these baggage cases. As will be discussed later, the flight attendants' direct involvement in stowing or retrieving the baggage may lead to airline liability. Under the *Andrews* and *Brosnahan* analyses, the flight attendants' lack of involvement in the process leads to the same result, despite the intervening negligence of a third party (the passenger retrieving or stowing the luggage). Foreseeability is the key to the analysis. Flight attendants are aware of the hazard, and many major airlines have been involved in litigation resulting from such incidents. As the *Andrews* court noted, even

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148 24 F.3d 39 (9th Cir. 1994).
149 Id. at 40.
150 Id.
151 Id. at 40-41.
152 Id. at 41.
153 Id. at 42. The plaintiff argued that the airline could have reduced the risk of falling luggage by retro-fitting overhead bins with netting. Id. at 41. The *Schwamb* court noted several readily available steps to minimize the risk of injuries caused by falling luggage: pre-boarding instructions about how to load the bins; pre-boarding inspection of the weight and volume of all carry-on baggage; announcements before landing and while taxiing concerning the removal of luggage; and, safety cards with illustrations of proper loading techniques. Schwamb, 516 So. 2d at 463.
154 See, e.g., id. at 462-463 (indicating flight attendants were aware that passengers sometimes overstuff the overhead bins, had witnessed or heard about incidents of falling luggage, and had read company publications reporting an increase in the number of such incidents).
an event that is statistically insignificant may still be considered foreseeable for the purposes of determining liability. As part of its defense, United Airlines pointed out that the 135 reports of falling baggage included incidents in which no one was injured and were spread over millions of passengers traveling on its 175,000 flights every year.

The results in Andrews and Brosnahan do not bode well for an airline defending itself from an EMI claim. First, the standard of care would almost certainly include a duty to limit the passengers' use of PEDs during take-offs and landings. The major airlines have already implemented such policies so one could argue that it is standard industry practice. Andrews indicates that industry practice sets the minimum, not the maximum, safety level. Second, the involvement of the flight attendants in monitoring the boarding process and informing the passengers about safety precautions increases the crew's presumed awareness of the passengers' activities. Third, passengers' confusion about in-flight use of PEDs and passenger tendency to ignore standard safety warnings create an environment in which use of PEDs in violation of airline policy is reasonably foreseeable. Thus, the crew's failure to ensure that all passengers have stopped using their portable electronic devices during take-off and landing would breach the standard of care.

Of course, the plaintiff must also show that the airline's negligence in monitoring the passengers' use of PEDs proximately caused the plaintiff's injuries by interfering with the aircraft systems. This causation requirement could be very difficult to show. Assuming there was actual physical harm, because of a crash or sudden change in altitude, the plaintiff would probably need direct evidence, such as eyewitness accounts, to establish that one or more passengers used PEDs during the flight. The next step would be the presentation of persuasive scientific data indicating that a PED in use on the flight caused the EMI, which in turn caused the crash or other harmful incident.

The airline could attack the lengthy chain of causation at several points. At the threshold, the airline might argue that the airline is not liable for the negligence of a third party. For

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155 Andrews, 24 F.3d at 41.
156 Id.
157 See, e.g., Baker v. Delta Airlines, Inc., No. 03A01-9312-CV-00431, 1994 WL 283858 (Tenn. Ct. App. June 28, 1994) (falling luggage case in which the defendant argued the proximate cause of the accident and the plaintiff's injuries was the negligent act or omission of someone for whom the airline was not responsible).
example, airlines are not negligent solely because they allow luggage to be stored overhead. Extending this logic to PEDs, one might argue that airlines are not negligent simply because they allow passengers to bring CD players, computers, and other portable electronic devices onto the plane. Such an argument seems likely to fail, however, even under a Rodriguez Pardo or Haley analysis. Those cases indicate that flight attendants must stop passengers from flouting safety precautions when they become aware of the passengers' misconduct. Neither case indicates any lessening of the crew's duty to supervise the passengers' activities during the flight. The defendants prevailed primarily because the flight attendant attempted to stop the offending passenger where there was time to do so. In an EMI case, an attack on the scientific data and anecdotal evidence, which are far from conclusive, is probably the better strategy for the airlines.

2. Where the Airline's Policy is Inadequate

Current airline policies allowing in-flight use of PEDs assume that all of the devices brought on board are in good condition and emit radio waves at standard levels. The policies also assume that the risk of EMI is limited to take-offs and landings. Airline policies do not adequately address passengers' use of damaged or home-made devices or other devices that emit unusually high levels of radio emissions. The flight crew has little time to inspect the devices and no way to screen their emissions levels. Further, the existing scientific data only relates to devices that are in proper working order. Harmful EMI could result, despite passengers' full compliance with airline policies.

The seat belt and smoking cases are illustrative. In the seat belt cases, passengers sue the airline after being injured during turbulence while the "Fasten Seat Belt" sign is off. FAA regulations allow the pilot to use discretion as to when the sign may

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159 Haley, 728 F. Supp. at 376; Rodriguez Pardo, 767 F. Supp. at 28.
160 Id.; Haley, 728 F. Supp. at 376.
161 The case law which discusses smoking on airplanes may have reached its full development now that passengers may not smoke on any commercial domestic airline flight. Delta Air Lines became the first major airline to ban smoking on all flights, domestic and international. Delta in Line to Be First to Ban Smoking on All of Its Flights, L.A. TIMES, Nov. 15, 1994, at D2.
safely be turned off. The smoking cases arise when non-smokers are injured by exposure to other passengers' tobacco smoke. In both scenarios the airline and the passenger comply with FAA regulations, but the airline may still be found liable for in-flight injuries.

In seat belt cases, numerous courts have held the airline liable for the pilot's failure to illuminate the seat belt light under circumstances where the pilot knew or should have known that the flight might encounter dangerous turbulence. This is particularly true when flying in bad weather. Once the flight encounters turbulence, the crew's responsibility to ensure that passengers comply with the seat belt policies becomes even greater. Illuminating the seat belt sign is critical, and flight attendants must immediately warn passengers who ignore the warning to return to their seats.

Instances of injuries sustained during "clear air turbulence" are less straightforward. Older cases indicate that the advanced meteorological equipment available to pilots and air traffic controllers increases their duty to predict turbulent conditions even in good weather. The pilot will be charged with knowledge of geographical hazards, such as irregular terrain with deep canyons and high mountain peaks, and changing weather patterns, such as a low pressure area or an advancing cold front which increase the chances of violent "clear air turbulence."

Airlines have achieved a higher success rate in more recent litigation involving sudden clear air turbulence. Defendants
have successfully argued that the very suddenness of such turbulence made it impossible or impracticable to prevent all injuries. This success seems at odds with the standard of foreseeability that courts apply in the overhead bin cases. Encountering turbulence would seem to be at least as reasonably foreseeable as an item falling from the overhead bin and, as previously discussed, even statistically improbable events can still be considered foreseeable. Yet, in recent clear air turbulence cases, plaintiffs who suffered injuries after the pilot had turned off the seat belt sign did not prevail. The dichotomy is striking given that in both the falling luggage and turbulence scenarios, one could argue that an inadequate policy led to the passenger’s injury. For example, a jury might reasonably conclude that since clear air turbulence is difficult to predict and can cause serious injuries, the pilot should keep the seat belt sign illuminated at all times. Passengers would then have to obtain permission from the flight attendant to make a trip to the lavatory or get something out of the overhead bin. The burden of such a policy might well outweigh its benefits. Passengers might feel like prisoners, and the flight attendants might spend an inordinate amount of time on each flight responding to ringing call buttons. In any event, courts and juries have found that standard industry practice and the pilot’s discretion in turning on the seat belt sign adequately safeguard against clear air turbulence mishaps.

If a flight attendant authorizes a passenger to leave her seat during a momentary calm, the airline may be liable for ensuing injuries. This scenario is analogous to a flight attendant’s grant of a passenger’s request to use a PED after the navigation systems have exhibited signs of EMI problems. Thus, communication between the pilot and the flight attendants is critical. The

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171 See supra notes 126-50 and accompanying text.
172 Andrews, 24 F.3d at 41.
173 The standard safety announcement typically includes a suggestion that passengers leave their seat belts fastened even after the pilot has turned off the “Fasten Seat Belt” sign. See AMERICAN AIRLINES, FLIGHT MANUAL (1994).
174 Urban, 139 F. Supp. at 290.
pilot should be aware that PEDs may affect navigation and communication systems. If the pilot notices irregularities in the systems' performance, he should ask the flight attendants to ascertain the number and kind of devices in use in the flight cabin and then instruct the passengers to turn off their PEDs.\footnote{175}

In {	extit{Powell v. Dell-Air Aviation, Inc.}},\footnote{176} the plaintiff's loosely fastened seat belt provided little protection from unexpected turbulence that catapulted her out of her seat. The court noted that, as is customary, the flight attendant had visually checked to see if passengers had fastened their belts.\footnote{177} The flight attendant, however, did not "yank" on the belt to see how tightly it was fastened.\footnote{178} The jury found that the visual inspection satisfied the airline's duty of utmost care.\footnote{179} The result in Powell may have turned on the fact that the pilot had illuminated the "Fasten Seat Belt" sign. In the early seat belt cases noted above (those litigated between 1950 and 1965), the pilot had turned off the sign.

Extending Powell's analysis to PEDs and EMI, one might conclude that the flight crew would not be expected to evaluate whether a device is home-made, damaged, or generating unusually high emissions. Rather, checking to ensure that all devices were turned off during take-off and landing would satisfy the duty of utmost care. A visual check may be inadequate because as the RTCA's 1988 study noted, not all PEDs have "obvious means of ensuring that the device is actually turned off."\footnote{180} The comparison is further strained by the fact that a loosely fastened seat belt would generally endanger only one person, whereas a malfunctioning PED would endanger the entire aircraft. It seems reasonable to assume, however, that the airline's duty to safely transport one passenger is no different from its duty to safely carry all of the passengers.

Once the plaintiff has cleared the causation hurdle and shown that another passenger's PED interfered with the avionics which resulted in some harmful event, the law will impute a

\noalign{\bigskip}175 The RTCA further advises the flight crew to: (1) confirm that the suspected device is causing interference by turning it on and off several times; (2) note the aircraft system and the radio frequency experiencing interference; and (3) note the severity of the interference. \textit{Special Committee} 156, \textit{supra} note 31, at 98.
\noalign{\bigskip}176 74 Cal. Rptr. 3 (Cal. Ct. App. 1968).
\noalign{\bigskip}177 \textit{Id.} at 5.
\noalign{\bigskip}178 \textit{Id.}
\noalign{\bigskip}179 \textit{Id.} at 6.
\noalign{\bigskip}180 \textit{Special Committee} 156, \textit{supra} note 31, at 4.
great deal of knowledge to the airline. An airline probably would be assumed to know that PEDs emit varying levels of radio waves and that some are hazardous even when the plane is at cruising altitude.

In *Ravreby v. United Airlines, Inc.* the plaintiff, a non-smoking passenger seated one row in front of the smoking section, sued for damages caused by exposure to another passenger's tobacco smoke. In applying the standard of care, the court used a two-part analysis: (1) whether a reasonable fact finder could conclude that United Airlines could reasonably have anticipated the danger that a non-smoker would become ill; and (2) whether a reasonable fact finder could conclude that United's policy guarded against the danger.

The court quickly concluded that United Airlines could have reasonably anticipated that non-smokers would be irritated or injured by exposure to second-hand tobacco smoke. Airlines must take reasonable notice of the habits of their passengers, and should expect some of its passengers to smoke, if airline regulations permit it. Further, it is common knowledge that many non-smokers find tobacco smoke highly bothersome, which led the CAB to adopt regulations segregating smoking and non-smoking seats. As previously discussed, on-board use of PEDs is common and could be considered a "habit" under this analysis.

The second prong of *Ravreby*’s two-prong test required a more detailed treatment. In evaluating the airline’s policy, the court balanced (1) the remoteness of the danger to the plaintiff; (2) the airline’s duty to preserve the comfort of all its passengers; and (3) the discretion inherent in the federal regulations governing designation of non-smoking seats. First, the court concluded that the air circulation in aircraft cabins minimizes the risk of exposure to secondhand smoke in the non-smoking section, thus making the irritation of non-smokers a remote danger. Second, the alternative to banning smoking entirely would subject smoking passengers to "severe discomfort." The air-

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181 293 N.W.2d 260 (Iowa 1980).
182 *Id.* at 264.
183 *Id.*
184 *Id.*
185 *Id.* (citing 38 Fed. Reg. 12209 (1973)).
186 *Ravreby*, 293 N.W.2d at 265.
187 *Id.*
188 *Id.* (quoting 38 Fed. Reg. 12209 (1973)).
line’s designation of smoking and non-smoking seats was a reasonable compromise to preserve the comfort of all passengers. Third, United Airlines used proper discretion and fully complied with the CAB regulations intending to give airlines flexibility in designating the smoking section. After evaluating all three factors, the court concluded that United had not breached its duty of care to Dr. Ravreby.

Another smoking case with a somewhat different factual setting resulted in a very different conclusion. In *Ricci v. American Airlines* the defendant overbooked the flight and in accordance with FAA regulations assigned a non-smoker to a seat in the smoking section. A physical and verbal altercation erupted between the non-smoking passenger and the plaintiff, who was smoking his second cigarette of the flight. In both *Ravreby* and *Ricci*, the airline and the plaintiff had complied with federal regulations. The *Ricci* court held that the airline’s policy did not adequately protect against a foreseeable “flareup between a militant nonsmoker and an intransigent smoker in the situation [the airline] created,” and did not include “appropriate safeguards to prevent it.”

Applying *Ravreby*’s three factors to EMI indicates the airline would probably be held liable for the resulting injuries. First, while perhaps statistically unlikely, the danger of EMI would probably not be considered “remote,” given the anecdotal and

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189 *Id.*
190 *Id.* (quoting 38 Fed. Reg. 12210 (1973)) (stating that the airline could designate the seats “in such a manner as to minimize, to the greatest practicable extent, points of contact between smokers and non-smokers”).
191 *Ravreby*, 293 N.W.2d at 266. The court also rejected Dr. Ravreby’s claim that United had breached its duty to protect passengers from the harmful or offensive conduct of fellow passengers, noting that the airline had taken “reasonably appropriate steps to minimize likely harm.” *Id.*
193 The non-smoker first asked the plaintiff to refrain from smoking. The plaintiff refused but did agree to sit facing the aisle to limit his seatmate’s exposure to secondhand smoke. The non-smoker grabbed the cigarette out of the plaintiff’s mouth and a scuffle ensued.
194 544 A.2d at 431 (emphasis added). In applying a standard of reasonable foreseeability, the court held that “American knew or should have known that overbooking, switched seats and the separation of parties, in themselves, are anxiety producing situations which could well have exacerbated ordinary tensions.” *Id.* As long as the defendant’s conduct was a substantial factor in bringing about the injury, and the airline knew or should have known that some injury might occur, its ignorance about any particular passenger’s propensities for violence or other unacceptable behavior was irrelevant. *Id.*
scientific evidence. The issue is one of concern in both the trade and popular media and airlines are well aware of it. The true nature and measure of the risk of EMI is unknown. The potentially catastrophic harm that EMI could cause might tend to outweigh its statistical remoteness and tip the balance in favor of a duty to eliminate—not just minimize—the risk by prohibiting the use of PEDs at any time during the flight.

Second, the airlines' PED policies undoubtedly inconvenience some passengers, though they are actually only losing a few minutes of computing time. When given a choice between a safe flight or maximum productivity, presumably even the most driven executive would turn off the laptop.

Third, like the flexible smoking regulations at issue in Ravreby, FAR section 91.21 gives airlines discretion to allow passenger use of personal electronic devices. FAR section 91.21 also requires the airline or pilot to determine that a particular device will not cause EMI. This determination should be based on something more than conjecture. Airlines would probably bear the risk of an erroneous conclusion, given the high standard of care that applies to common carriers. Further, the Ravreby court noted that the smoking regulations did not purport to eliminate all contact between smoking and non-smoking passengers. By contrast, FAR section 91.21 does not appear to contemplate an acceptable level of EMI. Looking at all three factors together indicates an airline's claim of complete compliance with all applicable FAA regulations would not be enough to alleviate liability.

A Ricci approach might yield a similar finding of airline liability but for different reasons. There, the court emphasized the airline's role in exacerbating the ordinary tensions of its passengers. An EMI plaintiff might argue that airline advertising which targets business passengers with promises of a flying office creates an environment encouraging passengers to use laptop computers or cellular phones throughout the flight. Airlines, however, may point to limits on PEDs during take-offs and

195 See supra notes 30-42 and accompanying text.
196 Id.
198 Ravreby, 293 N.W.2d at 265.
199 Portable Electronic Devices, 14 C.F.R. § 91.21(b)(5) (regulation does not qualify the term "interference").
200 Ricci, 544 A.2d at 431.
201 See supra note 18 and accompanying text.
landings as evidence that their primary goal is to ensure flight safety, not the maximum business productivity of their passengers. Such an argument seems unavailing given that foreseeability is a key component in determining airline liability.

3. Where Flight Attendants Instruct Passengers to Stop Using Their PEDs but Fail to Ensure Passenger Compliance

A passenger's failure to turn off a PED after being directed to do so raises some of the same issues discussed previously in the analysis of the overhead bin cases. In both scenarios, one passenger's foreseeable negligence results in injury to another. In several of the falling baggage suits, however (Andrews, Haley, Rodríguez Pardo, Schwamb, and Brosnahan), the flight attendants were not directly involved in the respective incidents. Despite the attendants' lack of direct involvement, in three of the five cases the plaintiff either won a jury verdict or survived the defendant's motion for summary judgment.

Once a flight attendant does more than make standard safety announcements regarding a harmful event, a finding of liability appears to be unavoidable. For example, in USAir, Inc. v. United States Department of the Navy a passenger had carelessly stowed his briefcase in the overhead bin without any assistance from the flight crew. He knew the briefcase was unstable when he closed the bin. A flight attendant later opened the bin, and the briefcase fell on another passenger. The only evidence of negligence on the part of the flight attendant was testimony that she was not looking at the bin when she opened it. The court of appeals held that "the flight attendant's actions

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202 Andrews v. United Airlines, Inc., 24 F.3d 39, 42 (9th Cir. 1994) (reversed summary judgment for defendant); Brosnahan v. Western Air Lines, Inc., 892 F.2d 730, 734 (8th Cir. 1989) (reinstatement of jury verdict for plaintiff after district court's grant of judgment notwithstanding the verdict); Schwamb v. Delta Air Lines, 516 So. 2d 452, 468 (La. Ct. App. 1987) (affirmed jury award for plaintiff), writ denied, 520 So. 2d 750 (Ky. 1988). In the remaining two cases, Haley v. United Airlines, Inc., 728 F. Supp. 374 (D. Md. 1989), and Rodríguez Pardo v. Delta Airlines, Inc., 767 F. Supp. 26 (D.P.R. 1991), the plaintiffs could not overcome the defendants' evidence that the flight attendant acted to prevent the harmful acts of another passenger, if there was time to do so.

203 14 F.3d 1410 (9th Cir. 1994).

204 The passenger who placed the briefcase in the bin was a civilian employee of the U.S. Department of the Navy traveling in the course of his employment. The plaintiff and his wife sued USAir in state court. The jury found USAir liable, and the airline settled for $550,000. USAir then sued the Navy for indemnity under the Federal Tort Claims Act. Id. at 1411-12.

205 Id. at 1411.
breached the common carrier's duty of utmost care."\textsuperscript{206} Actually, the result could have been even worse for the airline. The district court found that the flight attendant's actions were a superseding cause of the plaintiff's injuries and completely relieved the third party passenger of liability for his careless storing of the briefcase.\textsuperscript{207} The Ninth Circuit reversed that holding as clear error\textsuperscript{208} and remanded the case to the district court for an "apportionment of damages between USAir and the Department of the Navy as concurrent causes of [plaintiff's] injury, keeping in mind USAir's elevated standard of care."\textsuperscript{209}

An airline's practice of relying on the passengers' judgment\textsuperscript{210} will almost certainly be inadequate, as will a failure to specifically warn passengers about foreseeable hazards\textsuperscript{211} that apply equally to all passengers.\textsuperscript{212} Human nature tends to tempt people to test the boundaries of any rule. As such, it seems likely that passengers will attempt to use PEDs even when they are not authorized to do so.

Extending the analysis to PEDs and EMI indicates that the flight attendants should first instruct passengers to turn off their devices during take-offs and landings. The directive should specifically name the prohibited devices in order to eliminate any ambiguity. The flight attendants should then a walk down the aisle to confirm that the passengers have complied with the instruction. The burden of this procedure would be relatively

\textsuperscript{206} Id. at 1414.
\textsuperscript{207} Id. at 1412.
\textsuperscript{208} The Ninth Circuit held that the flight attendant's negligence was not a superseding cause because it was reasonably foreseeable at the time the passenger carelessly stowed his briefcase that someone subsequently would open the overhead bin and the briefcase would fall out. Id. at 1414.
\textsuperscript{209} Id.
\textsuperscript{210} Schwab, 516 So. 2d at 463 (flight attendant stated that Delta relied "on the good judgment of a passenger not to close [the bin] when it is not correctly filled.").
\textsuperscript{211} Id. Delta warned passengers only to be certain that all carry-on luggage was stowed either above or below the seats. Id. at 463 n.8. Plaintiff suggested numerous ways in which Delta could have minimized the risk of harm, such as requiring passengers to leave the overhead bins open prior to take-off. The flight attendant could then check every bin to make sure its contents were stored properly. Id.
\textsuperscript{212} Airlines need not "warn of hazards that vary according to the particular condition of the passenger." Sprayregen v. American Airlines, Inc., 570 F. Supp. 16, 18 (S.D.N.Y. 1983) (no duty to warn of dangers of flying with a head cold). \textit{But see} Kohler v. Aspen Airways, Inc., 214 Cal. Rptr. 720, 725-26 (Cal. Ct. App. 1985) (no duty to warn passengers of the possibility of clear air turbulence, absent evidence that a reasonably prudent person would have refused to take the flight as a result).
small because the attendants must currently perform a visual inspection to ensure that seats are upright, tray tables are stowed, and seat belts are fastened.

V. CONCLUSION

The idea that devices as seemingly harmless as laptop computers and FM radios might create chaos with aircraft systems has generated extensive, and sometimes unsubstantiated, coverage in the popular press. Lost in the uproar is the fact that, more than thirty years after the issue first arose, there still is no conclusive scientific data to either establish or repudiate the notion that an aircraft filled with passengers using PEDs might veer wildly off course with disastrous results. Available data indicates that the chance of EMI during a typical flight is statistically very small, especially if passengers comply with airline policies and the device is in proper working order. Anecdotal evidence suggests that the chance of EMI disruption is greater than one in one million, but reporting biases may lead pilots to erroneously attribute incidents to EMI that actually result from pilot error or mechanical malfunction. In any event, it is virtually impossible to recreate the conditions that allegedly caused the EMI. There is fairly persuasive evidence that personal cellular phones, which FCC regulations and airline policies bar from use at any time during the flight, pose a risk of EMI because of their high emission levels at frequencies commonly used by aircraft systems.

Industry participants from airline pilots to federal agencies do not agree on whether the devices actually threaten cockpit systems and, if so, what should be done about it. The FAA’s conservative approach to the issue seems to have succeeded in avoiding public concern, despite extensive media coverage of the issue. To date, most passengers have accepted the changes in airline policies without demanding detailed explanations. Development of uniform standards for implementing regulations governing PED use might eliminate some of the passenger confusion resulting from different airlines approaches to enforcement. The FAA’s approach also may be partially responsible for the fact that the issue is unresolved even after thirty years of periodic study.

It seems only a matter of time before a plaintiff sues an airline alleging injuries sustained as a result of EMI. Newspaper articles

\footnote{One in one million, or one incident every two years. Special Committee 156, \textit{supra} note 31, at 91.}
have already raised the issue in connection with major airplane crashes. The plaintiff's complaint could include allegations of hazardous EMI along with the familiar charges of pilot error, inadequate training, and other negligent acts and omissions.

Few flight hazards are truly analogous to EMI although falling luggage and smoking cases might provide a logical starting point for analysis. As in EMI cases, they involve a risk to passengers that the passengers themselves create. The seat belt/turbulence cases are helpful in determining how a court might evaluate an airline policy that complies with existing federal regulations yet still fails to prevent harm to passengers.

Analysis of the EMI issue under the three scenarios (negligent use of PEDs, inadequate airline policy, and failure to enforce passenger compliance) indicates that a court is likely to find an airline liable provided that the plaintiff can prove causation, which is a substantial obstacle. The high standard of care that applies to common carriers leads to the conclusion that passengers' negligent use of PEDs is as foreseeable as falling luggage. As such, the airline must take all practical steps to ensure that their negligence does not endanger other passengers.

The weakest part of a plaintiff's case is the causation element. Necessary evidence would probably need to include eyewitness testimony to establish that one or more passengers used PEDs during the flight. The plaintiff would then need persuasive scientific data linking the use of the PED to the crash or other harmful incident. Though a common carrier's standard of care is high, the scientific uncertainty surrounding the issue of PEDs on aircraft provides an effective means of attacking the causation element of the plaintiff's prima facie case.