Aircraft Crashworthiness: Should the Courts Set Standards?

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NOTES

AIRCRAFT CRASHWORTHINESS: SHOULD THE COURTS SET THE STANDARDS?

During the past twenty years, courts have extended the scope of products liability to include an amorphous doctrine known as "crashworthiness." The doctrine focuses on the capacity of a vehicle to protect its occupants from additional or enhanced injuries during a survivable accident. The cause of the accident is irrelevant to the crashworthiness issue. Instead, recovery is based solely on the injuries enhanced by the vehicle's inability to protect the passenger.

Although courts generally have accepted the doctrine of crashworthiness in automobile accident litigation, they have not

1. See Annot., 42 A.L.R.3d 560 (1972). The doctrine of crashworthiness also has been referred to as "post accident survivability," "second collision," or "enhanced injury." See Harris, Enhanced Injury Theory: An Analytic Framework, 62 N.C.L. Rev. 643, 647-51 (1984) (criticizing courts for using these terms interchangeably and declaring that the only proper term is "enhanced injury").

2. The Motor Vehicle Information and Cost Savings Act defines crashworthiness as "the protection that a passenger motor vehicle affords its passengers against personal injury or death as a result of a motor vehicle accident." 15 U.S.C. § 1901(14) (1982). The National Aeronautics and Space Administration (NASA) defines a "survivable" aircraft accident as one in which the "airframe survivable volume was maintained during impact," "at least one occupant did not die from trauma," and the passengers had "potential for egress." Thomson & Caiafa, Structural Response of Transport Airplanes in Crash Situations, NASA Tech. Mem. 85654, at 3 (1983) [hereinafter cited as Thomson & Caiafa, Structural Response]. Because most aircraft accidents occur during approach, landing, or takeoff, "the potential for survivability could be enhanced through applied crashworthiness technology in the design of the airplane." Thomson & Caiafa, Designing for Aircraft Structural Crashworthiness, 19 J. Aviation 868, 869 (1982) [hereinafter cited as Thomson & Caiafa, Aircraft Crashworthiness].

3. Most courts that have addressed the issue in automobile cases have decided to apply the doctrine of crashworthiness. The landmark decision allowing recovery is Larsen v. General Motors Corp., 391 F.2d 495 (8th Cir. 1968). Although the United States Court of Appeals for the Seventh Circuit denied recovery in Evans v. General Motors Corp., 359 F.2d 822 (7th Cir.), cert. denied, 385 U.S. 836 (1966), the Seventh Circuit overruled Evans eleven years later and now allows recovery under the crashworthiness doctrine. Huff v. White Motor Corp., 565 F.2d 104 (7th Cir. 1977). For a complete list of jurisdictions that have

371
been so receptive in aviation accident cases. Observers have attributed this phenomenon both to out-of-court settlements and to the limited number of reported decisions in aircraft crashworthiness cases. A better explanation of the courts' reluctance to extend the crashworthiness doctrine to aircraft cases, however, is the highly sophisticated and technical issues involved with the engineering design of aircraft.

This Note examines whether courts should determine an aircraft manufacturer's liability for a conscious design choice, particularly one involving complex crashworthiness issues. The Note discusses the development of the crashworthiness doctrine and the current theories of liability, and concludes not only that the


5. See Comment, supra note 4, at 558. The author cited no authority to support this proposition.

6. Id. In 1982, 574 deaths resulted from more than 3000 general aviation accidents, yet in the same year only one decision involving aircraft crashworthiness was reported.


One commentator attributed the lack of reported aircraft crashworthiness cases to the large number of cases that are settled before trial or that are tried but not appealed. Comment, supra note 4, at 558. This commentator, however, did not give any support for this proposition and did not give any reason why aircraft crashworthiness cases would be settled more quickly than automobile crashworthiness cases. Fortunately, several unappealed aircraft crashworthiness cases have been reported by secondary sources. See, e.g., Eichstedt v. Cessna Aircraft Corp., No. 282029 (Nev. Dist. Ct. Aug. 29, 1977) (abstracted at 21 ATLA News Letter 62 (1978)).

8. The Note applies to both general and commercial aviation, with differences noted when appropriate. For a detailed discussion of the crashworthiness doctrine in commercial aviation, see Note, The Crashworthiness Doctrine and the Allocation of Risks in Commercial Aviation, 52 S. Cal. L. Rev. 1581 (1979).

9. The phrase "conscious design choice" first was used by Professor James Henderson to indicate that the design was exactly what the designer intended it to be. Henderson, Judicial Review of Manufacturers' Conscious Design Choices: The Limits of Adjudication, 73 Colum. L. Rev. 1531, 1549 (1973); see infra note 105.
judiciary is unqualified to determine whether an aircraft is sufficiently crashworthy but also that legislatures and governmental agencies are incapable of determining standards for aircraft crashworthiness. The Note instead proposes that an adjudicative body composed of governmental agencies and aircraft manufacturers should determine the reasonableness of the manufacturer's crashworthiness design. If this panel determines that the design is unreasonable, the manufacturer should be liable for any injuries caused by the uncrashworthy design.11

TECHNICAL CONSIDERATIONS OF AIRCRAFT CRASHWORTHINESS

Crashworthy aircraft design primarily involves five considerations: minimization of deformation and breakage, energy absorption, incorporation of an adequate occupant restraint system, minimization of environmental hazards, and reduction of post-crash hazards.12 The first consideration, minimization of deformation and breakage, means that the aircraft's structure should be designed so that it will form a "protective shell" around its occupants in the event of a crash. A countervailing design consideration, however, is the requirement that the aircraft structure be lightweight and cost effective.15 Aircraft designers must balance these considerations to produce an aircraft with an acceptable level of crashworthiness without a significant increase in weight.16

10. The Note does not claim that a manufacturer has no duty to design a crashworthy aircraft, but only that the judiciary is not the proper body to determine the extent of that duty.
11. The Note suggests that the courts should retain their role in determining the amount of damages because of their experience and knowledge in assessing damages.
15. See D. Perry, AIRCRAFT STRUCTURES 277 (1950). Many other criteria must be considered in designing an aircraft structure, including the effect of extreme temperature variations, fatigue caused from cyclical loading, and the possibility of corrosion. See id. at 271.
16. Current research efforts by NASA have concentrated on increasing the crashworthiness of an aircraft without paying a substantial weight penalty. See Thomson & Caiafa, Aircraft Crashworthiness, supra note 2, at 869.
The second consideration, energy absorption, involves the ability of the aircraft structure and restraint system to absorb and distribute crash forces.\textsuperscript{17} Energy absorption is an element of aircraft structural design, and is engineered through the use of ductile metals,\textsuperscript{18} crush zones,\textsuperscript{19} special crashworthy seats,\textsuperscript{20} and padding around the occupants. An aircraft with sufficient energy absorption will reduce the magnitude and duration of the “g” loads\textsuperscript{21} experienced by its occupants during a survivable crash.\textsuperscript{22}

The third consideration is the effectiveness of the aircraft’s seat and occupant restraint system. The restraint system consists of a lap belt and, in some aircraft, a shoulder harness.\textsuperscript{23} Although the technology of restraint systems is simple and well developed,\textsuperscript{24} the majority of aircraft crashworthiness litigation has involved defectively designed restraint systems.\textsuperscript{25} The difficulty generally lies not in restraining the passenger to the seat, but in keeping the seat attached to the floor throughout the crash sequence.\textsuperscript{26}

\textsuperscript{17} NASA experts have emphasized the importance of energy absorption in preventing fatalities. According to these experts: “Trauma fatalities have predominated generally, when the energy absorbing protective capability of the aircraft structure has been expended and the aircraft has experienced major structural damage. Trauma fatalities might be reduced, however, by improving the airframe energy absorption capability and structural integrity.” Thomson & Caiafa, \textit{Structural Response, supra} note 2, at 22.

\textsuperscript{18} \textit{Id.}

\textsuperscript{19} \textit{See Thomson & Caiafa, \textit{Aircraft Crashworthiness, supra} note 2, at 869-76.}

\textsuperscript{20} \textit{See Thomson & Goetz, supra} note 13, at 588-89.

\textsuperscript{21} “G” loads measure the increase in loads resulting from accelerations. \textit{See D. Peery, supra} note 15, at 66. For general and descriptive discussions concerning “g” loads, \textit{see R. Schaden & V. Heldman, \textit{Product Design Liability 81-93 (1982), and Schaden, \textit{Aircraft Crashworthiness, 14 Trial 40, 42 (1978).}}

\textsuperscript{22} The greater the energy absorption of an aircraft structure, the less rigid the structure. As a result, designers are confronted with a trade-off between having a ductile airframe which absorbs crash forces by progressively yielding so as to cushion the occupants and a rigid airframe which forms a “protective shell” around the occupants. \textit{Cf. Dawson v. Chrysler Corp., 630 F.2d 950, 962 (3d Cir. 1980) (“[W]hile the jury found Chrysler liable for not producing a rigid enough vehicular frame, a factfinder in another case might well hold the manufacturer liable for producing a frame that is too rigid.”), cert. denied, 450 U.S. 959 (1981).}

\textsuperscript{23} The Federal Aviation Administration requirements for lap belts and shoulder harnesses are contained in 14 C.F.R. §§ 23.561, .785 (1985).

\textsuperscript{24} \textit{See Thomson & Goetz, supra} note 13, at 688-90; Thomson & Caiafa, \textit{Structural Response, supra} note 2, at 40.

\textsuperscript{25} \textit{See supra} note 7.

\textsuperscript{26} According to NASA experts: “The performance of seats with regard to protecting occupants during an accident is generally good provided the structural integrity of the
Although experts have extensively researched the interaction of the seat and restraint system with the floor,\textsuperscript{27} it still is "not well understood."\textsuperscript{28} Designing the aircraft restraint system, like designing the aircraft airframe, demands highly sophisticated technology.

Aircraft designers also must consider the fourth consideration, which is the minimization of environmental hazards. Environmental hazards include sharp protuberances, loose objects that become projectiles during a crash, and hard surfaces in close proximity to the occupants. Sophisticated technology is not required to prevent most environmental hazards. To minimize injuries during a crash, manufacturers easily can design smooth surfaces, padding, and storage areas for loose items.

The fifth and final crashworthiness consideration in aircraft designs is reduction of post-crash hazards. Post-crash hazards include fire and smoke, blocked or jammed exits caused by cabin distortion or debris, and toxic gasses.\textsuperscript{29} In accidents involving fire and smoke, the passengers' ability to evacuate quickly is critical.\textsuperscript{30} Airframe distortion caused by the impact frequently jams or blocks emergency exits.\textsuperscript{31} Miscellaneous debris\textsuperscript{32} or separated seats\textsuperscript{33} also may delay or prevent evacuation.

Technology reducing or eliminating post-crash fires probably would be "[t]he greatest gain in crashworthiness."\textsuperscript{34} Despite

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\item fuselage shell and supporting floor structure is maintained. The most vulnerable area for seat failure appears to be at the attachment to the floor." Thomson & Caiafa, \textit{Structural Response, supra} note 2, at 40; see also Bruce v. Martin-Marietta Corp., 544 F.2d 442 (10th Cir. 1976) (seats in the passenger cabin broke loose from their floor attachments).
\item See, e.g., Thomson & Goetz, \textit{supra} note 13 (describing the development of analytical and experimental techniques to model the dynamics of the interaction between the seat and the floor).
\item See, e.g., Bruce v. Martin-Marietta Corp., 544 F.2d 442, 444 (10th Cir. 1976) (passenger seats broke loose from the floor and were thrown forward, blocking the exit); see also infra notes 110-20 and accompanying text (discussing Bruce).
\item Thomson & Caiafa, \textit{Structural Response, supra} note 2, at 17.
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enormous efforts and expenditures, however, the government and
the aircraft industry have failed to develop the technology neces-
sary to contain or suppress post-crash fires. Until this technology
is developed, post-crash fire and smoke probably will continue to
be the primary cause of fatalities in survivable aircraft crashes.

Despite both government and industry efforts to improve
-crashworthiness in all five areas, the technology necessary to de-
sign an adequate crashworthy aircraft has not been developed
fully. Development of this technology will require more sophisti-
cated research and increased costs. The situation is complicated
by pressure to manufacture a more economical product, which
forces designers to compromise crashworthiness design for weight,
performance, and cost considerations. An understanding of the
complex technical considerations involved in crashworthiness de-
sign is imperative to the development of legal theories determining
a manufacturer's liability for failure to design crashworthy aircraft.

LEGAL THEORIES OF RECOVERY IN CRASHWORTHINESS CASES

Courts have developed three theories to justify recovery for
damages caused by defectively designed or defectively manufac-
tured products: breach of express or implied warranties, negli-
gence, and strict liability. Crashworthiness actions, however,
usually are based upon negligence or strict liability. Although
courts frequently have held automobile manufacturers liable for

35. Recently, for example, the government spent $11.8 million and worked for four years
to plan a full-scale crash of a passenger jetliner. One of the primary purposes of the crash
was to test a new "anti-misting" agent designed to suppress the post-crash fire. Unfortu-
nately, the anti-misting agent failed to suppress the fire and the aircraft was destroyed.
36. Thomson & Caiafa, Structural Response, supra note 2, at 17.
37. See Thomson & Caiafa, Aircraft Crashworthiness, supra note 2, at 869.
38. See, e.g., supra note 35.
39. See supra note 16 and accompanying text.
40. Courts occasionally have used a fourth theory in products liability, relying on tortious
misrepresentations by manufacturers. For an excellent discussion of the tortious misrepre-
sentation theory, see Shapo, A Representational Theory of Consumer Protection: Doctrine,
41. The rapid expansion of the strict liability theory in products liability cases explains
the limited number of crashworthiness cases based on the breach of warranty theory. See
Note, Aviation "Crashworthiness": An Extrapolation in Warranty, Strict Liability and
defective vehicle crashworthiness, they generally have been reluctant to extend that liability to aircraft manufacturers.\textsuperscript{42}

\textbf{Negligence}

Negligence theory has contributed significantly to the development of the crashworthiness doctrine. To recover using this theory of liability, a plaintiff must prove: (1) that the manufacturer had a duty to provide a reasonably safe vehicle under crash conditions, (2) that the manufacturer breached this duty, (3) that the plaintiff was injured, and (4) that a causal link existed between the manufacturer's breach and the plaintiff's injury.\textsuperscript{43} The courts' consideration of negligence claims in the context of crashworthiness cases demonstrates the application of these four elements.

\textit{Negligence in Automobile Cases}

The primary issue in the first automobile crashworthiness cases was whether the manufacturer had a duty to design a crashworthy vehicle. Initially, courts split on this issue. In the landmark case of \textit{Evans v. General Motors Corp.},\textsuperscript{44} which marked the birth of the crashworthiness doctrine, the plaintiff's decedent had been killed when another automobile struck the decedent's vehicle broadside. The plaintiff alleged that the manufacturer was negligent in designing an automobile with a frame that would not protect occupants adequately during a high speed side-impact collision.\textsuperscript{45} The United States Court of Appeals for the Seventh Circuit rejected the doctrine of crashworthiness. The court held: "A manufacturer is not under a duty to make his automobile accident-proof or fool-proof; nor must he render the vehicle 'more' safe where the danger to be avoided is obvious to all."\textsuperscript{46} According to the Seventh Circuit, an extension of liability to manufacturers for negligence in

\textsuperscript{42} See supra notes 3-7 and accompanying text.
\textsuperscript{44} 359 F.2d 822 (7th Cir.), cert. denied, 385 U.S. 386 (1966) (overruled in Huff v. White Motor Corp., 565 F.2d 104 (7th Cir. 1977)).
\textsuperscript{45} Id. at 823. The plaintiff claimed not that the design defect caused the accident, but rather that the car should have been designed to protect the decedent in a broadside collision. See id.
\textsuperscript{46} Id. at 824.
designing uncrashworthy vehicles "would be a legislative function, not an aspect of judicial interpretation of existing laws." 47

Although several jurisdictions have followed the Seventh Circuit's reasoning in Evans, 48 most courts have followed the reasoning of the United States Court of Appeals for the Eighth Circuit in Larsen v. General Motors Corp. 49 In that case, the plaintiff claimed that the vehicle manufactured by the defendant was defective because the rearward displacement of the steering shaft in a head-on collision was greater than it was in other automobiles. This defect, according to the plaintiff, enhanced his injuries. 50 The court allowed recovery, holding that a "manufacturer is under a duty to use reasonable care in the design of its vehicle to avoid subjecting the user to an unreasonable risk of injury in the event of a collision." 51 The court justified its decision by suggesting that

47. Id. This language suggests that the court believed that only the legislature could evaluate proposed safety design standards properly. This holding comports with reasoning in later cases, in which courts considered whether to extend crashworthiness liability to aircraft manufacturers and decided not to step in. See, e.g., Wilson v. Piper Aircraft Corp., 282 Or. 61, ---, 577 P.2d 1322, 1332-36 (1978) (en banc) (Linde, J., concurring). This position has received substantial support from commentators. One commentator, for example, has stated:

[J]udicially induced reform would of necessity be episodic and disorganized, dependent on the fortuitous circumstances of individual law suits. . . . [T]he imposition of safety standards on the automobile industry can most likely be achieved better by a consistent application of regulatory standards drawn up by experts and kept current by research, rather than by ad hoc decisions of inexpert judges and juries.


48. Courts in three jurisdictions have rejected the doctrine of crashworthiness: McClung v. Ford Motor Co., 472 F.2d 240 (4th Cir. 1973) (applying West Virginia law); Alexander v. Seaboard Air Line R.R., 346 F. Supp. 320 (W.D.N.C. 1971); Walton v. Chrysler Motor Corp., 229 So. 2d 568 (Miss. 1969). In Walton, the Supreme Court of Mississippi justified its refusal to apply the doctrine by stating: "The courts have no machinery to inspect and police industry so as to require compliance with detailed design of products. In the future there may be some legal requirements for uniform automobile design imposed upon the manufacturer, but we are of the opinion that such requirements should be outlined in detail by the legislative branch of the government." 229 So. 2d at 573.

49. 391 F.2d 495 (8th Cir. 1968).

50. Id. at 497. Because of the excessive rearward displacement, the shaft had been pushed up against the plaintiff's head. The plaintiff did not contend that the steering assembly design caused the accident. Id.

51. Id. at 502. The court did limit its holding, however, by stating that "manufacturers are not insurers" and that "an automobile manufacturer is under no duty to design an accident-proof or fool-proof vehicle." Id. at 502, 503.
there are many common-sense factors in design, which are or should be well known to the manufacturer that will minimize or lessen the injurious effects of a collision.52 Because the plaintiff's theory only allowed recovery for his "enhanced" injuries, however, the court found the manufacturer liable only "for that portion of the damages or injury caused by the defective design over and above the damage or injury that probably would have occurred as a result of the impact or collision absent the defective design."53

An overwhelming majority of jurisdictions follow Larsen.54 In fact, when the Seventh Circuit was called upon to reevaluate its

52. Id. at 503. The court, however, failed to discuss any "common-sense factors" that would have prevented the plaintiff's enhanced injuries. See id.

The Eighth Circuit's reference to "common-sense factors" demonstrates the court's inability to recognize the difficult and complex technical questions involved in the design of a vehicle. The highly technical engineering features of crashworthiness design scarcely can be called "common-sense factors." See, e.g., Lannanen, Mathematical Simulation for Crashworthy Aircraft Seat Design, AIAA P-77-1250 (1977) (sophisticated three-dimensional mathematical model of an aircraft seat, occupant, and restraint system); Thomson, Curden & Hayduk, Survey of NASA Research on Crash Dynamics, NASA TP-2298 (1984) (complex testing and analytical modeling of crash dynamics). The technical nature of these considerations, the number of factors relevant to crashworthiness design, and the tendency of these factors to conflict with each other means that a vehicle designer cannot protect occupants fully against all possible hazards in survivable automobile or aircraft accidents. See supra notes 12-39 and accompanying text.

Of course, this complexity does not absolve vehicle designers from all responsibility. A design engineer still "has the responsibility to see that no one is injured as a consequence of his design," and he must "consider the possibility of accidental or thoughtless misoperation." G. BEAKLEY & E. CHILTON, DESIGN SERVING THE NEEDS OF MAN 241 (1974).

53. 391 F.2d at 503.

interpretation of Indiana law in *Evans*, it overruled that decision and followed *Larsen*, stating that *Evans* was "in a distinct minority." According to the Seventh Circuit: "There is no rational basis for limiting the manufacturer's liability to those instances where a structural defect has caused the collision and resulting injury."

**Negligence in Aircraft Cases**

Although courts have been willing to use negligence principles to apply the doctrine of crashworthiness to automobile cases, they...

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55. Huff v. White Motor Co., 565 F.2d 104, 107 (7th Cir. 1977). Huff was a wrongful death action against a manufacturer based on faulty design of the fuel system which caused a post-crash fire. *Id.* at 105.

56. *Id.* at 109.

Although the crashworthiness doctrine is a matter of state law, most decisions concerning the doctrine have come from the federal courts. See Huddell v. Levin, 537 F.2d 726, 733 n.2 (3d Cir. 1976) ("The major cases involving the second collision theory of liability have arisen in federal courts, often in the context of negligence; these cases furnished, at best, unauthorized and diverse prognostications as to how several state courts would rule under the circumstances."). The lack of state court decisions is unfortunate, as at least one commentator has pointed out: "This dearth of state court doctrinal development has been widely criticized. Litigants, as well as the federal courts, have been forced into the 'hazardous occupation' of predicting, rather than applying, the legal principles that the states will enforce in enhanced injury cases." Harris, *Enhanced Injury Theory: An Analytic Framework*, 62 N.C.L. Rev. 643, 644-45 (1984).

57. Courts also have applied the crashworthiness doctrine to other means of transportation closely related to the automobile. See, *e.g.*, Huff v. White Motor Corp., 565 F.2d 104 (7th Cir. 1977) (truck); Dreisonstok v. Volkswagenwerk, A.G., 489 F.2d 1066 (4th Cir. 1974).
generally have been unwilling to do so in aircraft cases.\textsuperscript{58} A few plaintiffs have asserted aircraft crashworthiness claims exclusively under a negligence theory.\textsuperscript{59} In these cases, courts have divided between the \textit{Larsen} approach and the \textit{Evans} approach.

In \textit{Williams v. Cessna Aircraft Corp.},\textsuperscript{60} for example, the \textit{Evans} approach prevailed. In \textit{Williams}, the decedent had been killed when an airplane engine caught fire and the airplane crashed. The plaintiff alleged that the decedent's seat collapsed upon impact and that his restraint system failed. As a result, according to the plaintiff, the decedent was thrown forward into the instrument panel.\textsuperscript{61} The United States District Court for the Northern District of Mississippi rejected the crashworthiness doctrine as applied to aircraft, holding that Cessna "was under no duty to design its seat and harness assembly . . . to withstand a high speed crash."\textsuperscript{62}

Six years after \textit{Williams}, the Supreme Court of Mississippi confirmed the federal court's interpretation of Mississippi aircraft crashworthiness law. \textit{Pattillo v. Cessna Aircraft Corp.}\textsuperscript{63} involved an airplane crash, allegedly caused by the pilot's negligence, which took place in dense fog. The plaintiff's decedent had slammed into the instrument panel when his seat and restraint system tore away


\textsuperscript{59}. More commonly, plaintiffs employ both strict liability and negligence theories, focusing primarily on strict liability. \textit{See infra} notes 110-45 and accompanying text.

\textsuperscript{60}. 376 F. Supp. 603 (N.D. Miss. 1974).

\textsuperscript{61}. \textit{Id.} at 605.

\textsuperscript{62}. \textit{Id.} at 607. The court relied on three cases in which the Mississippi Supreme Court had followed the \textit{Evans} rationale in automobile cases. General Motors Corp. v. Howard, 244 So. 2d 726 (Miss. 1971); Ford Motor Co. v. Simpson, 233 So. 2d 797 (Miss. 1970); Walon v. Chrysler Motor Corp., 229 So. 2d 568 (Miss. 1969).

The plaintiff still had a cause of action against Cessna, and against Teledyne, the manufacturer of the aircraft engine, for the alleged engine defect that caused the crash. \textit{See} 376 F. Supp. at 605. This cause of action, however, was not based on a crashworthiness theory.

\textsuperscript{63}. 379 So. 2d 1225 (Miss. 1980).
from its floor attachments on impact.64 The plaintiff alleged that Cessna had negligently designed and manufactured the seat and restraint system.65 As it had done in earlier automobile cases,66 the Mississippi court rejected the doctrine of crashworthiness.67 The court stated that it was "committed . . . to the proposition that the defendant whose wrong caused the accident is the proper party defendant against whom recovery may be had."68 According to the court, crashworthiness requirements "should be outlined in detail by the legislative branch of the government"69 rather than by the judiciary.

Not all courts have followed Evans in aircraft cases, however. In Eichstedt v. Cessna Aircraft Corp.,70 for example, a Nevada trial court applied the crashworthiness doctrine to an aircraft case. In Eichstedt, the pilot had flown into a blind canyon and had crashed when he was unable to climb out of it. Like the plaintiffs in both Mississippi cases, the plaintiff in Eichstedt alleged that Cessna had negligently designed the seat belts in the aircraft. According to the plaintiff, the defect caused the decedent's body "to be thrown violently forward into his lap belt, which rode up into the soft tissues of his abdomen and caused his internal injuries."71 The jury found that pilot error had caused the accident, but that Cessna's negligence in designing the restraint system had caused the decedent's injuries.72 The court held Cessna liable for this design defect, reasoning that an aircraft manufacturer has a duty to design reasonably crashworthy aircraft.73

64. Id. at 1225, 1227.
65. Id. at 1225. The plaintiff also charged Cessna with breach of its implied warranty of fitness with respect to the seat belts and floor attachments. Id.
66. See supra note 62.
67. 379 So. 2d at 1227.
68. Id.
69. Id. (citing Walton v. Chrysler Motor Corp., 229 So. 2d 568, 573 (Miss. 1969)).
71. Comment, supra note 70, at 1109.
72. Id.
73. Id. The jury awarded wrongful death damages of $900,000. Id.
Williams and Pattillo demonstrate the reluctance of some courts to hold aircraft manufacturers liable for faulty crashworthiness design under a negligence theory. Eichstedt, on the other hand, demonstrates that this reluctance is not uniform. Most aircraft crashworthiness cases, however, have not involved negligence theories. Instead, strict liability has been the primary theory of recovery.74

**Strict Liability**

The doctrine of strict liability originated in 1962 with the California Supreme Court's landmark decision in *Greenman v. Yuba Power Products, Inc.*75 In that case, the plaintiff had been injured when a design defect in the lathe he was using caused a piece of wood to strike him in the head.76 The California court held the manufacturer liable under a new "strict liability" theory, which holds the manufacturer of a defective product liable for damages regardless of the due care exercised in the design, manufacture, or marketing of the product. Justice Traynor explained: "A manufacturer is strictly liable in tort when an article he places on the market, knowing that it is to be used without inspection for defects, proves to have a defect that causes injury to a human being."77 The purpose of strict liability, according to Justice Traynor, was "to ensure that the costs of injuries resulting from defective products are borne by the manufacturer that put such products on the market rather than by the injured persons who are powerless to protect themselves."78

75. 59 Cal. 2d 57, 377 P.2d 897, 27 Cal. Rptr. 697 (1962) (en banc).
76. Id. at ___, 377 P.2d at 898-99, 27 Cal. Rptr. at 698-99.
77. Id. at 62, 377 P.2d at 900, 27 Cal. Rptr. at 700.
After Greenman, other courts rapidly adopted the concept of strict liability. In 1965, the American Law Institute adopted section 402A of the Restatement (Second) of Torts, which set forth a rule of strict liability. The overwhelming majority of jurisdictions have adopted some form of strict liability for manufacturing

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80. RESTATEMENT (SECOND) OF TORTS § 402A (1965). Section 402A provides:

(1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if

(a) the seller is engaged in the business of selling such a product, and
(b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold.

(2) The rule stated in Subsection (1) applies although

(a) the seller has exercised all possible care in the preparation and sale of his product, and
(b) the user or consumer had not bought the product from or entered into any contractual relation with the seller.

Id.

Among states that have adopted strict liability, the major disagreement concerning section 402A has involved the proper interpretation of “unreasonably dangerous” in subsection (1). Cf. id. comment g (defining “defective condition” as “a condition not contemplated by the ultimate consumer, which will be unreasonably dangerous to him”). The California Supreme Court, for example, rejected the “unreasonably dangerous” requirement in Cronin v. J.B.E. Olson Corp., 8 Cal. 3d 121, 501 P.2d 1153, 104 Cal. Rptr. 433 (1972). According to the court in Cronin, a requirement of proof from the plaintiff that the product was “unreasonably dangerous” would burden the “injured plaintiff with proof of an element which rings of negligence.” Id. at 132, 501 P.2d at 1162, 104 Cal. Rptr. at 442. The court instead required only proof of a design defect in the product and proof that the defect proximately caused the plaintiff’s injuries. Id.

defects and design defects. In crashworthiness cases, however, plaintiffs generally have alleged only design defects.

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82. Manufacturing defects arise either because the raw materials or components used in making the product contained physical flaws or because the manufacturer made some error in assembling the product. See Allen, Fatigue Failure in Products Liability Actions, 28 Ala. L. Rev. 575 (1977); Weinstein, Twerski, Piehler & Donaher, Product Liability: An Interaction of Law and Technology, 12 Duq. L. Rev. 425, 430-34 (1974). Design defects, on the other hand, arise when the design intended by the manufacturer caused the alleged injuries. See Hoening, Product Designs and Strict Tort Liability: Is There a Better Approach?, 8 Sw. U.L. Rev. 109 (1976); Keeton, Manufacturer's Liability: The Meaning of "Defect" in the Manufacture and Design of Products, 20 Syracuse L. Rev. 559 (1969); see also
Courts have developed two tests to determine whether a design was defective. These two tests, the "risk-utility" test and the "consumer expectation" test, apply generally to all strict liability actions involving design defects. Courts employing the risk-utility approach assume that the manufacturer knew about the design defect, and decide whether a reasonably prudent manufacturer would have marketed the product in spite of the defect because the product's utility outweighed the risks associated with its use. If the court concludes that a reasonably prudent manufacturer would not have marketed the defective product, the manufacturer is liable for all damages resulting from the defect. Courts applying the consumer expectation test, on the other hand, decide whether the

Abramson, supra note 74, at 172 (describing distinction between manufacturing defects and design defects).

A product also may be defective because of inadequate instructions or warnings. See DeRosa v. Remington Arms Co., 509 F. Supp. 762, 765 (E.D.N.Y. 1981).

83. See Drago, supra note 3, at 443.

84. See generally Keeton, Products Liability—Design Hazards and the Meaning of Defect, 10 Cum. L. Rev. 293 (1979) (describing the risk-utility and consumer expectation tests, as well as variations of these theories developed by courts and commentators).

The varying approaches to design defect cases reflect the difficulty associated with the issues involved in these cases. One commentator has suggested that this difficulty reflects the fact that the issues involved in this context more than others involve decisions of major importance concerning the allocation of social resources. Not surprisingly, this is the area where the propriety of judicial action has received the greatest scrutiny. It is also the area of greatest concern to manufacturers, since a judicial declaration that the design of the product on trial is "defective" condemns the entire product line.


85. This approach originated with two commentators, Dean Page Keeton and Dean John Wade. Keeton, Product Liability and the Meaning of Defect, 5 St. Mary's L.J. 30, 37-38 (1973); Wade, Strict Tort Liability of Manufacturers, 19 Sw. L.J. 5, 15-17, (1965); see also Caterpillar Tractor Co. v. Beck, 593 P.2d 871, 883 (Alaska 1979) (applying the risk-utility test). Seven factors proposed by Dean Wade have been particularly useful to courts applying the risk-utility analysis: (1) the product's usefulness and desirability to the user and the public; (2) the safety aspects of the product; (3) the availability of a substitute product that would meet the same need and would not be unsafe; (4) the manufacturer's ability to make the product safe without impairing its usefulness or making it too expensive; (5) the user's ability to avoid danger by using the product carefully; (6) the user's probable awareness of the product's dangers and how to avoid them, either from public knowledge of the product or suitable warnings or instructions given by the manufacturer; and (7) the manufacturer's ability to spread the loss by increasing the price of the product or carrying liability insurance. Wade, On the Nature of Strict Tort Liability for Products, 44 Miss. L.J. 825, 831-38 (1973).
product was “dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics.” If the court concludes that the dangers of the product exceeded the reasonable expectations of the ordinary consumer, the manufacturer is liable for all damages resulting from the product.

One drawback of the risk-utility test is the difficulty in distinguishing between negligence and strict liability under this approach. Courts generally claim that the risk-utility approach focuses on the product itself and not on the manufacturer's conduct. See, e.g., Caterpillar Tractor Co. v. Beck, 593 P.2d 871, 883 (Alaska 1979) (focus of strict products liability is on the condition of the product, not on the manufacturing and marketing decision of the defendant). In reality, however, triers of fact often appear to consider that conduct, effectively converting the action from strict liability to negligence.

The risk-utility approach also appears to place an unfair burden of proof on plaintiffs by saddling them with virtually the same level of proof as in negligence actions. See, e.g., Cronin v. J.B.E. Olson Corp., 8 Cal. 3d 121, 130, 502 P.2d 1153, 1163, 104 Cal. Rptr. 433, 443 (1972). This onerous burden of proof conflicts with the important goal in strict liability of relieving the burden of proof associated with negligence actions. In crashworthiness cases, this increased burden of proof would be especially burdensome because the technological complexities of automobiles and aircraft already make issues in these cases difficult for potential plaintiffs.

86. RESTATEMENT (SECOND) OF TORTS § 402 comment i (1965); see also Vincer v. Esther Williams All-Aluminum Swimming Pool Co., 59 Wis. 2d 326, —, 230 N.W.2d 794, 798 (1975) (“[W]hether a product contains an unreasonably dangerous defect depends upon the reasonable expectations of the ordinary consumer concerning the characteristics of this type of product.”).

87. The classic formulation of the consumer expectation test is the “unreasonably dangerous” requirement of section 402A of the Restatement (Second) of Torts. See supra note 80. Criticism of this approach has caused some courts, most notably the California Supreme Court, to drop the “unreasonably dangerous” requirement. See Cronin v. J.B.E. Olson Corp., 8 Cal. 3d 121, 134, 501 P.2d 1153, 1162, 104 Cal. Rptr. 433, 441 (1972) (“We think that a requirement that a plaintiff also prove that the defect made the product ‘unreasonably dangerous’ places upon him a significant increased burden and represents a step backward in the area pioneered by this court.”). In its place, the California court has established a “dual” test which combines consumer expectations and risk-utility analysis. Under this dual test, a product is considered defectively designed “if the plaintiff establishes that the product failed to perform as safely as an ordinary consumer would expect when used in an intended or reasonably foreseeable manner,” or “if the plaintiff demonstrates that the product’s design proximately caused his injury and the defendant failed to prove, in the light of the relevant factors, that, on balance, the benefits of the challenged design outweigh the risk of danger inherent in such design.” Barker v. Lull Eng’g Co., 20 Cal. 3d 413, 432, 573 P.2d 443, 455-56, 143 Cal. Rptr. 225, 237-38 (1978).

The dual test is significant not only because it gives plaintiffs the option of selecting the approach that best suits their cases, but also because once the plaintiff has proved that the product’s design proximately caused his injuries, the dual test shifts to the manufacturer the burden of proving that the decision to market the product was reasonable. This shift reflects the California court’s adherence to the principles in products liability actions that direct the
Strict Liability in Automobile Cases

Decisions in automobile crashworthiness cases reflect both the risk-utility approach and the consumer expectation approach. In Dawson v. Chrysler Corp.,88 for example, the United States Court of Appeals for the Third Circuit used the risk-utility analysis to decide an automobile crashworthiness issue. In Dawson, a police officer had been injured when he lost control of his patrol car. The patrol car had struck and “literally wrapped itself around [a steel] pole.”89 The pole had sliced through the car and had crushed the police officer between his seat and the “header” area of the roof.90 The plaintiff alleged that the patrol car was uncrashworthy and defectively designed because it did not have a “full continuous steel frame.”91 If the frame had been continuous, according to the plaintiff, the patrol car would have bounced off the pole.92 The defendant manufacturer countered that deformation of the vehicle’s body “is desirable in most crashes because it absorbs the impact of the crash and decreases the rate of deceleration on the occupants of the vehicle.”93

Following the risk-utility approach, as adopted by the New Jersey Supreme Court,94 the Third Circuit held that “a product is defective ‘if a reasonable person would conclude that the trier of fact to focus on the product, not on the manufacturer’s conduct, and that allow the plaintiff to prevail without proving that the manufacturer acted unreasonably or negligently. See Barker, 20 Cal. 3d at 431, 573 P.2d at 455, 143 Cal. Rptr. at 127.

The focus in the consumer expectation test on the expectations of consumers causes particular problems in aircraft crashworthiness cases because passengers injured or killed in aircraft accidents are not users and generally lack “sophisticated knowledge about the product.” Saba, supra note 12, at 323 (“For technologically complicated products such as aircraft . . . purchasers and passengers may not [have definite expectations concerning] how safely the product could or should have been made.”).

89. Id. at 954.
90. Id.
91. Id.
92. Id. The plaintiff also introduced expert testimony to prove that the existing frame was unable to withstand side impacts at low speeds and that the injuries would not have occurred if the frame had been designed differently. Id.
93. Id. The manufacturer’s defense, in more precise terms, was that the existing “piecewise” frame had better energy absorption properties than a continuous frame. See supra notes 17-22 and accompanying text.
magnitude of the scientifically perceivable danger as it is proved to be at the time of trial outweighed the benefits of the way the product was so designed and marketed.\textsuperscript{95} Applying this test, the court upheld the jury verdict holding the defendant liable for misdesigning the frame.\textsuperscript{96} The court, however, expressed "uneasiness" about its approach and the result it yielded because, "[a]lthough it is important that society devise a proper system for compensating those injured in automobile collisions, it is not at all clear that the present arrangement of permitting individual juries, under varying standards of liability, to impose this obligation on manufacturers is fair and efficient."\textsuperscript{97}

In \textit{Leichtamer v. American Motors Corp.},\textsuperscript{98} on the other hand, the Ohio Supreme Court applied the consumer expectation test to an automobile crashworthiness claim. In \textit{Leichtamer}, two people had been killed and two others had been injured when the jeep in which they were riding suddenly pitched over and landed upside down while climbing a hill. The roll bar support system in the jeep

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95. 630 F.2d at 957 (quoting Cepeda v. Cumberland Eng'g Co., 76 N.J. 152, 172-73, 386 A.2d 816, 826 (1978), which, in turn, was quoting Keeton, \textit{supra} note 85, at 37-38 (emphasis in original article)).

96. \textit{Id.} at 962. The jury considered sophisticated expert testimony from design analysts and engineers from both sides, and also considered several factors relevant to the risk-utility analysis. \textit{See supra} note 85. The jury concluded that the patrol car was "not reasonably fit, suitable and safe for its intended or reasonably foreseeable purposes." 630 F.2d at 959.

97. 630 F.2d at 963. The court preceded its general statement concerning the method of determining manufacturers' liability with an expression of reservations about the particular result achieved in \textit{Dawson}:

\begin{quote}
[W]hile the jury found Chrysler liable for not producing a rigid enough vehicular frame, a factfinder in another case might well hold the manufacturer liable for producing a frame that is too rigid. Yet, as pointed out at trial, in certain types of accidents—head-on collisions—it is desirable to have a car designed to collapse upon impact because the deformation would absorb much of the shock of the collision, and divert the force of deceleration away from the vehicle's passengers. In effect, this permits individual juries applying varying laws in different jurisdictions to set nationwide automobile safety standards and to impose on automobile manufacturers conflicting requirements. It would be difficult for members of the industry to alter their design and production behavior in response to jury verdicts in such cases, because their response might well be at variance with what some other jury decides is a defective design. Under these circumstances, the law imposes on the industry the responsibility of insuring vast numbers of persons involved in automobile accidents.
\end{quote}

\textit{Id.} at 962.

had failed, and as a result the roll bar had been displaced. The injured occupants sued, alleging that the jeep was uncrashworthy and that their injuries were “substantially enhanced, intensified, aggravated, and prolonged by the roll bar displacement.”

The court followed the consumer expectation test, stating: “The concept of ‘unreasonably dangerous,’ as found in section 402A, provides implicitly that a product may be found defective in design if it is more dangerous in use than the ordinary consumer would expect.” The court explained: “The commercial advertising of a product will be the guiding force upon the expectations of consumers with regard to the safety of a product, and is highly relevant to a formulation of what those expectations might be.” Applying this test, the court upheld the jury verdict holding the defendant manufacturer liable for failing “to test [the] roll bar support system for foreseeable roll-overs and/or foreseeable pitch-overs.”

Dawson and Leichtamer not only show the varying approaches to strict liability, but also demonstrate the difficulties associated with adjudication of “conscious” design choices made by the manufacturer. In contrast to inadvertent design defects, which courts may assess easily and objectively by comparing the product to the manufacturer’s specifications, conscious design choices present difficult technical problems. The assessment of conscious design choices requires judges and juries to absorb large amounts of technical expert testimony based on hindsight so that they can

99. Id. at ___424 N.E.2d at 572.
100. Id. The plaintiffs did not claim that the jeep had a manufacturing defect.
101. Id. at ___424 N.E.2d at 576. The “section 402A” to which the court referred was section 402A of the Restatement (Second) of Torts. See supra note 80.
102. 67 Ohio St. 2d at ___, 424 N.E.2d at 578. The defendant had advertised the jeep’s off-the-road capabilities extensively in television commercials.
103. Id. at ___, 424 N.E.2d at 574.
104. Id. at ___, 424 N.E.2d at 573. The jury awarded the plaintiffs more than $2,000,000 in compensatory and punitive damages. Id.
105. See supra note 9. Conscious design choices occur when a design engineer accepts known risks associated with the intended design of a product because he believes that benefits flowing from the product justify the risks. Inadvertent defects, on the other hand, are unintentional. Henderson, supra note 9, at 1548.
106. See Henderson, supra note 9, at 1550-52; cf. Traynor, supra note 78, at 367 (1965) (proposing a simple “deviation from the norm” test for manufacturing defects that also could be applied to inadvertent design defects).
107. The hindsight view of courts and juries can cause significant unfairness, which may be particularly severe in aircraft cases:
decide whether the design engineer properly weighed the risks and the benefits.

These difficulties are even greater in aircraft crashworthiness cases than in automobile cases because the choices made during the aircraft design process involve even more complex and technical considerations.\(^\text{108}\) Given these difficulties, courts might have been expected to shy away from adjudicating aircraft crashworthiness claims based upon strict liability. As the cases discussed in the following section demonstrate, however, the "social pressures generally favoring injured plaintiffs"\(^\text{109}\) have prompted many courts to tackle these issues, with mixed success.

**Strict Liability in Aircraft Cases**

*Bruce v. Martin-Marietta Corp.*\(^\text{110}\) was one of the first aviation cases in which a court recognized crashworthiness as a potential basis of recovery under strict liability. *Bruce* involved a commercial aircraft\(^\text{111}\) that had crashed into a mountain. Upon impact, several passenger seats had broken loose from their floor attachments, not only injuring the passengers but also blocking the exit. When a post-crash fire had developed, the blocked exit had prevented the passengers from escaping. As a result, thirty-two of the forty passengers had died.\(^\text{112}\) The plaintiffs alleged that the manufacturer, Martin-Marietta, had not designed a crashworthy

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Manufacturers may be held liable for the dangerous propensities of a product that were scientifically unknowable at the time the product was manufactured and sold, but which propensities were subsequently discovered through additional research and development. Such a hindsight approach when applied to aircraft accident litigation may be onerous on aircraft manufacturers whose industry is so rapidly changing that risks of harm previously unknown are continually being discovered through advanced technology.

Saba, *supra* note 12, at 328.

108. *See id.* at 321-22; *supra* note 107.

109. Henderson, *supra* note 9, at 1558; *see* Wilson v. Piper Aircraft Corp., 282 Or. 61, ——, 577 P.2d 1322, 1326 (1978) (en banc); *infra* note 132 and accompanying text.

110. 544 F.2d 442 (10th Cir. 1976).

111. *Bruce* is unique among aircraft crashworthiness cases because it is the only case in which a court applied the doctrine of crashworthiness to a commercial aircraft. *See Note, supra* note 8, at 1590-92.

112. 544 F.2d at 444.
aircraft. They contended that the seat design was defective and that the post-crash fire protection was inadequate.\textsuperscript{113}

The United States Court of Appeals for the Tenth Circuit applied the consumer expectation test, stating that to recover from Martin-Marietta "the plaintiff must show that the product was dangerous beyond the expectations of the ordinary customer."\textsuperscript{114} The court decided that the plaintiffs had not met this burden, and it therefore affirmed the district court's summary judgment for the defendant.\textsuperscript{115} In reaching this conclusion, the court gave particular weight to Martin-Marietta's compliance with all design and safety regulations of the Civil Aeronautics Administration\textsuperscript{116} when it manufactured the plane in 1952.\textsuperscript{117} Based on this compliance with federal requirements, the court concluded that "[p]laintiffs have not shown that the ordinary consumer would expect a plane made in 1952 to have the safety features of one made in 1970."\textsuperscript{118}

\textit{Bruce} is significant because the court relied heavily on federal crashworthiness requirements as a standard to determine whether a manufacturer's conscious design choice was improper. The Tenth Circuit's reluctance to create its own safety standards probably stemmed from its lack of expertise in the technical area of aircraft crashworthiness.\textsuperscript{119} \textit{Bruce} thus began what has become a trend of deferring to federal regulations in cases involving the highly

\begin{thebibliography}{9}
\bibitem{113} Id. at 445-46.
\bibitem{114} Id. at 447 (citing \textit{Restatement (Second) of Torts} § 402A (1965)); see supra notes 86-87 and accompanying text.
\bibitem{115} Id. at 448, \textit{aff'd} Bruce v. Martin-Marietta Corp., 418 F. Supp. 829 (W.D. Okla. 1975).
\bibitem{117} See id. at 446. The court acknowledged that, in general, "[c]ompliance with governmental air safety regulations is admissible, but not conclusive, evidence in a suit arising out of an airplane crash." \textit{Id.} (citing Lightenburger v. Gordon, 81 Nev. 553, ----, 407 P.2d 728, 733 (1965)). The court insisted, however, that compliance with governmental regulations was crucial when the consumer expectation test was involved. Compliance with governmental regulations, according to the court, showed that "when the plane was made and first sold, its design was within the state of the art," which is important in "determin[ing] the expectation of the ordinary consumer." \textit{Id.} at 447.
\bibitem{118} \textit{Id.} at 447.
\bibitem{119} \textit{Cf.} Bowman v. General Motors Corp., 427 F. Supp. 234, 241 (E.D. Pa. 1977) ("[W]hen a conscious design choice has caused the injury, [the court is] faced with quite a
complex and technical issues associated with aircraft crashworthiness.\textsuperscript{120}

This trend of deferring to federal standards has not been limited to courts that follow the Tenth Circuit’s adherence to the consumer expectation test. In \textit{Wilson v. Piper Aircraft Corp.},\textsuperscript{121} for example, the Oregon Supreme Court applied the risk-utility analysis to an aircraft crashworthiness case, but also concluded that compliance with federal requirements precluded liability. In \textit{Wilson}, the plaintiffs alleged two design defects: an uncrashworthy rear passenger compartment, and a carburetor defect that produced icing.\textsuperscript{122} After a jury verdict for the plaintiffs, the defendant appealed.\textsuperscript{123}

The court in \textit{Wilson} applied the risk-utility test, inquiring “whether ‘a reasonably prudent manufacturer would have so designed and sold the article in question had he known of the risk involved which injured plaintiff.’”\textsuperscript{124} To aid this inquiry, the court required the plaintiffs to produce evidence of alternative designs that would have been “not only technically feasible but also practicable in terms of cost and the over-all design and operation of the product.”\textsuperscript{125} In considering the plaintiffs’ carburetor defect claim, the court was satisfied that they had met the “technically feasible” requirement by showing that a fuel injection system could have replaced the carburetor system. The court rejected the claim,

different problem; for there is no built-in objective standard by which the jury can measure the alleged defect.”).


\textsuperscript{121.} 282 Or. 61, 577 P.2d 1322 (1978) (en banc).

\textsuperscript{122.} \textit{Id. at} ______, 577 P.2d at 1324. Carburetor icing is one potential cause of engine failure. Icing can occur when the vaporization of fuel, combined with the expansion of air as it flows through the carburetor, causes a sudden cooling of the mixture of fuel and air. The drop in temperature can be as severe as 60° F within a fraction of a second. When this cooling occurs, water vapor in the air is “squeezed out” and, if the temperature in the carburetor reaches 32° F or below, the moisture is deposited as frost or ice inside the carburetor passages. Even a slight accumulation of this ice reduces power and may lead to complete engine failure, particularly when the throttle is partly or fully closed. \textit{Federal Aviation Administration, Pilot’s Handbook of Aeronautical Knowledge} 42 (rev. ed. 1980).

\textsuperscript{123.} 282 Or. at _______, 577 P.2d at 1324.

\textsuperscript{124.} \textit{Id. at} _______, 577 P.2d at 1325 (quoting Phillips v. Kimwood Mach. Co., 269 Or. 485, 494, 525 P.2d 1033, 1037 (1974)).

\textsuperscript{125.} \textit{Id. at} _______, 577 P.2d at 1327.
however, after noting that the plaintiffs had presented no evidence showing what effect the alternative system would have had "upon the airplane's cost, economy of operation, maintenance requirements, over-all performance, or safety." More importantly, the Oregon court, like the Tenth Circuit in *Bruce*, placed great weight on the manufacturer's compliance with FAA regulations regarding carburetor icing and the manufacturer's reliance on the FAA's determination that carbureted engines were not dangerous:

> Although we have held that compliance with the FAA safety standards does not preclude the possibility of liability for a design defect, we nevertheless believe that in a field as closely regulated as aircraft design and manufacture, it is proper to take into consideration . . . the fact that the regulatory agency has approved the very design of which [the plaintiffs] complain after considering the dangers involved.\(^\text{127}\)

Based largely on this compliance with federal requirements, the court held that the plaintiffs "did not produce sufficient evidence that a reasonably prudent manufacturer who was aware of the risks of carburetor icing would not have designed this model of aircraft with a carbureted engine, or that substitution of a fuel injected engine was practicable." \(^\text{128}\)

In a concurring opinion, Justice Linde advocated the expanded use of federal aircraft regulatory standards in design defect cases. According to Justice Linde, the factors that the FAA uses to judge the safety of an aircraft design are similar to the factors that the court applied in its risk-utility analysis. \(^\text{129}\) Justice Linde stated that, because the FAA subjects product designs to performance standards, government supervised testing, and safety approval, a court cannot find a product design "unreasonably dangerous" unless the plaintiff can prove either that the regulatory scheme does

\(^{126}\) *Id.*

\(^{127}\) *Id.* at ___, 577 P.2d at 1328. The court cited the 1976 and 1977 revisions of two FAA regulations: 14 C.F.R. § 23.1093 and 14 C.F.R. § 33.35. *Id.* at ___ n.4, 577 P.2d at 1328 n.4.

\(^{128}\) *Id.*

\(^{129}\) *Id.* at ___, 577 P.2d at 1334 (Linde, J., concurring). Justice Linde listed the risk-utility factors as "the safety risks, the availability of safer design, the financial and other costs of the safer alternative, and the user's awareness of and ability to avoid the risks." *Id.*
not address the allegedly defective design or that the strict liability standard is more demanding than the regulatory scheme.\textsuperscript{130}

Although the majority agreed with Justice Linde that deference to government standards was appropriate, it did not carry that deference as far. The court acknowledged some grounds for the defendant's contention that lay juries cannot understand the complex and technical questions of aeronautical design and that courts are inherently unsuited to determine problems involving conscious design choices.\textsuperscript{131} Nevertheless, the court rejected the total deference suggested by the defendant and by Justice Linde because it would mean that, "'[i]n the absence of an ability to recover through courts, persons injured by such designs would be without a remedy.'"\textsuperscript{132}

Even the California courts, which first developed the strict liability theory to ensure that plaintiffs injured by defective products receive a remedy\textsuperscript{133} and which now follow a "dual approach" to determining liability for conscious design defects that embodies both consumer expectation and risk-utility concepts,\textsuperscript{134} rely heavily on federal standards in aircraft crashworthiness cases. \textit{McGee v. Cessna Aircraft Co.}\textsuperscript{135} exemplifies the California approach. In \textit{McGee}, the plaintiff had sustained severe burns in a post-crash fire.\textsuperscript{136} She alleged that the defendant had designed an uncrashworthy airplane because the fuel system had been designed for gravity feed from the wings to an "accumulator" tank, the top of which served

\textsuperscript{130.} \textit{Id.} at \textsuperscript{---}, 577 P.2d at 1334-35 (Linde, J., concurring).
\textsuperscript{131.} \textit{Id.} at \textsuperscript{---}, 577 P.2d at 1326 ("We do not underestimate the difficulties involved in this type of litigation."). The plaintiff's arguments, in part, were based on the analysis of conscious design choice issues by Professor James Henderson. See Henderson, supra note 9 (cited in Wilson, 282 Or. at \textsuperscript{---}, 577 P.2d at 1326).
\textsuperscript{132.} 282 Or. at \textsuperscript{---}, 577 P.2d at 1326. Justice Linde also recognized the importance of providing a remedy for injured plaintiffs: "A choice may have to be made between a theory of recovery premised on the need to compensate victims of product-caused injuries and one premised on liability for 'faulty' products, no matter how attenuated the 'fault' has become." \textit{Id.} at \textsuperscript{---}, 577 P.2d at 1335 (Linde, J., concurring).
\textsuperscript{133.} See Greenman v. Yuba Power Prods., Inc., 59 Cal. 2d 57, 377 P.2d 897, 27 Cal. Rptr. 697 (1962) (en banc); \textit{supra} notes 75-78 and accompanying text.
\textsuperscript{134.} See Barker v. Lull Eng'g Co., 20 Cal. 3d 413, 573 P.2d 443, 143 Cal. Rptr. 225 (1978); \textit{supra} note 87.
\textsuperscript{136.} \textit{Id.} at 1008, 147 Cal. Rptr. at 695.
as the cockpit floor. Because the fuel tank had been located at the feet of the aircraft occupants, near the hot engine and the nosewheel, the plaintiff alleged that the fuel system was inherently unsafe.\textsuperscript{137}

On its initial consideration of \textit{McGee}, the California Court of Appeal reversed the trial court's judgment for the defendant because the trial court had instructed the jury only on negligence principles.\textsuperscript{138} The court held that plaintiffs can assert aircraft crashworthiness claims not only based on negligence principles but also based on strict liability.\textsuperscript{139} After remand to the trial court and a second appeal, the California Court of Appeal again reversed a judgment for the defendant.\textsuperscript{140}

The manufacturer's alleged violations of federal crashworthiness requirements,\textsuperscript{141} and the effect of those violations on the plaintiff's burden of proof, were a significant focus of the court's opinion in the second appeal. The court noted that, under California law, violations of statutes, ordinances, and regulations constitute negligence per se. Under the negligence per se doctrine, an injured plaintiff who falls within the class that a particular law was designed to protect must prove only that the defendant violated the law in order to recover. Once a plaintiff makes this proof, the burden shifts to the defendant to prove that the violation did not

\begin{itemize}
  \item \textsuperscript{137} \textit{Id. at 1007-10, 147 Cal. Rptr. at 695-96}. This design had exacerbated the occupants' injuries, according to the plaintiff, because the aircraft's nonretractable nosewheel strut had penetrated the fuel accumulator on the passenger side of the firewall, causing the post-crash fire. \textit{Id. at 1009, 147 Cal. Rptr. at 696.}
  \item The plaintiff also alleged that the defendant's failure to install a shoulder harness had caused her to be thrown forward during the crash, rendering her unconscious and leaving her unable to evacuate the aircraft before the fire. \textit{Id. at \textendash, 147 Cal. Rptr. at 696.}
  \item \textsuperscript{138} \textit{Id. at 1022, 147 Cal. Rptr. at 705}. The trial judge had said:
    
    It is my opinion and I am going to so find that crashworthiness would be a matter of the exercise of care by a manufacturer in putting his product on the market so as to avoid any injury that might result in the use of the product in the event of a crash. And the more logical and realistic approach would be one of negligence and not strict liability.
  \item \textsuperscript{139} \textit{Id. at 1017, 147 Cal. Rptr. at 701.}
  \item \textsuperscript{140} \textit{139 Cal. App. 3d at 194, 188 Cal. Rptr. at 552.}
  \item \textsuperscript{141} The plaintiff alleged that the manufacturer had violated 14 C.F.R. \textsection{23.1191} (specifications for aircraft firewalls) and 14 C.F.R. \textsection{23.561} (specifications for protection of occupants in emergency landing conditions). \textit{139 Cal. App. 3d at 185, 188 Cal. Rptr. at 546-47.}
\end{itemize}
proximately cause the plaintiff's injury. According to the court, "A Federal Aviation Safety Regulation is entitled to as much weight as a statute, ordinance or regulation." As a result, the court concluded that once the plaintiff proved that the defendant "violated the [federal regulation] and the injury resulted from an occurrence which it was designed to prevent, . . . the only issue remaining [was] whether the violation . . . proximately caused the injury."

Like the courts in Bruce and Wilson, the court in McGee used federal regulatory standards to avoid creating its own safety standards for measuring liability. In contrast to the courts in Bruce and Wilson, however, the California court did not demonstrate any reluctance to hold a manufacturer liable for a conscious design choice. This lack of reluctance probably stems from California's approach to strict liability, which only requires a plaintiff to show that the design of the product proximately caused his injuries and leaves to the defendant the burden of proving that the product was not defective.

**Determination of Appropriate Standards in Aircraft Crashworthiness Cases**

**Federal Standards**

As the above discussion demonstrates, courts deciding aircraft crashworthiness cases rely heavily on federal aviation regulations as a standard to measure liability. The most important of these

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142. See 139 Cal. App. 3d at 186, 188 Cal. Rptr. at 547.
143. Id. at 186-87, 188 Cal. Rptr. at 547.
144. Id. at 187, 188 Cal. Rptr. at 547.
145. See McGee, 139 Cal. App. 3d at 187, 188 Cal. Rptr. at 548 (quoting Barker v. Lull Eng'g Co., 20 Cal. 3d 413, 431, 573 P.2d 443, 455, 143 Cal. Rptr. 225, 237 (1978)) ("[O]nce the plaintiff makes a prima facie showing that the injury was proximately caused by the product's design, the burden should appropriately shift to the defendant to prove, in light of the relevant factors, that the product is not defective."); supra note 87.
146. See supra notes 110-45 and accompanying text. Courts consider these regulations only as evidence and not as the sole determinant either of the reasonableness of the manufacturer's conduct or of the defectiveness of the product. See, e.g., Bruce v. Martin-Marietta Corp., 544 F.2d 442, 446 (10th Cir. 1976); Wilson v. Piper Aircraft Corp., 282 Or. 61, 577 P.2d 1322, 1324-25 (1978) (en banc). This "evidence" however, can be very persuasive. Bruce and Wilson, for example, demonstrate the importance of compliance with federal regulations as a factor excusing a manufacturer from liability. See supra notes 110-32 and
regulations are the minimum aircraft design standards that the Federal Aviation Administration has promulgated pursuant to its statutory duty to promote safety. Some of these federal aviation regulations, which are commonly referred to as "FARs," address aircraft crashworthiness concerns such as emergency exits, restraint systems, and compartment interiors. In spite of their relevance, however, the FARs do not function effectively as standards of liability in aircraft crashworthiness cases for several reasons.

First, the FARs are unsatisfactory because they are out of date. As one commentator has noted: "Regarding airplane crashworthiness, [the National Transportation Safety Board] has concluded that current FARs are outdated in that they fail to reflect very significant findings in FAA and industry studies over the last three decades." Because the FARs do not reflect advancements in the state of the art, a court applying them may determine an aircraft manufacturer's liability based on the state of the art that existed thirty years ago. To be an effective standard of liability, the regulations governing this dynamic industry must be updated constantly.

Second, the FARs governing aircraft crashworthiness are unsatisfactory because they are vague. One FAR, for example, stipulates that the aircraft "structure must be designed to give each
occupant every reasonable chance of escaping serious injury in a minor crash landing."\textsuperscript{154} This type of regulation provides little guidance to a court attempting to determine an aircraft manufacturer's liability. This shortcoming is particularly troubling because it is unlikely to improve in the future. The FAA purposely has promulgated vague standards to give aircraft manufacturers flexibility to solve unanticipated design problems. Such flexibility is imperative because the design of an aircraft involves many trade-offs and the FAA cannot anticipate all the design problems associated with a particular aircraft.

Finally, the FARs are unsatisfactory as a standard of liability because they establish only "minimum" standards.\textsuperscript{155} Because an aircraft manufacturer's compliance with a minimum standard does not prove that the manufacturer's design provided adequate crashworthiness protection for occupants, courts should not regard that compliance as conclusive concerning liability unless the legislative history of that standard explicitly requires courts to do so.\textsuperscript{156}

**Judicial Standards**

The only available alternative seemingly is to have the courts develop their own safety standards to measure an aircraft manufacturer's liability.\textsuperscript{157} Unfortunately, this alternative has its own shortcomings. For example, uniformity is completely destroyed when courts attempt to create their own standards. Without this uniformity, manufacturers suffer because they cannot determine which safety standards to apply to their designs.\textsuperscript{158}

\begin{itemize}
\item \textsuperscript{154} 14 C.F.R. § 23.561(b) (1985).
\item \textsuperscript{155} See 49 U.S.C. § 1421(a)(1) (1982) (providing that FAA design standards are "minimum" standards only).
\item \textsuperscript{156} See Wilson v. Piper Aircraft Corp., 282 Or. 61, ———, 577 P.2d 1322, 1324-25 (1978) (en banc).
\item \textsuperscript{157} Cf. id. at 1334-35 (Linde, J., concurring) ("It must be kept in mind that this aircraft is alleged to be defective not because it fell short of the safety standards set for its type, but on the ground that these standards provide insufficient safety for the whole series.").
\item \textsuperscript{158} See Haskell, The Aircraft Manufacturer's Liability for Design and Punitive Damages—The Insurance Policy and the Public Policy, 40 J. Air. L. & Com. 595, 606-07 (1974); Saba, supra note 12, at 302; infra notes 172-74 and accompanying text.
\end{itemize}
AN EFFECTIVE ALTERNATIVE FOR DETERMINING AIRCRAFT CRASHWORTHINESS LIABILITY

The difficulties associated with determining appropriate standards cannot be allowed to prevent effective assertion of liability against manufacturers for failure to design crashworthy aircraft. Both individuals and society benefit in at least three ways when plaintiffs assert crashworthiness claims against manufacturers: first, claims provide an avenue of relief to plaintiffs; second, judgments against manufacturers provide incentives to design more crashworthy aircraft; and third, claims increase pressure on the FAA to promulgate more rigid safety standards. As a result, some effective alternative must be found.

Present Mechanisms

Currently, the only mechanisms besides the courts that tend to force manufacturers to produce crashworthy aircraft are marketplace incentives and regulations promulgated by administrative

159. See, e.g., supra note 132 and accompanying text; Henderson, supra note 9, at 1558. 160. See Phillips v. Kimwood Machine Co., 269 Or. 485, —, 525 P.2d 1033, 1041-42 (1974). Adverse judgments often have only an indirect deterrent effect because the manufacturers' insurance companies usually pay any judgments. Deterrence still is accomplished, however, because the manufacturer is faced with a rise in premiums for product liability insurance. But see Plant, Strict Liability of Manufacturers for Injuries Caused by Defects in Products—An Opposing View, 24 TENN. L. REV. 938, 945 (1957) (arguing that manufacturers are just as careful in the absence of these incentives because they need to safeguard their valuable reputations).

161. For example, the FAA acted promptly after the crash of a DC-10 in May 1979 that killed all its passengers. Investigators suspected that the crash was caused by a design defect in the engine attachment. In response, the FAA quickly issued a series of directives calling for inspection and grounding of DC-10's. Wall St. J., June 7, 1979, at 1, col. 3. But see Note, supra note 8, at 1605-06 (discussing several examples which illustrate the FAA's failure to respond adequately to safety needs).

162. See Note, supra note 8, at 1608-16. The marketplace places economic incentives on manufacturers that may or may not encourage crashworthy design. Presumably, manufacturers perform cost-benefit analyses to predict the degree of crashworthiness that should be incorporated into particular aircraft designs. These analyses weigh the cost of crashworthiness improvements against the willingness of purchasers to pay for them. Manufacturers also must consider additional costs, such as liability claims and federal regulations governing designs. After these analyses, manufacturers select the level of crashworthiness that properly balances costs against benefits.

Whether this theory actually works is questionable. In any event, this Note will not examine marketplace theory in detail because the Note's primary focus is the judiciary's role in determining liability for a manufacturer's design choices.
agencies pursuant to congressional authority.\textsuperscript{163} Neither of these mechanisms, however, provides an effective alternative to the judicial imposition of liability.\textsuperscript{164} Unfortunately, the judiciary also is not an effective mechanism in the area of aircraft crashworthiness because courts generally are not well qualified or well suited to adjudicate liability for conscious design choices involving aircraft crashworthiness for at least four reasons.\textsuperscript{165}

First, courts are not qualified technically to adjudicate claims concerning conscious design choices because these claims place the aircraft design in issue. Inquiry into the design of an aircraft forces courts and juries to absorb the enormous amounts of technical information involved in aircraft design.\textsuperscript{166} Even if a court or jury is capable of understanding this information, it still must face the difficult task of balancing the costs and benefits of alternative designs to determine whether the manufacturer subjected the plaintiff to an unreasonable risk of injury in a survivable accident.\textsuperscript{167} The numerous engineering trade-offs involved in aircraft design make this determination particularly difficult for lay persons. As one commentator has noted:

\begin{quote}
[\textit{A}ny design engineer will concede that the design of any product involves a series of compromises. If the cockpit windows of an aircraft are enlarged to create better visibility, as one simple example, the fuselage shell may be weakened, or other cockpit
\end{quote}

\textsuperscript{163} See \textit{supra} notes 147-50 and accompanying text. Other forces also may operate to encourage the incorporation of crashworthiness features into aircraft design. For example, manufacturers are aware that a major disaster involving a particular type of aircraft may lead passengers to inquire about the type of aircraft on which they will be flying and to avoid the type of aircraft that was involved in the disaster. Many such inquiries occurred after the well-publicized DC-10 crash in Chicago, Illinois in May 1979. See \textit{Wall St. J.}, June 6, 1979, at 2, col. 2.

\textsuperscript{164} See \textit{supra} notes 151-56 and accompanying text; \textit{supra} note 162. \textit{But see} Comment, \textit{supra} note 70, at 1129. ("[T]he complexity of aircraft design decisions dictates that the FAA, rather than the courts, should assume primary responsibility for developing adequate aircraft safety standards.").

One problem with these mechanisms is that they do not necessarily determine the amount of crashworthiness that would be the most economically efficient or the most appropriate for a particular aircraft. See \textit{Note, supra} note 8.

\textsuperscript{165} See Henderson, \textit{supra} note 9.

\textsuperscript{166} See \textit{supra} note 7 and accompanying text; \textit{see also} \textit{supra} notes 12-39 and accompanying text (describing the relevant considerations).

design problems, such as instrument visibility, would be created. If the fuselage is then strengthened, the resultant weight gain and decreased load-carrying capability or resultant inaccessibility may then make the aircraft dangerous or unmarketable. This is but one small example of the thousands of decisions and judgments which any design engineer must make in the design of any aircraft. To permit a lay jury to "second guess" all design decisions years later in products litigation . . . results in an unwarranted expansion of an aircraft manufacturer's liability.

... [Such an inquiry is] an invitation to substitute hindsight, inconsistency, sympathy, and speculation in place of the overall balancing in the public interest of the social and economic questions involved in all aircraft design. 168

Second, judicial determinations regarding aircraft crashworthiness often are unsound because of the tendency of courts and juries to concentrate unrealistically on one aspect of an aircraft's design when they should consider all aspects of the design. 169 This tendency causes problems even in automobile crashworthiness cases, as the California Court of Appeal has recognized: "We are also well aware that prosecution of a lawsuit is a poor way to design a motor vehicle, for the suit will almost invariably emphasize a single aspect of design to the total exclusion of all others." 170 When the much more complex and often conflicting considerations associated with aircraft design 171 are involved, this problem becomes even greater.

Third, judicial resolution of crashworthiness issues is inappropriate because courts seem incapable of developing the single objective standard for determining design defects in aircraft.

168. Haskell, supra note 158, at 601-02, 607; see supra note 22; see also supra notes 13-16 and accompanying text (describing some of the conflicting considerations involved in aircraft design).


171. See G. Deakley & E. Chilton, Design Serving the Needs of Man 170-266 (1974); supra notes 12-39 and accompanying text.
crashworthiness cases that manufacturers must have to guide their conduct.\textsuperscript{172} As one commentator put it:

The manufacturer \ldots cannot even make an educated guess—much less accurately predict—as to what course of action will reasonably assure him that another jury will not again hold him liable. For example, assume a manufacturer is held liable on the basis that injuries were caused or aggravated by a seat of insufficient crashworthiness. That does not tell the manufacturer how crashworthy he ought to make the next seat, for the circumstances of the next accident will be different, and may well be experienced under more severe conditions than the accident in question. Unless one takes the position that a seat should be designed so that it should adequately protect the occupant under the circumstances of every possible accident, regardless of severity, the manufacturer's dilemma is obvious.\textsuperscript{173}

The implications of the lack of a uniform standard extend even beyond manufacturers. This shortcoming also affects jurors who, without the technical expertise necessary to determine what constitutes "reasonably safe" crashworthiness design, will tend to engage in speculation.\textsuperscript{174}

Fourth, and finally, judicial resolution of aircraft crashworthiness claims wastes judicial and financial resources. Litigants in aircraft crashworthiness cases must bring in expert witnesses to testify concerning technical issues at a very high cost.\textsuperscript{175} In addition, attorney fees are very high because of extensive discovery and lengthy trials.\textsuperscript{176} Litigants in large aircraft crash cases cannot reduce these costs by bringing class actions because the need to

\textsuperscript{172} See Haskell, supra note 158, at 606-07; Saba, supra note 11, at 302; supra note 158 and accompanying text.


\textsuperscript{174} See Haskell, supra note 158, at 607.

\textsuperscript{175} See L. Kreindler, Aviation Accident Law § 39.06, at 3 (1971).


\textsuperscript{177} See, e.g., Friends for All Children v. Lockheed Aircraft Corp., 725 F.2d 1392 (D.C. Cir. 1984) (litigation involving a 1976 aircraft crash had not been concluded in 1984). The length and cost of aircraft crashworthiness cases also is increased by the difficult choice of law questions that often arise in these cases because of the numerous residences of the plaintiffs. See In re Air Crash Disaster of Washington, D.C., 599 F. Supp. 333, 335 (D.D.C. 1983).
adjudicate damages separately for each plaintiff makes class actions inappropriate. The inability to bring class actions wastes valuable court time, ultimately imposing additional costs on the public because courts are kept from hearing other cases on their dockets.

In short, the judiciary is not the proper body to review the highly technical aircraft crashworthiness choices made by large, diversified groups of highly trained engineers who have made many difficult decisions involving complex and often conflicting design considerations. Judicial resolution of aircraft crashworthiness claims places the review of engineering design decisions and the determination of aircraft manufacturers' liability in the hands of a small number of laypersons—the jury. Aircraft crashworthiness design standards should not be determined in this way.

An Alternative Proposal

An alternative adjudicative body composed of existing governmental agencies and aircraft manufacturers could do a far better job. This Note proposes the formation of such a panel to determine the reasonableness of manufacturers' designs when crashworthiness disputes arise. The panel should include representatives from the Federal Aviation Agency, the National Transportation

178. See, e.g., McDonnell Douglas Corp. v. United States District Court for the Central District of California, 523 F.2d 1083 (9th Cir. 1975) (writ of mandamus issued ordering district court to vacate certification of class action involving multiple claimants in large aircraft crash disaster). Multidistrict litigation procedures have mitigated this problem somewhat. See Speiser, supra note 176.

179. The design of an aircraft typically involves coordination between several groups of engineers. For example, aircraft manufacturers often employ a structures group composed of metallurgical and structural engineers, an aerodynamics and performance group consisting of aerospace engineers, a weights group made up of weight engineers, a quality control group composed of industrial engineers, and an avionics group consisting of electrical engineers. Design trade-offs must be made within each group and between groups because of the numerous considerations involved in the development of safe, efficient, and reliable aircraft and the frequent conflict between these considerations. See supra notes 12-39 and accompanying text.

180. The FAA could participate pursuant to its duty and power “to promote safety of flight of civil aircraft” by prescribing minimum design standards, inspections, and testing. 49 U.S.C. § 1421(a) (1982).
AIRCRAFT CRASHWORTHINESS

Safety Board, and the National Aeronautics and Space Administration, who would work with representatives of aircraft manufacturers to promulgate compulsory minimum aircraft crashworthiness standards. The crashworthiness design standards not only should be up-to-date, clear, and precise, but also should be sufficiently flexible to allow manufacturers to solve unanticipated design problems.

This panel also would be responsible for adjudicating manufacturers' liability in aircraft crashworthiness cases. The panel would resolve these cases in formal adjudicative hearings similar to those conducted by other governmental agencies, and it would concentrate on whether the particular aircraft manufacturer complied with the compulsory crashworthiness standards. A finding of compliance with these standards would be conclusive evidence that the aircraft was crashworthy. A finding that the manufacturer failed to comply with these standards, however, would subject the manufacturer to liability under a negligence per se doctrine. If the panel found a manufacturer liable in this manner, it would refer the matter to the courts for determination of damages because of the courts' superior experience and knowledge concerning damage issues.

181. The NTSB could participate pursuant to its duty "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations," id. § 1901(1), or its duty to conduct aircraft accident investigations to "determine the facts, conditions, and circumstances and the cause or probable cause" of aircraft accidents, id. § 1903(a)(1).

182. NASA could participate pursuant to its duty to improve "the usefulness, performance, speed, safety, and efficiency of aeronautical ... vehicles," 42 U.S.C. § 2451(c)(2) (1982), or its duty to maintain "[t]he most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies," id. § 2451(c)(8).

183. The panel would promulgate these rules in a manner similar to any other agency. These procedures should include notice and comment requirements, as well as provisions for formal hearings that would give all interested parties ample opportunity to be heard. See 5 U.S.C. §§ 553, 556 (1982).

184. See supra notes 151-54 and accompanying text.

185. See supra text following note 154.


187. See supra note 142 and accompanying text; W. Prosser, supra note 43, at 200-01.

188. The panel's decision concerning liability would be binding on the courts in a manner similar to res judicata. See United States v. Utah Constr. & Mining, 384 U.S. 394, 421-22 (1966) ("When an administrative agency is acting in a judicial capacity and resolves disputed
Application of this proposal to a hypothetical crashworthiness claim arising from an actual commercial aircraft accident demonstrates how the panel would adjudicate liability. The hypothetical claim arises from the 1983 crash of Air Canada Flight 797. This crash involved a McDonnell-Douglas DC-9, which was en route to Toronto when the cabin crew discovered smoke in the rear lavatory. The smoke forced the crew to make an emergency landing at the Greater Cincinnati International Airport. The flight attendants and passengers immediately opened all the doors of the aircraft. About sixty to ninety seconds after the exits were opened, a flash fire engulfed the aircraft interior. Twenty-three of the forty-one passengers died in the fire because they were not able to escape the aircraft. The National Transportation Safety Board investigators discovered that the fire had burned undetected in the lavatory for almost fifteen minutes before the cabin crew detected the smoke.

Crashworthiness claims arising out of this accident would question whether the aircraft design adequately reduced or eliminated post-crash fire hazards. In adjudicating these claims, the proposed panel would have to decide whether the manufacturer followed the panel’s standards pertaining to aircraft fires. The panel would conduct a formal adjudicative hearing to decide this issue. The hearing would include the manufacturer, the airline, the claimants, and any other interested parties. The panel would determine only the liability issue. If it found the manufacturer liable, the claimants would proceed to court for a determination of damages. If the panel exonerated the manufacturer, the claimants would be entitled to judicial review of the agency decision. Judicial review, however, probably would not result in reversal of the panel’s decision because courts give strong deference to agency decisions.

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190. Id. at 69.
191. See supra notes 29-36 and accompanying text.
192. See supra note 186 and accompanying text.
193. In fact, the courts’ deference closely resembles res judicata. See supra note 188.
This alternative proposal would provide several benefits. First, the governmental agencies and manufacturers sitting on the panel would have the technical expertise necessary to understand the numerous design trade-offs involved in aircraft design. In contrast to the judiciary's focus on only one or two aspects of the design, the panel would consider the overall design of the aircraft to determine the reasonableness of its design. Second, the proposal would give aircraft manufacturers clear, objective, and uniform guidelines to regulate future design safety decisions. These guidelines would eliminate the unfairness to the manufacturer inherent when courts second-guess design safety decisions long after the aircraft was manufactured. Third, the proposal would significantly reduce the excessive public and private costs and the waste of judicial resources currently associated with protracted litigation of complex aircraft crashworthiness claims.

The proposal would achieve these benefits without sacrificing the ability of aircraft crash victims to obtain proper compensation when a manufacturer fails to design reasonably crashworthy aircraft. Compensation of injured plaintiffs will continue to be the paramount goal of the system. In fact, the potential for compensating deserving plaintiffs would improve in many cases. In short, the proposal would eliminate the problems inherent in the present system of aircraft crashworthiness claim adjudication, while preserving victims' rights to be compensated.

194. See supra notes 169-71 and accompanying text.
195. See supra notes 172-74 and accompanying text.
196. See supra notes 175-78 and accompanying text.
197. See supra notes 109 & 132 and accompanying text.
198. For example, a crash victim who was injured because an aircraft manufacturer did not incorporate modern crashworthiness design advancements into the aircraft the victim was riding might not recover under the current system of judicial claim determination. In this situation, the manufacturer might be able to prove compliance with all current regulations because the regulations would not reflect modern advancements. See supra notes 151-52 and accompanying text. Given the current judicial deference to federal standards, this proof of compliance might preclude liability. See supra note 146 and accompanying text. The proposed panel, however, would have both the duty and the technical expertise to include all modern advancements in its standards. As a result, an injured plaintiff could recover from any manufacturer that did not incorporate these advancements into its aircraft design.
CONCLUSION

The present method of adjudicating aircraft crashworthiness issues through the judicial process is inadequate. Neither the courts nor lay juries have the technical expertise to decide the complex issues involved in aircraft crashworthiness design. Adjudication of such issues also wastes valuable judicial resources and is unfair to manufacturers. Current federal aircraft crashworthiness standards are equally unsatisfactory because they are out of date and vague, and because they establish only a minimum standard. These standards fail to give courts any meaningful guidance in deciding complex aircraft crashworthiness issues.

This Note recommends an alternative adjudicative body to determine the reasonableness of manufacturers' designs when crashworthiness issues are involved. The panel's purpose would be both to establish new aircraft crashworthiness standards and to adjudicate liability in cases involving aircraft crashworthiness issues. Failure to comply with a standard would subject a manufacturer to liability. This proposal would eliminate the problems that courts currently face, while preserving victims' rights to be compensated for their losses.

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