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Aircraft Designs Subjected to FAA Special Certification Review - Mitsubishi MU-2 and Beechcraft Bonanza: The Role of the SCR in Aircraft Design Certification and Implications on Federal Preemption

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AIRCRAFT DESIGNS SUBJECTED TO FAA SPECIAL CERTIFICATION REVIEW—MITSUBISHI MU-2 AND BEECHCRAFT BONANZA: THE ROLE OF THE SCR IN AIRCRAFT DESIGN CERTIFICATION AND IMPLICATIONS ON FEDERAL PREEMPTION

THOMAS N. TARNAY

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I. INTRODUCTION

COMMERCIAL JET airline service has been commonplace for more than thirty years. While the occasional accident can send a wave of trepidation through the air traveler community, most of us probably do not question the basic soundness of the design of the aircraft we ride. China Airlines flight 583, on April 6, 1993, from Beijing to Los Angeles, however, caused the Federal Aviation Administration (FAA) to question the design of the McDonnell Douglas MD-11 commercial transport.¹ While flying at cruise altitude about five hours into a trans-Pacific flight, the aircraft unexpectedly began to pitch up and down with $\pm 2g$ forces,² throwing unbelted passengers around the cabin for over a minute. Ultimately, "[t]wo passengers died of head injuries, one was paralyzed, and one flight attendant suffered severe brain damage," and of the 255 total passengers, sixty sustained serious injuries.³ As a result of this and other MD-11 incidents, the FAA instituted a "special certification review" (SCR) of the MD-11 "center[ing] on the aircraft's high-altitude handling characteristics."⁴ Investigation revealed that the trouble started with an inadvertent slat deployment during cruise.⁵ When the aircraft pitched up in response to the slat deployment, the pilot over-controlled in his push forward control response.⁶ The ensuing pilot-induced-oscillation was the source of ninety seconds of porpoising flight.⁷ While the source of the oscillation was the pilot, the explanation for the upset lay with the lateral stability of the aircraft and light control forces—both functions of the aircraft design.⁸

¹ NATIONAL TRANSP. SAFETY BD., AIRCRAFT ACCIDENT REPORT, NTSB/AAR-93/07, INADVERTENT IN-FLIGHT SLAT DEPLOYMENT, CHINA EASTERN AIRLINES FLIGHT 583, 950 NAUTICAL MILES SOUTH OF SHEMYA, ALASKA, APRIL 6, 1993 (1993) [hereinafter NTSB/AAR-93/07].

² The acceleration of gravity is called one "g" and is equal to 9.8 meters/sec² of acceleration. A pitch "force" of plus 2g's would cause a person to feel twice as heavy as normal.

³ Peter Garrison, *High-Altitude MD-11 Upset Is Disastrous*, FLYING, May 1994, at 52.

⁴ Edward H. Phillips, *NTSB: Pilots Need Training for High-Altitude Stalls*, AVIATION WK. & SPACE TECH., Feb. 21, 1994, at 43.

⁵ NTSB/AAR-93/07, *supra* note 1, at 1.

⁶ Garrison, *supra* note 3, at 52.

⁷ *Id.*

⁸ Most civil aircraft are designed to be statically stable so that active control is not required to maintain a flight altitude. The FAA has certification requirements pertaining to stability, and an aircraft's stability characteristics are examined during certification. Due to conscious design choices, the MD-11

As illustrated with the MD-11 situation, when warranted, the NTSB can recommend, and the FAA can institute, an SCR of an aircraft design. These certification reviews are instituted only rarely, usually following an unexplained accident or a series of accidents with similar circumstances.⁹ Although the design of the particular aircraft has been previously certified under all applicable FAA regulations, in SCR investigations the design is

"operates in the cruise regime with less stability margin than some other transport category airplanes. DAC [Douglas Aircraft Corporation] refers to this as 'relaxed stability.'" NATIONAL TRANSP. SAFETY BD., AIRCRAFT INCIDENT REPORT, NTSB/AAR-94/02, IN-FLIGHT TURBULENCE ENCOUNTER AND LOSS OF PORTIONS OF THE ELEVATORS CHINA AIRLINES FLIGHT CI-012 20 (1994) [hereinafter NTSB/AAR-94/02]. The MD-11 design review revealed that the light control inputs by the pilot could "produce larger than desired flight loads unless the pilots are very careful" and that "there are no certification tests or objective measures to specifically assess the airplane's susceptibility to pilot overcontrol." *Id.*

It may surprise some readers to learn that the basic airworthiness of a large passenger aircraft, like those regularly used by U.S. carriers for daily commercial flights, can suddenly come into doubt, as here with the MD-11. The MD-11, however, is not the first heavy transport aircraft to be subject to an SCR. In 1979, all McDonnell Douglas DC-10 series aircraft were grounded following the crash of American Airlines flight 191 which went down just 31 seconds after departing from Chicago's O'Hare field. David M. North, *DC-10 Type Certificate Lifted*, AVIATION WK. & SPACE TECH., June 11, 1979, at 47. In that crash, 259 passengers, 13 crew members, and 3 persons on the ground were killed after the left wing mounted engine separated from its attachment during the takeoff roll, critically damaging control systems in the process. *Id.* Not only were all DC-10s grounded, the FAA Administrator issued an emergency order suspending the type certificate for the DC-10. NATIONAL TRANSP. SAFETY BD., AIRCRAFT ACCIDENT REPORT, NTSB/AAR-79/17, AMERICAN AIRLINES, INC., DC-10-10, N110AA, CHICAGO-O'HARE INTERNATIONAL AIRPORT, CHICAGO, ILLINOIS, MAY 25, 1979 47 (1979) [hereinafter NTSB/AAR-79/17]. Suspending the type certificate of the DC-10 was nearly unprecedented in 1979. David M. North, *Conquest Certification Review Planned*, AVIATION WK. & SPACE TECH., Nov. 28, 1977, at 19. An FAA official commented during the Cessna Conquest investigation in 1977 that he was only aware of two other instances where an aircraft certification had been revoked—these were the McDonnell Douglas DC-6 and the Lockheed Model 049 Constellation. *Id.* The emergency order over the DC-10 was eventually lifted when the formal investigation showed that the aircraft met the requirements for the type certificate and concluded that "the certification of the DC-10 was carried out in accordance with the rules in effect at the time." NTSB/AAR-79/17, *supra*, at 47-58. The DC-10 is a large, "wide-body" transport, over 181 feet long, with a wing span of 155 feet and a maximum take off weight of 455,000 pounds. JANE'S ALL THE WORLD'S AIRCRAFT 1986-87 457 (Jane's Publishing Co. Ltd. 1987) [hereinafter JANE'S]. It was originally certified in 1971. *Id.* at 456. The DC-10 aircraft are still in wide use today.

⁹ David M. North, *NTSB Urges MU-2 Certification Review*, AVIATION WK. & SPACE TECH., Sept. 12, 1983, at 60. In researching this article, the author found less than 15 aircraft models mentioned in all the literature reviewed that had been subject to an SCR.

again subjected to testing, documentation, and evaluation to confirm the safety of the design and conformance with certification criteria. The aircraft may be grounded or subject to operational limitations during the course of the SCR. One of the more recent SCR investigations involved the ATR-72 commuter aircraft.¹⁰ Other designs that have been subject to an SCR include the Robinson R22/44 helicopters; designs certified under Part 23¹¹ such as the Mitsubishi MU-2, the Piper Malibu, the Beechcraft Bonanza, and the Cessna 441 Conquest; as well as designs certified under Part 25 such as the Douglas DC-10 and Douglas MD-11. In nearly all of the SCR cases reviewed, the aircraft design was vindicated following the investigation without finding any fundamental design flaws.¹²

One main purpose of this Comment is to explain and explore the SCR—a little known weapon in the FAA regulatory arsenal—and to illustrate how the SCR fits into the overall federal aviation regulatory picture. Specific areas of interest include how the SCR fits into the aircraft certification/airworthiness puzzle; how the SCR process impacts pilot certification and training; under what circumstances the FAA may institute an SCR; and the impact on aircraft designs that have come under the SCR scrutiny. An additional legal question raised is whether the SCR process impacts federal preemption in the area of aviation law and aircraft design certification.

This Comment reviews the extent of regulations pertaining to aircraft design, certification, and production and explains how the SCR fits into the total picture of initial and ongoing government regulation over aircraft design and operation. Also provided is some background on the accident histories of two aircraft models to illustrate how those accidents or circum-

¹⁰ The ATR-72 was the type of aircraft involved in the American Eagle fatal crash near Chicago on October 31, 1994. Following that accident, the FAA banned flights into actual or forecasted icing conditions while icing characteristics were being studied. Ramon Lopez & Gilbert Sedbon, *ATR Says Ice Tests Show No Danger with ATR 72*, FLIGHT INT'L, Jan. 4, 1995. The Avions de Transport Regionale consortium (ATR) is the consortium that builds the ATR. The consortium consists of France's Aerospatiale and Italy's Alenia. Edward H. Phillips, *NTSB Studies Jetstream Crash, ATR Icing Data*, AIR TRANSPORT, Jan. 2, 1995, at 28.

¹¹ The sections of FAA regulations that pertain to airworthiness standards for normal, utility, and acrobatic category airplanes are 14 C.F.R. §§ 23.1-1589, app. A-I (1996). These sections are referred to collectively as "Part 23." Other sequences of regulations from 14 C.F.R. pertaining to other subjects are also referred to by their respective "Part."

¹² See *infra* part III (reviewing SCR investigations into various aircraft types).

stances brought those designs under SCR examination. Finally, the question of federal preemption in the area of aircraft design is analyzed. This preemption analysis includes a historical look at cases raising federal preemption in aircraft design and discusses the argument that the existence of the SCR process and FAA reexamination power is evidence of an intent that state action was to be preempted by the federal aviation laws.

II. AIRCRAFT DESIGN AND PRODUCTION CERTIFICATION

A. AIRCRAFT CATEGORIES, CLASSES, AND DEFINITIONS

Aircraft are classified by category, class, and type, and regulations pertaining to aircraft design, production, and operation are segregated according to these classification divisions.¹³ The largest division is the "category" which differentiates the aircraft principally on the means of obtaining lift. The categories of aircraft include: lighter-than-air, glider, rotorcraft, and airplane.¹⁴ Lighter-than-air aircraft include the balloon, blimp, and dirigible.¹⁵ Gliders are aircraft "whose free flight does not depend principally on an engine."¹⁶ Rotorcraft include both gyroplanes and helicopters. The largest group of aircraft, however, are the airplanes.

A closer distinction between aircraft is achieved by class and type definitions. "Class" of an aircraft means "a classification of aircraft *within a category* having similar operating characteristics."¹⁷ "Type" definitions, "[a]s used with respect to the certifi-

¹³ See, e.g., 14 C.F.R. pt. 23 (airworthiness standards for normal, utility, and acrobatic category airplanes); *id.* pt. 25 (airworthiness standards for transport category airplanes); *id.* pt. 27 (airworthiness standards for normal category rotorcraft); *id.* pt. 29 (airworthiness standards for transport category rotorcraft).

¹⁴ *Id.* § 1.1.

"Category": (1) As used with respect to the certification, ratings, privileges, and limitations of airmen, means a broad classification of aircraft. Examples include: airplane; rotorcraft; glider; and lighter-than-air; and (2) As used with respect to the certification of aircraft, means a grouping of aircraft based upon intended use or operating limitations. Examples include: transport, normal, utility, acrobatic, limited, restricted, and provisional.

Id.

¹⁵ *Id.* "'Lighter-than-air aircraft' means aircraft that can rise and remain suspended by using contained gas weighing less than the air that is displaced by the gas." *Id.*

¹⁶ *Id.*

¹⁷ *Id.* (emphasis added). "Examples include: single engine; multiengine; land; water; gyroplane; helicopter; airship; and free balloon . . . having similar

cation, ratings, privileges, and limitations of airmen, means a specific make and basic model of aircraft, including modifications thereto that do not change its handling or flight characteristics."¹⁸ An additional definition frequently used in the regulations is "large aircraft," which "means aircraft of more than 12,500 pounds, maximum certificated takeoff weight."¹⁹

B. FAA STATUTORY/REGULATORY AUTHORITY OVERVIEW

1. *Federal Regulation over Aircraft and Aeronautics Generally*

The FAA regulates the design, testing, production, operation, and maintenance of civil aircraft in the United States.²⁰ FAA regulations apply to nearly all aircraft including one-of-a-kind prototype aircraft that must receive special "experimental" certification before they can be legally flown.²¹

At one time, the rules and regulations governing the operation of aircraft were rather simple. The 1920 federal regulations for operating aircraft contained only twenty-five one-sentence commandments. The first of these stated: "Don't take the machine into the air unless you are satisfied it will fly."²² Today, however, the rules and regulations pertaining to aircraft are extensive and address most aspects of aircraft design, manufacturing, and operation. The roots of modern aviation regulation started with the Civil Aeronautics Board (CAB) which was created by the Civil Aeronautics Act of 1938.²³

The charter of the regulatory system under the 1938 Act "was very vague . . . [including] 'encouragement and development of an air transportation system properly adapted to . . . present and

characteristics of propulsion, flight, or landing. Examples include: airplane; . . . landplane; and seaplane." *Id.*

¹⁸ *Id.*

¹⁹ *Id.*

²⁰ One type of aircraft exempt from registration and certification requirements are "ultralight" models.

²¹ See 14 C.F.R. § 21.191 (experimental certificates).

²² Regulations for Operation of Aircraft, Commencing 1920, *reprinted in* course outline for Air Law I, by Robert A. Gwinn (1989) (on file at the Underwood Law Library, Southern Methodist University, Dallas, Tex.).

²³ ANDREAS F. LOWENFELD, AVIATION LAW § 1.3, at 1-11 (2d ed. 1981). Originally, the CAB was called the Civil Aeronautics Authority. *Id.* The CAB was incorporated into the Bureau of Air Commerce and the Bureau of Air Mail. 1 PAUL S. DEMPSEY ET AL., AVIATION LAW AND REGULATION § 1.03, at 1-7 (1992). The Act of 1938 superseded the first basic federal aviation statute which was the Air Commerce Act of 1926. The Act of 1926 placed responsibility for the regulation of air commerce on the Secretary of Commerce.

future needs.’”²⁴ Even though the charter was vague, the CAB nevertheless exercised broad regulatory power over most aspects of aviation under this grant. The CAB regulation of aviation continued until the Federal Aviation Act of 1958 created the FAA.²⁵ Among other changes, the 1958 Act reallocated responsibility for air navigation and safety to the newly formed FAA while retaining in the CAB responsibility for the economic regulation of airlines.²⁶ Later, accident investigation and recommendation authorities held by the CAB were transferred to the National Transportation Safety Board (NTSB).²⁷ The NTSB was made an independent organization in 1974 by the Transportation Safety Act of 1974.²⁸ An interesting aspect of the division of power and responsibilities between the NTSB and the FAA is that the NTSB investigates accidents and makes recommendations, but these recommendations do not have the force of law.²⁹

2. *Development of Modern Federal Regulation over Aircraft and Aeronautics*

The FAA exercises regulatory authority over aircraft designs under statutory grant of power to the Department of Transportation.³⁰ The statute provides that “[t]he Administrator of the Federal Aviation Administration shall promote safe flight of civil aircraft in air commerce by prescribing—(1) minimum standards required in the interest of safety for appliances and for

²⁴ LOWENFELD, *supra* note 23, § 1.4, at 1-13 (quoting § 102 of the 1938 Act). This same language was later retained when the Federal Aviation Act of 1958 was adopted.

²⁵ Federal Aviation Act of 1958, Pub. L. No. 85-726, 72 Stat. 731, *repealed by* Pub. L. No. 103-272, § 7(b), 108 Stat. 1379, 1383 (1994) [hereinafter Act of 1958]. Originally the FAA was in the Department of Commerce, but was later moved to the Department of Transportation. 1 DEMPSEY ET AL., *supra* note 23, § 1.04, at 1-10.

²⁶ 1 DEMPSEY ET AL., *supra* note 23, § 1.04, at 1-10.

²⁷ *Id.* § 3.08, at 3-7.

²⁸ *Id.* at 3-7 to 3-8; *see also* Transportation Safety Act of 1974, Pub. L. No. 93-633, 88 Stat. 2167, *repealed by* Pub. L. No. 103-272, § 7(b), 108 Stat. 1379, 1388 (1994).

²⁹ 1 DEMPSEY ET AL., *supra* note 23, § 3.08, at 3-8. The NTSB investigates accidents and recommends to the FAA that an SCR be commenced. *See infra* note 149 and accompanying text (example of this procedure). This procedural approach results from the division of power.

³⁰ 49 U.S.C. § 44701 (1994).

the design, material, construction, quality of work, and performance of aircraft, aircraft engines, and propellers.”³¹

The FAA, and the power delegated to it, were created by the Federal Aviation Act of 1958.³² The background leading to the Act of 1958 is reviewed in House Report 2360 on the proposed bill.³³ In reviewing the legislative intent behind the Act of 1958, two points are emphasized: (1) the legislative rationale for regulating both air traffic and aircraft design safety; and (2) the simultaneous goals of the legislation in both the Act of 1938 and the Act of 1958 of seeking safety while still promoting civil aviation. The original legislative motivation leading to the Act of 1958 is emphasized in House Report 2360 on the bill as “[a]irspace use and air-safety problems” that came “first to general public notice, perhaps, as a result of the midair collision of two airliners over the Grand Canyon on June 30, 1956, when 128 lives were lost.”³⁴ Safety in aircraft design, however, was not principally discussed. In 1955 the President appointed a group known as the Harding Committee³⁵ to “study the nature and seriousness of the air traffic control problem,”³⁶ and in 1958 the President recommended creation of an independent aviation agency.³⁷ While the federal studies were largely instigated by air traffic control concerns, aircraft safety, as related to licensing and certification, was added to the responsibilities of the proposed new agency when the bill was created. The legislative language makes clear that aviation safety was the paramount

³¹ *Id.* § 44701(a).

³² Act of 1958, *supra* note 25.

³³ H.R. REP. NO. 2360, 85th Cong., 2d Sess. (1958), *reprinted in* 1958 U.S.C.C.A.N. 3741.

³⁴ *Id.*, 1958 U.S.C.C.A.N. at 3742.

³⁵ The committee was formed under the Director, Bureau of the Budget, at the request of the President, and was officially known as the Aviation Facilities Study Group. *Id.*

³⁶ *Id.*

³⁷ In that message, the President said:

Recent midair collisions of aircraft, occasioning tragic losses of human life, have emphasized the need for a system of air traffic management which will prevent, *within the limits of human ingenuity*, a recurrence of such accidents.

In this message, accordingly, I am recommending to the Congress the establishment of an aviation organization in which would be consolidated among other things all the *essential management functions* necessary to support the common needs of our civil and military aviation.

Id. (emphasis added).

concern and that a comprehensive framework of air traffic control and aircraft safety regulations was the intended solution.³⁸

Just as control over air traffic and aircraft design was envisioned to work hand-in-hand to achieve safety, House Report 2360 indicates that there were in fact the simultaneous goals of seeking a high degree of safety while encouraging civil aviation generally. House Report 2360 indicates that the "purpose of th[e] legislation" was, in part, "advancement and promotion of civil aeronautics *generally*, including the promulgation and enforcement of safety regulations,"³⁹ and to do so "in such manner as to best foster its development and safety."⁴⁰ This is consistent with the legislative position taken twenty years earlier in the grant of power to the CAB under the 1938 Act. That Act stated that its purpose was the "encouragement" of aviation.⁴¹ The Act of 1958 conference report makes clear that no matter the choice of word, "promotion" or "encouragement," the legislators intended the same effect.⁴² It is significant that aircraft safety and "advancement," "encouragement," and "foster[ing]" [civil avia-

³⁸ See *id.*

³⁹ *Id.*, 1958 U.S.C.C.A.N. at 3741 (emphasis added).

⁴⁰ *Id.*

⁴¹ Civil Aeronautics Act of 1938, Pub. L. No. 75-706, § 2, 52 Stat. 973, 980.

⁴² H.R. CONF. REP. NO. 2556, 85th Cong., 2d Sess. (1958), *reprinted in* 1958 U.S.C.C.A.N. 3767, 3771. In regard to the 1938 Act, the 1958 Act "is a reenactment of existing law without substantial change." H.R. REP. NO. 2360, *supra* note 33, 1958 U.S.C.C.A.N. at 3756. While the legislative comment indicates that no substantive change to the 1938 Act *was intended*, one official expressed concern that the new framework would vest economic and safety responsibilities in separate organizations—the CAB and the FAA, respectively—and that such action would have the unintended effect of changing the law. Letter from James R. Durfee, Chairman, Dept. of Commerce, Civil Aeronautics Admin., to Rep. Oren Harris, Chairman, Committee on Foreign Commerce (July 29, 1958), *reproduced in* H.R. REP. NO. 2360, *supra* note 33, 1958 U.S.C.C.A.N. at 3763 [hereinafter Durfee letter]. Mr. Durfee's concern was that the separation of these two functions would frustrate the intent of the Act of 1958—that aviation be both encouraged and safety promoted. In his letter, Mr. Durfee states:

[Separation of the two functions] repudiates the congressional intent expressed in the civil aeronautics act [of 1938] that there should be a balancing of the safety and economic considerations in the field of safety rulemaking. In adopting the Civil Aeronautics Act of 1938, this was a basic concept which Congress spelled out in section 2. It was the specific intent of Congress that the board consider the economic consequences of each safety regulation which it promulgates. It is obvious that standards could be established which would further enhance safety but at a price that few could afford to fly.

Id.

tion's] development" are stated on *equal terms*.⁴³ This point is emphasized to make clear that part of the legislative intent in both the 1938 Act and 1958 Act was that regulations be promulgated only after balancing the safety and advancement objectives. The legislative intent that aviation *safely flourish* under a *comprehensive framework* of FAA regulations will be reconsidered later in this Comment in the federal preemption analysis. The questions there, of course, are whether the intended balancing can be accomplished if the safety and advancement functions exist in separate government agencies, and whether state legislatures and state courts are allowed to rule on matters related to aircraft design.

C. FAA REGULATIONS AND CERTIFICATIONS TODAY

1. Introduction

Under the present statutory grant, regulation of aviation is extensive—one might say pervasive. While some of the various aviation regulations will be addressed in additional detail later, a quick overview is provided in this section. First, in order to legally operate the aircraft, the pilot will be licensed (called a pilot certificate) and may also have various "ratings" that authorize such things as instrument operation and operation of general category and class of aircraft such as an airplane, single-engine, or seaplane.⁴⁴ Additionally, depending on the type of aircraft, the pilot may also have a special "type" rating that is aircraft model specific, which is required for piloting large or complex aircraft.⁴⁵ In addition to a pilot certificate, the pilot will also have a medical certificate⁴⁶ and will have met certain recency of experience requirements.⁴⁷ The pilot will be charting the aircraft course based on airspace use regulations, visibility, and weather, all of which are addressed in various regulations.⁴⁸

In addition to the pilot, the aircraft, its manufacturers, owners, and operators will also have passed a number of regulatory hurdles. Any new aircraft design, prior to eligibility for produc-

⁴³ See *supra* notes 33-40 and accompanying text.

⁴⁴ See 14 C.F.R. § 61.5 (1996).

⁴⁵ *Id.*

⁴⁶ Pilot medical certificate requirements are set out in 14 C.F.R. pt. 67.

⁴⁷ See generally 14 C.F.R. § 61.57 ("Recent Flight Experience: Pilot in Command").

⁴⁸ See generally *id.* pt. 91 ("General Operating and Flight Rules"); *id.* § 91.155 ("Basic [Visual Flight Rules] VFR weather minimums").

tion, must first gain a "type certification" (TC).⁴⁹ A manufacturer who desires to build the specific model of aircraft must obtain a "production certificate" (PC),⁵⁰ and each individual aircraft made must obtain an "airworthiness certificate."⁵¹ The aircraft may also have been modified from the original design, for instance adding long-range fuel tanks, in which case a "supplemental type certification" (STC)⁵² is required, and installed equipment may be governed by a "technical standard order" (TSO).⁵³

Even if the aircraft, and its installed equipment, met every regulatory hurdle when it was produced, the FAA prescribes ongoing regulations, inspections, and other oversight mechanisms to assure continuing safety and compliance. The following sections will go through these initial and ongoing certification steps in more detail, but the point to note here is that the overall regulatory process is comprehensive and spans from the original aircraft design, to the manufacturing, to the maintenance of each aircraft, and finally to the ongoing certification of a model.

2. *Certification of Aircraft Designs*

A TC of a new aircraft design is required to insure that all characteristics meet FAA safety requirements. For each category of aircraft, the FAA has regulations that define allowable physi-

⁴⁹ See generally 49 U.S.C. § 44704(a) (1994) (definition of type certificates and their significance).

⁵⁰ See generally *id.* § 44704(b) (definition of production certificates and their significance).

⁵¹ See generally *id.* § 44704(c) (definition of airworthiness certificates and their significance).

⁵² An STC is required for any aircraft alteration that introduces "a major change in type design, not great enough to require a new application for a type certificate." 14 C.F.R. § 21.113. Examples of common modifications requiring an STC would include additional fuel tanks, speed brakes, speed modifications, and engine substitutions, although even less significant modifications may also require an STC.

⁵³ A TSO "is a minimum performance standard for specified articles . . . used on civil aircraft." *Id.* § 21.601. To manufacture TSO related items, manufacturers must have approved quality control and record keeping systems in place. *Id.* §§ 21.607, 21.613. An example of a TSO item is a Global Positioning System (GPS) unit that is specifically approved for instrument (IFR) flight navigation. To obtain TSO certification, the manufacturer must prove that the GPS "performs up to IFR standards." *Unicom, FLYING*, Nov. 1995, at 50. Also, a GPS manufacturer would obtain an STC that demonstrates that the GPS operates properly when installed in a specific aircraft. As summarized in a recent article, "A TSO is a laboratory type test of performance and durability to show a device is of aircraft quality, while the STC checks operation of the device in an actual aircraft." *Id.*

cal and flight characteristics for certification. To illustrate, most small aircraft are certified under Part 23 of the Federal Aviation Regulations (FARs).⁵⁴ Part 23 “prescribes airworthiness standards for the issue of type certificates, and changes to those certificates, for airplanes in the normal, utility, acrobatic, and commuter categories.”⁵⁵ Part 23 prescribes such constraints as maximum landing configuration stalling speed—single engine and light twin-engine aircraft must have a stalling speed of sixty-one knots or less⁵⁶—and maximum control forces—roll control force can not exceed seventy-five pounds for temporary application and ten pounds for prolonged application.⁵⁷ Some of the requirements seem extremely obscure. One section provides a test for determining ground loads for skiplanes (ski-equipped planes intended to land on snow).⁵⁸ That section describes the certification requirement by saying: “[A]ssuming that the airplane is resting on the ground with one main ski frozen at rest and the other skis free to slide, a limit side force equal to 0.036 times the design maximum weight must be applied near the tail assembly, with a factor of safety of 1.”⁵⁹ In all, the certification requirements under Part 23 dictate over 360 areas for test, verification, and inspection, with each area often having numerous specific tests.⁶⁰ A sample of the topics addressed in Part 23 includes: load distribution, weight and balance, propellers, propeller pitch, flight performance, stall speed, takeoff speed, minimum flight speed fifty feet AGL after takeoff, minimum angle of climb capability, minimum climb speed at minimum angle of climb, single engine performance for climb, cruise, descent and landing, landing distance, balked landing climb performance, flight controllability and maneuverability, critical engine inoperative stalls, longitudinal stability and control, vibration and buffeting, high speed characteristics, flight envelope, design airspeeds, limit maneuvering load factors, and unsymmetrical flight conditions.⁶¹ This lengthy—but far from exhaustive—list is provided to emphasize the comprehensive

⁵⁴ 14 C.F.R. §§ 23.1-.1589, app. A-I (known as “Part 23”).

⁵⁵ *Id.* § 23.1.

⁵⁶ *Id.* § 23.49.

⁵⁷ *Id.* § 23.143.

⁵⁸ *Id.* § 23.505.

⁵⁹ *Id.*

⁶⁰ See generally *id.* pt. 23.

⁶¹ *Id.*

scope of the certification test procedures.⁶² The detailed certification procedures seem to produce two chief results. First, aircraft certification is a long, difficult and expensive process. Second, aircraft that are certified have been very closely analyzed before they are produced and flown. In discussing the cost of design certification, a build-it-yourself aircraft kit company representative commented that if they could afford to obtain FAA approval for their four-seat kit-built aircraft, the production price might "approach \$100,000—nearly four times the basic kit cost."⁶³

3. Aircraft Production Certification

Once an aircraft design has been tested, verified, and received FAA type certification, additional certification is required for a manufacturer to produce and sell that aircraft. To obtain a "production certificate" (PC), an applicant must hold, or have rights to, a type certificate (TC) or supplemental type certificate (STC).⁶⁴ A significant aspect of the production certificate process is that the holder must develop, have certified, and maintain a rigorous quality control system.⁶⁵ The holder is responsible for making sure that "each part and each completed product . . . conforms to the approved design and is in a condition for safe operation."⁶⁶ The primary privileges of a production certificate are that the holder can "[o]btain an aircraft airworthiness certificate without further showing" and may conduct training for maintenance, inspection, and operation of the aircraft model.⁶⁷ The ability to obtain an airworthiness certifi-

⁶² Since hundreds of detailed engineering reports are required to comply with the certification procedures, the FAA uses two administrative procedures to delegate much of the responsibility in certification: the designated engineering representative (DER) procedure and the delegation of authority (DOA) procedure. Under these procedures, the FAA observes major tests and reviews key documents. FEDERAL AVIATION ADMIN. TRANSP. SYS. CTR., U.S. DEP'T OF TRANSP., TASK FORCE REPORT V-TAIL BONANZA INVESTIGATION 11 (1986) [hereinafter BONANZA SCR REPORT].

⁶³ Edward H. Phillips, *Aerospace Perspectives Kit-Built Aircraft Fuel Renaissance in Industry Dominated by Old Designs*, AVIATION WK. & SPACE TECH., Dec. 18, 1989, at 93.

⁶⁴ 14 C.F.R. § 21.133; see also *supra* note 52 (discussion of STC).

⁶⁵ 14 C.F.R. § 21.139. "The applicant must show that he has established and can maintain a quality control system for any product, for which he requests a production certificate, so that each article will meet the design provisions of the pertinent type certificate." *Id.*

⁶⁶ *Id.* § 21.165.

⁶⁷ *Id.* § 21.163.

cate without further showing is key for a manufacturer, because an airworthiness certificate is required before an aircraft can be legally operated.⁶⁸

4. *Airworthiness and Registration*

The preceding discussions on type certification and production certification address requirements for the design of a particular model or type of aircraft. In addition to the regulations that oversee the basic model, there are additional regulations that address the safety of each individual aircraft. Each aircraft must be both certified airworthy and registered. Issuance of aircraft registration "is not a function of airworthiness certification; however, U.S. registration is a prerequisite for issuance of an airworthiness certificate."⁶⁹ Before an aircraft can legally be operated, an appropriate airworthiness certificate must be issued. FAR section 21.183 prescribes the basic requirements for issuance of standard airworthiness certificates for aircraft manufactured under a PC or TC.⁷⁰ A standard airworthiness certificate remains valid as long as maintenance, preventive maintenance, and alterations are performed in accordance with FAR Parts 43 and 91.⁷¹ "Section 41.13 of the FAR requires aircraft to be maintained in accordance with its approved type design."⁷²

5. *Post-Certification Regulations*

Although an aircraft may be registered, its design fully certified, and the aircraft operational in all respects, ongoing maintenance and inspections are necessary to keep the aircraft safe (and legal) to fly. Furthermore, the FAA may impose new airworthiness requirements at any time, retroactively forcing inspection, maintenance, or upgrade on an aircraft in order to keep it flying.

a. *Inspections*

All aircraft must receive (at least) annual inspections by a certified mechanic. Details of the inspection must be entered in an official maintenance logbook. Aircraft operated for hire, or

⁶⁸ See *supra* note 51 and accompanying text.

⁶⁹ FEDERAL AVIATION ADMIN., U.S. DEP'T OF TRANSP., AIRWORTHINESS CERTIFICATION OF AIRCRAFT AND RELATED PRODUCTS 8 (1994).

⁷⁰ *Id.* at 33.

⁷¹ *Id.*

⁷² *Id.*

used to give flight instruction, must receive a 100-hour inspection.⁷³ The purpose of the inspection is to determine whether the aircraft and all its parts meet "all applicable airworthiness requirements."⁷⁴ The annual inspection is comprehensive and addresses all areas of the aircraft including, but not limited to, airframe, flight control systems, engine, fuel and oil systems, avionics, wheels, brakes, windows, controls, hoses, linkages, accessories, and wiring.⁷⁵ In general, all aspects of the aircraft must "pass" the inspection for it to continue flying. Any finding of a nonairworthy condition would ground the aircraft until repaired.

b. Airworthiness Directives

While each aircraft is individually inspected for general airworthiness on an annual basis, the FAA can also issue airworthiness directives (ADs) which dictate mandatory actions, inspections, or maintenance on aircraft.⁷⁶ ADs are issued when unsafe conditions are found in an aircraft, aircraft engine, propeller, system or aircraft appliances, or when the FAA determines that a similar unsafe condition "is likely to exist or develop in other products of the same type design."⁷⁷ ADs are mandatory⁷⁸ and may "prescrib[e] inspections and the conditions and limitations, if any, under which those [aircraft] may continue to be operated."⁷⁹ An AD may ground an aircraft until a specified inspection is performed, may require that an inspection be performed within a specified number of operating hours, or may dictate that a specific maintenance task be accomplished. Examples of recent ADs issued for small aircraft include one requiring inspection of wing attached bolts on Grumman "Tigers" (AA-5 series) and another requiring repetitive inspections of the main landing gear on Piper PA-24, -28, -30, -32, -34, and -39 series aircraft.⁸⁰ Both ADs require compli-

⁷³ 14 C.F.R. § 91.409. There are some exceptions and variations on the annual inspection for experimental aircraft and for aircraft (mostly commercial) which are periodically inspected as part of a regular inspection program. *Id.*

⁷⁴ *Id.* § 43.15.

⁷⁵ See generally *id.* pt. 43, app. D (detailing the items included in annual and 100-hour inspections).

⁷⁶ *Id.* § 39.1.

⁷⁷ *Id.*

⁷⁸ *Id.* § 39.3.

⁷⁹ *Id.* § 39.11.

⁸⁰ *Squawk Sheet*, AOPA PILOT, Dec. 1995, at 34.

ance within one hundred operating hours from the AD effective date.⁸¹

c. NTSB Recommendations

The NTSB, as the result of their investigations, can make safety recommendations to the FAA. While the NTSB recommendations do not by themselves have the force of law, the FAA can act on the NTSB's recommendations, thus, providing such authority.⁸²

d. Special Certification Reviews

In exceptional circumstances, the FAA can question the certification of a design and require that tests and analysis of the sort originally required to obtain a type certificate be repeated. A detailed look at that process follows in the next section.

D. SPECIAL CERTIFICATION REVIEW

As indicated above, one of the post-certification measures that may be invoked by the FAA is the SCR. The FAA has an express statutory power to reinspect, reexamine, suspend, or revoke any certificate, including a type certificate or production certificate, where "safety . . . and the public interest require that action."⁸³ According to the FAA, "An SCR is an in-depth comprehensive

⁸¹ *Id.*

⁸² See *supra* notes 27-29 and accompanying text (discussing the relationship between the FAA and the NTSB).

⁸³ 49 U.S.C. § 44709 (1994). The relevant statute provides:

(a) Reinspection and reexamination.—The Administrator of the Federal Aviation Administration may reinspect at any time a civil aircraft, aircraft engine, propeller, appliance, air navigation facility, or air agency, or reexamine an airman holding a certificate issued under section 44703 of this title.

(b) Actions of the Administrator.—The Administrator may issue an order amending, modifying, suspending, or revoking—

(1) any part of a certificate issued under this chapter if—

(A) the Administrator decides after conducting a reinspection, reexamination, or other investigation that safety in air commerce or air transportation and the public interest require that action. . . .

Id.

This section was recently updated and recodified from various sections now repealed. Section 44709(b)(1) which refers to "a certificate" should be read as including "type certificate, production certificate, airworthiness certificate, airman certificate, air carrier operating certificate, air navigation facility certificate (including airport operating certificate), or air agency certificate" as previously provided for in various sections of 49 U.S.C. [now repealed]. *Id.*

review of complex, controversial, or potential unsafe aircraft design features, or aircraft component problems associated with airworthiness determinations.”⁸⁴ In the course of the SCR, “[e]very significant aspect and ramification of the potential safety problem in question should be *fully explored*.”⁸⁵ The FAA further makes clear that the SCR is applied as an ongoing safety scheme after a design has already fully met certification requirements. “[The SCR] is a means of evaluating past type certification programs or potential unsafe design features on *previously approved* products.”⁸⁶ The SCR can be an extensive investigation whose scope can match that of the original certification procedure. The results of an SCR include the following: (1) a detailed review and evaluation of the product’s (aircraft’s) pertinent airworthiness and operational certification requirements; (2) recommendations for revisions of the aircraft’s airworthiness and operational certification requirements, if appropriate; and (3) improvement in effecting uniform application of the certification rules throughout the FAA.⁸⁷ The SCR activity is initiated in the FAA center responsible for certification of the aircraft design,⁸⁸ and an SCR team is established for the investigation.⁸⁹ Depending on the circumstances, during the course of an SCR the subject aircraft may be grounded or have its operations lim-

⁸⁴ Federal Aviation Admin., U.S. Dep’t of Transp., Order No. 8110.4A, at 41 (1995) [hereinafter FAA Order No. 8110.4A].

⁸⁵ *Id.* at 42 (emphasis added).

⁸⁶ *Id.* at 41 (emphasis added). The FAA offers the following guidelines for when, and under what circumstances, an SCR is warranted:

(b) Potential safety problem areas for which an SCR may be appropriate include:

- 1 Complex or unique design features;
- 2 Advanced state-of-the-art concepts in design and manufacturing;
- 3 Potential unsafe features used on similar previous designs requiring further analysis and evaluation;
- 4 Compliance areas critical to safety and operational suitability which require evaluations;
- 5 Unsafe operational or maintainability characteristics;
- 6 Equivalent level of safety determinations with potential major effects on safety; and
- 7 Complicated interrelationships of unusual features.

Id.

⁸⁷ *Id.* at 42.

⁸⁸ The FAA has multiple certification centers each of which have responsibility for different types of aircraft designs. For instance, small aircraft are certified out of the Small Aircraft Directorate in Kansas City, Missouri; rotorcraft are certified out of the Rotorcraft Directorate in Fort Worth, Texas.

⁸⁹ FAA Order No. 8110.4A, *supra* note 84, at 42.

ited.⁹⁰ Following the SCR investigations, the SCR team prepares a report containing the various findings and recommendations. It is the responsibility of the certification directorate to act on these recommendations to the extent deemed appropriate.⁹¹ Further discussion of the SCR is provided later in this Comment under the application of the SCR process to specific aircraft designs.

E. FAA REGULATIONS SUMMARY

1. *Conclusions as to Federal Statutory/Regulatory Oversight of Aircraft Design*

In the preceding sections, the extent and scope of FAA regulation of aircraft design has been reviewed in some detail. While this Comment is not intended to be a treatise on FAA regulation of aircraft design, such a detailed review is necessary to clearly portray the overall scheme of the regulations and to illustrate their extensive nature.

Although the statutory grant of power is rather general, the FAA regulations are extensive and exhaustively address each phase of aircraft design, manufacture, and operation. Of particular interest is the process of continuous monitoring of both aircraft designs and of individual aircraft.⁹² Even where a design is certified under all applicable regulations, any new information or improvement in technology that brings safety into question can immediately be acted upon under existing regulations.

2. *Impact of Recent Revisions/Recodification of Title 49 of the United States Code*

In 1994, in a couple of bills, Congress significantly revised, restated, and recodified Title 49 of the United States Code.⁹³

⁹⁰ Edward H. Phillips, *NTSB Studies Jetstream Crash, ATR Icing Data*, AVIATION WK. & SPACE TECH., Jan. 2, 1995, at 30. For example, following the American Eagle flight 4184 crash on October 31, 1994, the FAA banned ATR 42 and ATR 72 aircraft from flying in known or forecasted icing conditions. *Id.*; see also *supra* note 8 and accompanying text.

⁹¹ FAA Order No. 8110.4A, *supra* note 84, at 42.

⁹² As discussed in *supra* notes 76-91 and accompanying text, each model of aircraft can be the subject of ADs, NTSB recommendations, and SCRs that assure that unsafe aspects of a design, if discovered, can be corrected. Similarly, the annual and other repetitive inspections required for an airworthiness certificate assure that each individual aircraft is being maintained in safe condition.

⁹³ Act of July 5, 1994, Pub. L. No. 103-272, 108 Stat. 745; Act of Oct. 31, 1994, Pub. L. No. 103-429, 108 Stat. 4377.

With decades of judicial interpretation of the prior code addressing significant aviation questions, an important issue now is whether the 1994 code revisions altered the rules of law pertaining to aviation. While much of the code language has been significantly altered, the legislative intent, however, is stated in the bill as “restat[ing] in comprehensive form, *without substantive change*, certain general and permanent laws related to transportation . . . [and] to make other technical improvements in the Code.”⁹⁴ An example of the type of changes made is described as “simple language has been substituted for awkward and obsolete terms.”⁹⁵ This language says that the changes were not intended to impact the application or interpretation of the aviation statutes and, therefore, should not be used to justify new interpretations of aviation law in settled areas.

III. SPECIFIC AIRCRAFT DESIGNS: ACCIDENT HISTORIES, INVESTIGATIONS, AND CONCLUSIONS

A. INTRODUCTION

As discussed in the preceding sections, the SCR plays an important role in policing the safety of aircraft design once that design has been certified by the FAA. This section provides a detailed look at two aircraft designs that have been subjected to an SCR. Some background on the aircraft, its design history, and accident statistics are included to provide a framework against which the FAA SCR action can be viewed. Both aircraft described here are small aircraft, chosen, in part, because their structure and systems are more understandable. One is a piston-powered, single-engine design—the Beechcraft “V-tail” Bonanza; the other is a turboprop, twin-engine design—the Mitsubishi MU-2.

B. BEECHCRAFT V35 “V-TAIL” BONANZA

1. *The Beechcraft Bonanza*

The ubiquitous Beechcraft “V-tail” Bonanza⁹⁶ is one of the more recognizable small aircraft on the airport ramp, character-

⁹⁴ H.R. REP. NO. 180, 103d Cong., 1st Sess. 1 (1993), *reprinted in* 1994 U.S.C.C.A.N. 818, 818 (emphasis added).

⁹⁵ H.R. REP. NO. 831, 103d Cong., 2d Sess. 1 (1994), *reprinted in* 1994 U.S.C.C.A.N. 3579, 3579.

⁹⁶ “The Beechcraft V35, V35A and V35B Bonanzas are four- or six-place all-metal, low-wing, single-engine airplanes with fully retractable tricycle landing

ized by the unusual “V”-shaped tail with no vertical rudder.⁹⁷ The Bonanza is also noteworthy for its long-lived production.⁹⁸ The first production started in 1946 and continued with some modifications through 1982.⁹⁹ Today, with the oldest Bonanza almost 50 years old, over 6000 of the more than 10,000 Bonanzas made are still flying.¹⁰⁰ In pilot circles, the Bonanza has long enjoyed a reputation as one of the premier small aircraft. In spite of its popularity and long production, several years ago the V-tail came under FAA scrutiny when the strength of the aircraft was questioned. Ultimately, the FAA instituted an SCR of the Bonanza analyzing the tail in particular.¹⁰¹

2. Bonanza Accident History

Prior to discussing the FAA review, this Comment will present a brief review of small aircraft accident statistics from approximately 1979. Much of the accident statistical data and conclu-

gear.” PILOTS OPERATING HANDBOOK AND FAA APPROVED AIRPLANE FLIGHT MANUAL FOR THE BEECHCRAFT V35, V35A AND V35B 7-5 (Beech Aircraft Corp. 1982) [hereinafter BONANZA OPERATING HANDBOOK]. The aircraft is manufactured by Beech Aircraft Corp., Wichita, Kansas, which is now a subsidiary of Raytheon, Corp. The V35 was first flown in 1945, and mass production ended in 1985 after 10,390 were produced. JANE’s, *supra* note 8, at 338.

Bonanza characteristics include the following:

Length	26 feet 5 inches
Wingspan	33 feet 6 inches
Height	7 feet 7 inches
Max Take-off Weight	3400 pounds
FAA approved in normal and utility category, certified under FAR Part 23.	

BONANZA OPERATING HANDBOOK, *supra*, at 1-9, 1-12.

⁹⁷ According to Beech, “The Bonanza has ‘Vee’ tail control surfaces which are arranged to act as both elevator and rudder. The two surfaces work together for elevator action and opposite each other in rudder action. The ‘Vee’ tail operates like a conventional tail in response to elevator and rudder control action.” BONANZA OPERATING HANDBOOK, *supra* note 96, at 7-5.

⁹⁸ See *Used Airplane Report: 285hp V-Tails*, FLYING, Nov. 1995, at 78-80 [hereinafter *Used V-Tails*]. The Bonanza is also known as the model of aircraft which crashed on February 3, 1959, killing singer Buddy Holly. The cause of that accident, however, is considered to be weather related. *Unicom*, FLYING, Mar. 1996, at 111.

⁹⁹ *Used V-Tails*, *supra* note 98, at 78-80. Another source states that the Bonanza was introduced in 1947, not 1946. BONANZA SCR REPORT, *supra* note 62, at 1.

¹⁰⁰ *Used V-Tails*, *supra* note 98, at 79.

¹⁰¹ *Id.*

sions are from a 1979 study by the NTSB.¹⁰² This report was published just three years before the end of V-tail Bonanza production, and, at the time the study started, the V-tail had been in production for twenty-six years.¹⁰³ The FAA study focused on thirty-three makes and models of aircraft (including the Beech 33, 35, and 36 Bonanzas) which together accounted for 89.3% of the hours flown by the active single-engine fleet during the study period.¹⁰⁴ Of the thirty-three aircraft models studied, the Beech 33, 35, and 36 family¹⁰⁵ had the *lowest overall* accident incident rate per 100,000 hours flown—8.73 per 100,000 hours.¹⁰⁶ The venerable Piper J-3 “Cub” accident incident rate, for comparison, was 26.97 per 100,000 hours flown.¹⁰⁷ One startling statistic is that in the more than 11,000 accidents tabulated, 185 were airframe failures, and of those 185, 40 were in the Bonanza family. The next closest was the Piper PA-28 (Warrior) with twenty-eight airframe failures. Only four of the thirty-three designs reviewed had double-digit incidences of airframe failure.¹⁰⁸ At the end of the FAA report, the authors noted, “It is significant that all 40 of the in-flight airframe failures of the Beech 33, 35, and 36 involved the V-tailed models (Beech 35). Obviously attention should be focused on this model.”¹⁰⁹

The conclusions that can be drawn from this data, however, are mixed. As the FAA noted, “Numerous highly interrelated variables are involved in these accidents including the pilot, the manner in which he operates the aircraft, the weather and terrain in which and over which the aircraft is flown, the type of flying, maintenance of the aircraft, the aircraft design, and the manufacturing process.”¹¹⁰ Beech Aircraft Company has stressed that all aircraft are vulnerable to excessive speed build

¹⁰² NATIONAL TRANSP. SAFETY BD., SPECIAL STUDY, NTSB-AAS-79-1, SINGLE-ENGINE, FIXED-WING GENERAL AVIATION ACCIDENTS 1972-1976 (1979) [hereinafter NTSB-AAS-79-1].

¹⁰³ See *supra* note 99 and accompanying text (discussing Bonanza production history).

¹⁰⁴ NTSB-AAS-79-1, *supra* note 102, at 10. This study was limited to light aircraft, which are defined as those weighing less than 12,500 pounds. *Id.* at 1.

¹⁰⁵ The Beech 36 is also a “Bonanza,” but has a conventional tail with separate elevators and rudder.

¹⁰⁶ NTSB-AAS-79-1, *supra* note 102, at 15.

¹⁰⁷ *Id.*

¹⁰⁸ *Id.* at 25.

¹⁰⁹ *Id.* at 55 (pointing out that none of the 40 Bonanza airframe failures occurred in the Beech 36 conventional tail Bonanza).

¹¹⁰ *Id.* at 2.

up which can result from a situation where the pilot becomes disoriented such as during severe turbulence.¹¹¹

3. *FAA Special Certification Review of the Bonanza*

In 1984 the President of the American Bonanza Society wrote to the FAA and requested that the FAA conduct an investigation into the V-tail to address the ongoing debate regarding the safety of the design in light of the seemingly disproportionately high rate of in-flight structural failures.¹¹² The FAA immediately responded to the request and instituted actions to perform a study that “would produce conclusive data that either proves or refutes the allegations of defective design.”¹¹³

The technical details of the Bonanza SCR¹¹⁴ investigation are quite interesting from both engineering and legal perspectives. From a legal perspective, it is not the technical details that are important but rather the scope, detail, and thoroughness of the investigation; the conclusions and actions that resulted from the investigation; and the role the SCR plays in the overall safety process—only part of which is the initial design certification.

¹¹¹ BONANZA OPERATING HANDBOOK, *supra* note 96, at 3-14. Additionally, in the safety information section, Beech adds:

The result of vertigo is loss of control of the airplane. If the loss of control is sustained it will result in an excessive speed accident. Excessive speed accidents occur in one of two manners, either as an in-flight airframe separation or as a high speed ground impact; and they are fatal accidents in either case. *All airplanes are subject to this form of accident.*

Id. at 10-37 (emphasis added).

¹¹² BONANZA SCR REPORT, *supra* note 62, at 1. The American Bonanza Society requested a study to “determine conclusively that there are or that there are not deficiencies inherent in the design of the Beechcraft V-tail Bonanza that contribute significantly to in-flight airframe failures.” *Id.* at xi. The American Bonanza Society is a private organization of Bonanza owners and enthusiasts. At the time the *Bonanza SCR Report* was written, the Bonanza Society had about 7000 active members. *Id.* at 1.

¹¹³ *Id.* at 1. The FAA Administrator assigned responsibility to the FAA Central Region for this study, and the Central Region engaged the Department of Transportation, Transportation Systems Center (TSC), in Cambridge, Mass., to perform the engineering analysis and testing. *Id.*

¹¹⁴ While every report and article on the Bonanza refers to the study as a “Special Certification Review,” a letter from the FAA “Central Region” (now called the Small Airplane Directorate) said that the “V-tail Bonanza investigation wasn’t an official SCR but it was handled like an SCR. It was not done by the usual FAA certification personnel but was done by FAA contract to the Transportation Systems Center.” Letter from Robert W. Alpiser, FAA official at the Small Airplane Directorate, to Thom Tarnay (Nov. 6, 1995) (on file with the *Journal of Air Law and Commerce*).

To illustrate these points, the following provides some detail about the SCR investigation.

The Bonanza SCR investigation was performed by the Department of Transportation, Transportation Systems Center in Cambridge, Massachusetts.¹¹⁵ The study was performed by government personnel with both contract support from industry and universities as well as extensive help from other government agencies, industry, and academia.¹¹⁶ Task force members included distinguished scientists including several university professors from leading schools.¹¹⁷

The task force conducted an intensive six-month study with two main thrusts. The first consisted of a detailed analysis of Bonanza accident records for "a better understanding of the factors contributing to in-flight structural accidents,"¹¹⁸ the second focused on a review of the Bonanza certification history including a detailed review of structural analyses and tests that had been conducted by the manufacturer.¹¹⁹

The structural analyses and tests were intended to ascertain whether the aircraft, and in particular the V-tail structure, could be expected to survive the most severe flight loads that the airplane could encounter including extreme maneuvers and gust encounters during flight.¹²⁰

The task force also reviewed the strength of the tail, wing, and empennage. As the task force report makes clear, this is an extremely complicated issue because "[d]esign for airframe structural integrity is not an exact science."¹²¹ The design must comprehend not only the loads encountered in straight and level flight, but much more complicated situations such as gust response, loads during dive or flare, complicated loads during slip or stall, and other transient conditions. The task force reviewed all strength tests and calculations against the certification requirements and found that the Bonanza met those requirements within the approved flight envelope. This analysis was very involved and the engineering summary of those tests cover over forty pages in the task force report.¹²² In summarizing

¹¹⁵ BONANZA SCR REPORT, *supra* note 62, at iii.

¹¹⁶ *Id.*

¹¹⁷ *Id.* at 111-14.

¹¹⁸ *Id.* at xi.

¹¹⁹ *Id.*

¹²⁰ *Id.* at 22-23.

¹²¹ *Id.* at 17.

¹²² *Id.* at 17-60.

their finding about the V-tail, the task force concluded that due to the nonconventional configuration, the certification requirements may not provide the same safety margin as for a conventional tail.¹²³ The report also observed that “[t]here exist maneuvers, which, when executed at, or even below, the maneuver speed, can produce loads exceeding the limit load of the tail. . . . Such maneuvers are unlikely under normal circumstances, but inadvertent executions by inexperienced pilots might be possible.”¹²⁴

The Department of Transportation, Transportation Systems Center (TSC) published their report on the Bonanza in January 1986. Because that study was conducted by the TSC, which is an independent agency from the certifying directorate which has certification cognizance over the Bonanza, the FAA Small Airplane Directorate published a “foreword” summarizing the report and the official FAA conclusions after reviewing the TSC report.¹²⁵ In that letter the FAA concludes:

The study found that the V-Tail Bonanza met the structural requirements applicable at the time of initial FAA type certification. However, three recommendations for further action were made as follows:

1. Limited tests should be conducted to determine, definitively, the tail failure mechanisms, and to define the actual structural margins of the Model 35 V-Tail Bonanza.
2. FAA should review airworthiness standards for general aviation aircraft to determine their adequacy to properly certify non-conventional tail aerodynamic configurations.
3. FAA should review pilot certification requirements for high performance, single-engine aircraft.

The study identified no immediate safety concerns, provided the airplane is operated within the approved flight envelope. Therefore, no mandatory airworthiness or other immediate action is being considered at this time.¹²⁶

Following the SCR, support brackets were added to the leading edge of the tail,¹²⁷ and a modification kit was provided free

¹²³ *Id.* at 59.

¹²⁴ *Id.*

¹²⁵ FAA Small Airplane Directorate, *Foreword to BONANZA SCR REPORT*, *supra* note 62.

¹²⁶ *Id.*

¹²⁷ *Used V-Tails*, *supra* note 98, at 79.

of charge by Beech Aircraft to all Bonanza owners.¹²⁸ In spite of the conclusion to strengthen the tail assembly, the final result of the SCR was that any structural weakness in the V-tail was found outside the approved flight envelope.¹²⁹ Although—as a result of the SCR—“the V-tail [became] one of the most-tested general aviation airplanes,” production was nevertheless over.¹³⁰ As one writer stated, “What drove the final decision to discontinue the V-tail [after more than thirty-five years of success] is open to question, but the airplane was hurt by allegations of structural weakness in the tail.”¹³¹

C. MITSUBISHI MU-2

1. *The Mitsubishi MU-2*

The Mitsubishi MU-2 is a twin engine, high wing, turboprop aircraft with seating for approximately six passengers.¹³² It is a small,¹³³ fast aircraft with a reputation for being a demanding aircraft to fly.¹³⁴ One unique feature of the aircraft is that it uses spoilers instead of ailerons to provide bank control. The MU-2 also has unusually high wing loading in relation to comparable airplanes.¹³⁵ At the time of this Comment, the MU-2 was no longer in production.

¹²⁸ *Beech Will Modify V-Tail Bonanzas Built from 1951-82*, AVIATION WK. & SPACE TECH., May 18, 1987, at 108.

¹²⁹ *Used V-Tails*, *supra* note 98, at 79.

¹³⁰ *Id.*

¹³¹ *Id.* Since the SCR, the reputation of the Bonanza has recovered. In reviewing the sales of used aircraft, the same author added:

V-tail Bonanza prices languished for a number of years as controversy over the tail raged, but once everyone realized that it was what it always had been—one fine airplane—the prices recovered and V-tail Bonanzas are today among the best performers in the used airplane market. On average, a 30-year-old V-tail Bonanza sells for over 150 percent of its new price.

Id.

¹³² The Mitsubishi MU-2 is made by Mitsubishi Heavy Industries, Ltd., a Japanese Company, and was first flown on September 14, 1963. Both long body and short body MU-2s were made with differing seating capacity. By 1986, over 755 MU-2s had been ordered from the manufacturer. JANE'S, *supra* note 8, at 170.

¹³³ The empty weight of one MU-2B-60 (N72B as equipped), for example, was 7589 pounds. *Uncontrolled Descent Cited by NTSB*, AVIATION WK. & SPACE TECH., Aug. 27, 1984, at 83.

¹³⁴ The aviation community nickname for the MU-2 is the “Rice Rocket,” alluding to its high performance characteristics. Barry Schiff, *Test Pilot*, AOPA PILOT, Jan. 1996, at 95, 102.

¹³⁵ FEDERAL AVIATION ADMIN., SPECIAL CERTIFICATION REVIEW OF MITSUBISHI MU-2 app. 1, at 6 (1984) (letter from Jim Burnett, Chairman, National Transport-

Because the aircraft was developed in Japan, the MU-2 was certified under the Bilateral Airworthiness Agreement between the United States and Japan.¹³⁶ For production, completed airframes were shipped to the United States where engines and other accessories were then added.¹³⁷ Mitsubishi's original U.S. representative finishing the aircraft was Mooney Aircraft Corporation. Later, Mitsubishi Aircraft International (MAI) obtained a type certificate.¹³⁸ Although the MU-2 is a very high performance aircraft, only one pilot is required for operation, and a pilot type rating specifically for the MU-2 is not required.¹³⁹

2. *Mitsubishi Accident History*

On March 24, 1983, a Mitsubishi airplane Model MU-2B-60, N72B, crashed near Jeffersonville, Georgia, killing all four persons aboard. The airplane, engaged in an air-taxi operation, disappeared from radar at an altitude of 18,000 feet shortly after the pilot had established initial contact with the Atlanta Air Route Traffic Control Center. Despite an intense and continuing investigation, the causal circumstances of the accident remain undetermined.¹⁴⁰

The Mitsubishi MU-2 has a controversial safety record.¹⁴¹ At the time of the March 1983 crash, the MU-2 had been involved in twenty-two fatal accidents in the preceding eight years that were primarily related to uncontrolled collisions with the ground, controlled collisions during cruise or instrument landing approaches, or engine failures in various phases of flight.¹⁴² The NTSB said that the circumstances of several of the accidents

tation Safety Board, forwarded to Honorable J. Lynn Helms, Administrator, Federal Aviation Administration (Aug. 24, 1983) (NTSB Safety Recommendation A-83-56)) [hereinafter MU-2 SCR REPORT].

¹³⁶ The Bilateral Airworthiness Agreement was dated February 1, 1963. *Id.* at 3.

¹³⁷ *Id.* at 4.

¹³⁸ The MU-2 type certificates are A2PC and A10SW. *Id.* See *supra* notes 54-55 and accompanying text (discussing type certificates).

¹³⁹ MU-2 SCR REPORT, *supra* note 135, at 8. See *supra* note 45 and accompanying text (discussing pilot certificate "type rating").

¹⁴⁰ MU-2 SCR REPORT, *supra* note 135, app. 1, at 1.

¹⁴¹ Although this Comment primarily addresses MU-2 accidents that lead up to an FAA SCR of the MU-2 in 1983, today, more than 10 years later, the MU-2 is still making headlines. On April 19, 1993, South Dakota Governor George S. Mickelson and seven other persons were killed when the MU-2 in which they were riding crashed near Dubuque, Iowa. *Propeller Warning Issued Before Governor's Crash*, L.A. TIMES, Apr. 28, 1993.

¹⁴² David M. North, *NTSB Urges MU-2 Certification Review*, AVIATION WK. & SPACE TECH., Sept. 12, 1983, at 60.

were "puzzling" and that it may suggest that the causal circumstances may be design related.¹⁴³ In investigating those accidents, the NTSB had not been able to come up with a cause for four of the eight accidents involving uncontrolled ground collision or for three of the six involving engine failure.¹⁴⁴ Overall, the NTSB file as of September 12, 1983, contained 183 accident and incident reports, 53% of which were classified as "pilot mishandling" and 15% as unknown or miscellaneous cause.¹⁴⁵ The accident reports from some of the crashes include aircraft actions that are difficult to explain. One MU-2 had been operating normally in clear skies at 12,000 feet when it suddenly dove into the ocean and crashed near Jacksonville, Florida.¹⁴⁶ Another MU-2 suddenly rolled and dove into the ground immediately after takeoff, crashing near Saratoga, Wyoming.¹⁴⁷ Still another MU-2 that was being flown by a Mitsubishi corporate executive pilot suddenly dove to the ground from an altitude of several thousand feet.¹⁴⁸

3. FAA Special Certification Review of the Mitsubishi

Following the March 1983 MU-2 crash, the NTSB wrote to the administrator of the FAA and recommended that the FAA conduct an SCR of the MU-2 "relative to the engines, fuel system, autopilot, and flight control systems; flight in known icing conditions; engine inoperative characteristics; and handling characteristics during IMC landing approaches; and take the appropriate action to correct any deficiencies identified."¹⁴⁹ The NTSB recommendation was based on "the continued involvement of the Mitsubishi MU-2 in fatal accidents . . . and sudden unexplained loss of control."¹⁵⁰

In response to the NTSB recommendation, the FAA assigned an SCR team to review selected portions of the MU-2 design and type certificate programs.¹⁵¹ The SCR team for the MU-2 made an initial review of the MU-2 and recommended the following

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ MU-2 SCR REPORT, *supra* note 135, at 5.

¹⁴⁶ *Id.* app. 1, at 6.

¹⁴⁷ *Id.*

¹⁴⁸ *Id.*

¹⁴⁹ *Id.* app. 1, at 7.

¹⁵⁰ *Id.*

¹⁵¹ *Id.* app. 5 (letter from Barry D. Clements, Manager, Aircraft Certification Division (FAA, ACE-100), to Charles E. Arnold (FAA, ACE-106) (Sept. 14, 1983) (assigning Mr. Arnold as MU-2 SCR team leader)) [hereinafter Clements letter].

four areas for full team action: first, a review of accident files for all MU-2 accidents with “unknown cause;” second, assignment of a team to determine the causes of all MU-2 accidents; third, the formation of an expert team to evaluate pilot workload, cockpit arrangement, the possible need for type certification, aircraft handling and single engine controllability, and pilot workload; and fourth, the completion of a design review of the MU-2 fuel, landing gear, autopilot/trim, and icing protection systems to determine if improvements are necessary.¹⁵² The scope, detail, and process of the MU-2 SCR investigation was in accordance with normal, stringent, FAA SCR procedures.¹⁵³

After several months of research, testing, and analysis, the MU-2 SCR team reported their findings to the FAA. In that report, the SCR team concluded that “there was no evidence of noncompliance with the certificating regulations . . . or that an identifiable safety hazard exist[ed].”¹⁵⁴ The SCR team did make several recommendations. First, it was recommended that several of the aircraft systems be subject to further testing even though there was no evidence of noncompliance with regulations.¹⁵⁵ Additionally, the SCR team recommended several actions which they believed “would possibly enhance the overall safety record of the airplane,”¹⁵⁶ and concluded that the certification of the design for single pilot operation without a type certificate was proper.¹⁵⁷ Several of the SCR recommendations addressed the aircraft systems designs as they pertain to use by the pilots¹⁵⁸ and included certain revisions to the operating manual to “ensure more consistent understanding and application of information” found in the manual.¹⁵⁹

¹⁵² MU-2 SCR REPORT, *supra* note 135, at 2-3.

¹⁵³ Clements letter, *supra* note 151; *see also supra* notes 84-87 and accompanying text (discussing FAA Order No. 8110.4A pertaining to the process of conducting a special certification review).

¹⁵⁴ MU-2 SCR REPORT, *supra* note 135, at 6.

¹⁵⁵ *Id.* at 7. The SCR team recommended that the ice protection, pitot-static, and electrical systems as well as the environmental system turbine be further analyzed. *Id.*

¹⁵⁶ *Id.*

¹⁵⁷ *Id.* at 8.

¹⁵⁸ In particular, the SCR team recommendations addressed settings for the landing gear warning horn, location of oxygen on-off control, location of autopilot/trim disconnect button, labeling of device circuit breaker, and location of the pilot's turn-and-bank indicator. *Id.* at 7-8.

¹⁵⁹ *Id.* at 8.

D. CONCLUSIONS ABOUT SPECIAL CERTIFICATION REVIEW

1. *General Conclusions*

As both the Beech Bonanza and Mitsubishi MU-2 SCRs illustrate, often the aircraft designs subject to an SCR are found to be in compliance with the certification requirements. Designs that have been subject to the SCR, however, also enjoy the benefit of having passed an extremely rigorous review conducted by a team of experts who undoubtedly enter the process with careful skepticism. As noted in the discussion on the V-tail Bonanza, as a result of the SCR, "the V-tail [became] one of the most-tested general aviation airplanes."¹⁶⁰ As will be addressed later in this Comment, when a legal action is brought challenging the safety or adequacy of an aircraft design, any design that has been subject to an SCR investigation should enjoy a strong presumption of safety.

A recurring theme in SCR studies is the need for better pilot training and the inter-relationship between the pilot and the aircraft. In the Bonanza study, the SCR team concluded that training in high-performance aircraft was needed.¹⁶¹ The Mitsubishi review included a number of recommendations relating to pilot ergonometics.¹⁶² This emphasis on pilot training, however, is not unique to the two studies reviewed above in detail. Several recent SCR investigations on other aircraft designs also highlight the emphasis on better pilot training that often follows from an SCR investigation.

2. *Better Pilot Training*

In 1994, the FAA conducted an SCR investigation into the Robinson R22/44 helicopters following several fatal accidents. After the investigation, the FAA said that the R22/44 helicopters did comply with certification requirements even though the NTSB continued to express concern. The manufacturer said that some of the accidents were caused by pilot error and recommended pilot experience and training.¹⁶³ Also in 1994, the FAA completed an SCR investigation into high-altitude stability of the MD-11. Although the MD-11 design was generally vindicated, the NTSB emphasized that pilots should receive training

¹⁶⁰ *Used V-Tails*, *supra* note 98, at 79.

¹⁶¹ *See supra* note 126 and accompanying text.

¹⁶² *See supra* note 158 and accompanying text.

¹⁶³ Ramon Lopez, *Nothing To Be Afraid Of*, FLIGHT INT'L, Mar. 15, 1995.

in recovery from high-altitude upsets.¹⁶⁴ In 1992, the FAA completed an exhaustive SCR investigation into the PA-46 Piper Malibu¹⁶⁵ following seven in-flight breakups. After the review, the FAA found the design complied with certification requirements, but strongly recommended improved education and training of pilots in high performance airplanes.¹⁶⁶

The emphasis on pilot training following the SCR investigation of so many different aircraft designs is a significant commentary on the interdependence of aircraft design with pilot training and certification. As discussed earlier in this Comment, the regulatory scheme for certification of pilots and aircraft are complex and closely related. Recall that pilot certification for large or complex aircraft requires not only a basic pilot certificate, but often an aircraft model-specific "type rating."¹⁶⁷ Recall also, that one aspect of the Mitsubishi MU-2 review addressed the question of whether that model aircraft was so complex that a type rating should be required.¹⁶⁸

The Bonanza and MU-2 reviews demonstrate that the FAA and NTSB clearly understand that pilot training and aircraft complexity cannot be separated. That recognition should also be critical in legal review of aircraft design. It is not possible to review an aircraft design by itself without regard to the associated training and checkout that the pilot must legally receive. An aircraft design that may seem to be exceptionally complicated to operate may not be unreasonably dangerous if significant training is required in order to legally fly it. The interdependence of aircraft design certification and pilot certification will be addressed further in the subsequent sections of this Comment where federal preemption is discussed.

¹⁶⁴ Edward H. Phillips, *Air Transport NTSB: Pilots Need Training for High-Altitude Stalls*, AVIATION WK. & SPACE TECH., Feb. 21, 1994, at 43.

¹⁶⁵ The Piper Malibu (PA-46-310P) is a high performance, pressurized, single-engine aircraft originally developed and manufactured by the Piper Aircraft, Corp. of Vero Beach Florida (now defunct). Originally certified in September 1983, the company claimed the Malibu was "the world's first cabin class, pressurized, piston powered, single-engine aircraft." JANE'S, *supra* note 8, at 487-88.

¹⁶⁶ *FAA Clears Malibu, with Warning*, FLIGHT INT'L, Feb. 26, 1992.

¹⁶⁷ See *supra* note 45 and accompanying text.

¹⁶⁸ See *supra* note 157 and accompanying text.

IV. FEDERAL PREEMPTION OF STATE LAW: STATE PRODUCT LIABILITY CLAIMS FOR AIRCRAFT DESIGNS DEVELOPED, TESTED, AND CERTIFIED UNDER FEDERAL CERTIFICATION REGULATIONS

A. PREEMPTION INTRODUCTION

Although this is not intended to be a comprehensive Comment on federal preemption in aviation law,¹⁶⁹ judicial analysis of implied or conflict preemption should be influenced by the SCR process. First, the SCR procedure provides a feedback mechanism in the aircraft certification process that makes the overall scheme more comprehensive, and which makes the regulation of aircraft design largely self-policing. The self-policing aspect of the regulatory scheme is evidence of the intent of lawmakers to have the federal regulatory system include its own corrective processes, eliminating the need for state supervision. Second, the SCR procedure serves as a continuing link between aircraft design certification and pilot training and certification. The interdependence of aircraft design and pilot certification was demonstrated during SCR investigations for a number of aircraft as discussed in the preceding section of this Comment.¹⁷⁰ This section will review the background of preemption analysis in aviation law and several recent cases on the subject; then, it will comment on those cases in light of the SCR process.

B. CONSTITUTIONAL BASIS FOR PREEMPTION

The federal preemption doctrine of federal law over state law springs from the Supremacy Clause of the Constitution.¹⁷¹ The Supremacy Clause renders invalid any state laws that are inconsistent with federal laws. An early case addressing the supremacy of federal law was *M'Culloch v. Maryland*,¹⁷² where a state law that attempted to tax the Bank of United States was held invalid as a burden on federal power to regulate cur-

¹⁶⁹ Several detailed articles addressing federal preemption in aviation law have been written recently and would be good references for a thorough discussion of preemption in aviation law. See Mary A. Wells & David Mayhan, *Federal Preemption of Strict Liability Claims in Aviation Litigation: A Fresh Look*, 27 TORT & INS. L.J. 693 (1992); Geoffrey M. Hand, Comment, *Should Juries Decide Aircraft Design?* Cleveland v. Piper Aircraft Corp. and Federal Preemption of State Tort Law, 29 U.S.F. L. REV. 741 (1995).

¹⁷⁰ See *supra* notes 161-68 and accompanying text.

¹⁷¹ U.S. CONST. art VI, cl. 2.

¹⁷² 17 U.S. (4 Wheat.) 316 (1819).

rency.¹⁷³ As will be illustrated below, preemption may be expressly stated in a federal statute,¹⁷⁴ or it may be deemed to be implied either by the nature of the federal laws or as a result of conflict with state law. In *Ray v. Atlantic Richfield Co.*,¹⁷⁵ the Supreme Court explained:

[Implied preemption may] be evidenced in several ways. The scheme of federal regulation may be so pervasive as to make reasonable the inference that Congress left no room for the States to supplement it. Or the Act of Congress may touch a field in which the federal interest is so dominant that the federal system will be assumed to preclude enforcement of state laws on the same subject.¹⁷⁶

The Court also noted that total preemption is not necessary; state law can be partially preempted such that it is unenforceable only to the extent that it conflicts with federal law.¹⁷⁷ In all cases, congressional intent “is the ultimate touchstone of preemption analysis.”¹⁷⁸

C. APPLICATION OF PREEMPTION IN AVIATION LAW

1. *Introduction*

The extensive nature of the federal regulations pertaining to aircraft certification raises the question of implied and conflict preemption. “Did Congress intend to totally occupy the field with respect to design of aircraft, so that the statute and regulations implied preempt a state court jury from determining the existence of a design defect?”¹⁷⁹ The Federal Aviation Act of 1958 did not contain an express preemption provision, but did include a “savings clause” that provided that the Act was not to

¹⁷³ *Id.* at 427 (“[T]he sovereignty of the state . . . is subordinate to, and may be controlled by the constitution [sic] of the United States.”).

¹⁷⁴ See, e.g., The Copyright Act of 1976, 17 U.S.C. § 301 (1994) (expressly voiding state and common law copyright for works of authorship that would be covered by the Copyright Act).

¹⁷⁵ 435 U.S. 151 (1978).

¹⁷⁶ *Id.* at 157 (quoting *Rice v. Santa Fe Elevator Corp.*, 331 U.S. 218, 230 (1947) (citations omitted)). In the situation where pervasive federal regulation is presumed to preclude any state action, that type of preemption is known as “field preemption.”

¹⁷⁷ *Id.* at 158.

¹⁷⁸ *Cipollone v. Liggett Group, Inc.*, 505 U.S. 504, 516 (1992) (citing *Malone v. White Motor Corp.*, 435 U.S. 497, 504 (1978), which quoted *Retail Clerks v. Schermerhorn*, 375 U.S. 96, 103 (1963)).

¹⁷⁹ *Wells & Mayhan*, *supra* note 169, at 694.

alter "remedies" then available under the law.¹⁸⁰ The argument against preemption is that because the Act allowed prior remedies to remain, that implies that the Act was not intended to "occupy a given field."¹⁸¹ The Airline Deregulation Act of 1978,¹⁸² however, added an express preemption provision applying to attempted state regulation of rates, routes, or services,¹⁸³ but did not address aircraft design certification.

Recent cases have addressed aircraft design defects and have rejected the federal preemption assertion that federal regulations over aircraft design preclude common law or state findings for defective design. The following is a brief review of two federal appellate cases which have been much discussed.

2. Public Health Trust v. Lake Aircraft, Inc.

In *Public Health Trust v. Lake Aircraft, Inc.*,¹⁸⁴ the court of appeals vacated and remanded a trial court's summary judgment for the defendant Lake Aircraft. In this case, plaintiff William Dee was a passenger in an aircraft manufactured by defendant Lake, which possessed a valid airworthiness certificate at the time. Dee was seriously and permanently injured when the amphibious aircraft struck a rocky bank during an attempted take-off. Dee sued the manufacturer alleging negligence and strict liability for the design of the passenger seat averring that the seat design enhanced his injuries.¹⁸⁵ The district court granted summary judgment for the defendant, ruling that Dee's state law claims were preempted by the federal aircraft certification laws and that no violation of the federal design and performance standards was demonstrated. On appeal, however, the

¹⁸⁰ The original savings clause language provided that "[n]othing contained in this chapter shall in any way abridge or alter the remedies now existing at common law or by statute, but the provisions of this chapter are in addition to such remedies." 49 U.S.C. app. § 1506 (1988), *repealed by* Pub. L. No. 103-272, § 7(b), 108 Stat. 1379, 1383 (1994). The Code has recently been updated and the new language states simply that "[a] remedy under this part is in addition to any other remedies provided by law." 49 U.S.C. § 40120(c) (1994). The statutory notes, however, indicate that the change was not meant to modify the law but only "to eliminate unnecessary words and for clarity." *Id.*

¹⁸¹ *Silkwood v. Kerr-McGee Corp.*, 464 U.S. 238, 248 (1984), *cert. denied*, 476 U.S. 1104 (1986).

¹⁸² Pub. L. No. 95-504, 92 Stat. 1705 (codified as amended in scattered sections of 49 U.S.C.).

¹⁸³ 49 U.S.C. app. § 1305(a) (1988), *repealed by* Pub. L. No. 103-272, § 7(b), 108 Stat. 1379 (1994) (now recodified at 49 U.S.C. § 41713(b) (1994)).

¹⁸⁴ 992 F.2d 291 (11th Cir. 1993).

¹⁸⁵ *Id.* at 292.

court of appeals reversed holding that even though the FAA had promulgated airworthiness standards, including specific performance standards for seats, berths, safety belts, and harnesses, the federal certification regulations did not preempt state common law remedies.¹⁸⁶ The court of appeals reached this conclusion by reasoning that because there was an express preemption provision relating to rates, routes, or services and that by application of the statutory interpretation principle of *expressio unius est exclusio alterius* (meaning that the expression of one thing is the exclusion of another), those matters not expressly addressed were, by definition, not preempted.¹⁸⁷ This conclusion was also supported by the recent Supreme Court decision in *Cipollone v. Liggett Group, Inc.*,¹⁸⁸ which held that preemptive language should be narrowly construed in light of a presumption against preemption.¹⁸⁹

3. Cleveland v. Piper Aircraft Corp.

In *Cleveland v. Piper Aircraft Corp.*,¹⁹⁰ the court of appeals upheld a district court ruling that the Federal Aviation Act does not expressly or impliedly preempt New Mexico state law tort claims. In this case, the pilot of a "Super Cub,"¹⁹¹ tail-dragger aircraft, manufactured by defendant Piper Aircraft, was seriously injured when the aircraft struck a vehicle on the runway during an attempt to take off while towing a glider. The aircraft had been modified, replacing the front seat with a movie camera in order to film a commercial, and was being piloted from the rear seat at the time of the accident. The plaintiff alleged that the airplane was defective because it had inadequate rear seat preflight visibility and lacked a rear seat shoulder harness.¹⁹² The court of appeals found for the plaintiff on the preemption challenge using reasoning similar to that used in *Lake Aircraft*. First, the court reviewed the original statute and the savings clause. The court concluded that the absence of any express preemption clause in the Federal Aviation Act of 1958,¹⁹³ together with

¹⁸⁶ *Id.* at 295.

¹⁸⁷ *Id.* at 294-95.

¹⁸⁸ 505 U.S. 504 (1992).

¹⁸⁹ *Id.* at 505.

¹⁹⁰ 985 F.2d 1438 (10th Cir.), *cert. denied*, 510 U.S. 918 (1993).

¹⁹¹ The aircraft was a Piper Super Cub Model PA-18-150, manufactured and sold by Piper in 1970.

¹⁹² *Piper Aircraft*, 985 F.2d at 1441.

¹⁹³ *See supra* note 25.

the recognition of tort liability for design defects at the time the Act was implemented "resulted in the states retaining their traditional regulatory powers in this area."¹⁹⁴ The court cited *Morales v. Trans World Airlines, Inc.*¹⁹⁵ as support for their conclusion. Next, the court examined the express preemption clause added with the Deregulation Act of 1978 and concluded that the addition of an express preemption of some subjects could be interpreted as expressly not preempting all others. This is the same logic applied in *Lake Aircraft*.¹⁹⁶ The court concluded that because the Deregulation Act of 1978 added a preemption clause that did not address state tort claims, that act was evidence that such tort claims were not intended to be preempted.¹⁹⁷ The court next rejected a conflict preemption theory concluding that it would not be a "a physical impossibility" to comply with both state and federal law.¹⁹⁸ Finally, the court distinguished a series of cases that had held that states were preempted from requiring airbags for automobiles by the National Traffic and Motor Vehicle Safety Act because that Act gave several choices in passenger restraints. For a state to eliminate the federally provided choice "would, in effect, remove the element of choice authorized in Safety Standard 208 [and] would frustrate the federal regulatory scheme."¹⁹⁹

4. Cases Finding Preemption for Comparison

While recent decisions in the court of appeals have been hesitant to find federal preemption in aircraft design, cases that have found federal preemption of state law suggest that the basis

¹⁹⁴ *Piper Aircraft*, 985 F.2d at 1443.

¹⁹⁵ 504 U.S. 374 (1992). The court in *Piper Aircraft* describes *Morales* as holding that state truth-in-advertising laws were preempted under the express preemption clause added with the Deregulation Act of 1978, but would not have been preempted under the original act with the savings clause. *Piper Aircraft*, 985 F.2d at 1443. This misconstrues the *Morales* decision. In fact, the *Morales* opinion does not say that the state truth-in-advertising laws would not have been preempted before the deregulation act. The *Morales* opinion says that the general savings clause does not trump the specific preemption statute. *Morales*, 504 U.S. at 385. *Morales* holds that because the specific subject in the case was clearly preempted by an express statute, the general savings clause did not allow states to retain their regulatory power. *Id.*

¹⁹⁶ See *supra* note 187 and accompanying text.

¹⁹⁷ *Piper Aircraft*, 985 F.2d at 1443.

¹⁹⁸ *Id.* at 1445 (quoting *Florida Lime & Avocado Growers, Inc. v. Paul*, 373 U.S. 132, 142-43 (1963)).

¹⁹⁹ *Id.* at 1446 (quoting *Taylor v. General Motors Corp.*, 875 F.2d 816, 827 (11th Cir. 1989), *cert. denied*, 494 U.S. 1065 (1990)).

for finding preemption is not so different than the situation presented in aircraft design regulations. Several case examples follow to illustrate situations where federal preemption has been found.

a. *Ray v. Atlantic Richfield Co.*

In *Ray v. Atlantic Richfield Co.*,²⁰⁰ Justice White, for the Supreme Court, upheld the United States District Court for the Western District of Washington ruling that the State of Washington's tanker laws regulating the size and design of oil tankers in Puget Sound were preempted by federal law and hence unenforceable. In this case, Washington law required certain size tankers to meet "standard safety features," which specified certain design aspects, engine horse power requirements, navigation equipment requirements, and other items.²⁰¹ The Court concluded that the Washington statute was preempted by the Federal Ports and Waterways Safety Act of 1972 (PWSA).²⁰² The Court reviewed the purpose of the PWSA as establishing "'comprehensive minimum standards of design, construction, alteration, repair, maintenance, and operation' for vessels carrying certain cargoes in bulk, primarily oil and fuel tankers"²⁰³ and concluded, "[A]s we see it, Congress did not anticipate that a vessel found to be in compliance with the Secretary's design and construction regulations . . . would nevertheless be barred by state law . . . on the ground that its design characteristics constitute an undue hazard."²⁰⁴ The Court observed in regard to the federal statute language of "minimum standards," "We are unconvinced that because [the act] speaks of . . . 'minimum standards' [that it] requires recognition of state authority to impose higher standards than the Secretary has prescribed."²⁰⁵ In its analysis, the Court noted that the goals of both the state and federal laws were the same: to protect the environment and assure vessel safety.²⁰⁶ The Court concluded that Congress "intended uniform national standards for design and construction

²⁰⁰ 435 U.S. 151 (1978).

²⁰¹ *Id.* at 160.

²⁰² *Id.* at 168. The PWSA was originally codified at 46 U.S.C. app. § 391a (1970 & Supp. V) (recently recodified in various sections under the same title including 46 U.S.C. §§ 2101, 3301, 3305-3307 (1994)).

²⁰³ *Atlantic Richfield*, 435 U.S. at 161 (citing 46 U.S.C. § 391a(1)).

²⁰⁴ *Id.* at 163-64.

²⁰⁵ *Id.* at 168 n.19 (citations omitted).

²⁰⁶ *Id.* at 161.

of tankers" and as a result a state law with the same purpose imposing more stringent requirements would be invalid under the Supremacy Clause.²⁰⁷

b. *City of Burbank v. Lockheed Air Terminal, Inc.*

In *City of Burbank v. Lockheed Air Terminal, Inc.*,²⁰⁸ the Supreme Court affirmed the district court and court of appeals in holding invalid a city ordinance prohibiting jet aircraft from taking off from the Hollywood-Burbank Airport between the hours of 11:00 p.m. and 7:00 a.m.²⁰⁹ The Court held that Congress had preempted state and local control over aircraft noise by the enactment of the Federal Aviation Act and the Noise Control Act. In this case, the opinion begins with a quote from *Cooley v. Board of Wardens*,²¹⁰ where Justice Curtis observes that some subjects "imperatively deman[d] a single uniform rule, operating equally on the commerce of the United States in every port," while other subjects should lead to diverse conclusions in order to "meet the local necessities."²¹¹ The Court noted that the regulatory grant of power to the FAA was intended to "insure the safety of aircraft and the efficient utilization of . . . airspace."²¹² The Court went on to reason that night curfew on flights would impact flight schedules during the day, which would interfere with efficient use of the airspace and hence conflict with the federal mission.²¹³ The Court noted that "[i]t is the pervasive nature of the scheme of federal regulation of aircraft noise that leads us to conclude that there is pre-emption."²¹⁴ In reviewing the pervasive scheme of federal regulation, the Court was persuaded by the words of Justice Jackson who stated:

Federal control is intensive and exclusive. Planes do not wander about in the sky like vagrant clouds. They move only by federal permission, subject to federal inspection, in the hands of federally certified personnel and under an intricate system of federal commands. The moment a ship taxis onto a runway it is caught up in an elaborate and detailed system of controls.²¹⁵

²⁰⁷ *Id.* at 163, 165.

²⁰⁸ 411 U.S. 624 (1973).

²⁰⁹ *Id.* at 626.

²¹⁰ 53 U.S. (12 How.) 299 (1851).

²¹¹ *City of Burbank*, 411 U.S. at 625 (quoting *Cooley*, 53 U.S. (12 How.) at 319).

²¹² *Id.* at 627.

²¹³ *Id.* at 627-28.

²¹⁴ *Id.* at 633.

²¹⁵ *Id.* at 633-34 (quoting *Northwest Airlines, Inc. v. Minnesota*, 322 U.S. 292, 303 (1944) (Jackson, J., concurring)).

In *City of Burbank*, the Court stated: "If we were to uphold the Burbank ordinance and a significant number of municipalities followed suit, it is obvious that fractionalized control of the timing of takeoffs and landings would severely limit the flexibility of FAA in controlling air traffic flow."²¹⁶

c. *State Securities Co. v. Aviation Enterprises, Inc.*

In *State Securities Co. v. Aviation Enterprises, Inc.*,²¹⁷ the Court of Appeals for the Tenth Circuit found that Congress had preempted the field of registrations and liens pertaining to title to aircraft under Title 49, Section 1403 of the United States Code.²¹⁸ As a result, state recording statutes were not applicable. The court reasoned that by providing a federal system for registration of conveyances, Congress had preempted that field. This same conclusion was reached by the Supreme Court in *Philko Aviation, Inc. v. Shacket*,²¹⁹ where Justice White held that federal law preempted state law that would allow undocumented or unrecorded transfers of interest in aircraft to affect innocent third parties.²²⁰

D. CONCLUSION: HISTORICALLY, COMPLIANCE WITH
CERTIFICATION REQUIREMENTS HAS NOT SHIELDED
MANUFACTURERS FROM ALLEGATIONS OF
DEFECTIVE DESIGN

As illustrated by the *Lake Aircraft* and *Piper Aircraft* cases, recent court of appeals cases have held that regulations passed under the Federal Aviation Act do not preempt state actions for negligent design. The conclusions in these cases, however, seem to be a reflection more on current political attitude than on an analytic analysis of the law.

While the Federal Aviation Act does not expressly preempt state review of aircraft design, there is a strong basis for implied preemption based on the pervasive nature of the aviation laws and the need for national uniformity. The rationale applied in *Atlantic Richfield*, *City of Burbank*, and *State Securities* supports a

²¹⁶ *Id.* at 639.

²¹⁷ 355 F.2d 225 (10th Cir. 1966).

²¹⁸ 49 U.S.C. § 1403 (1988), *repealed by* Pub. L. No. 103-272, § 7(b), 108 Stat. 1379, 1383 (1994) (recently recodified at 49 U.S.C. § 44107 (1994)).

²¹⁹ 462 U.S. 406 (1983).

²²⁰ *Id.* at 409-10.

preemption argument for aircraft design; the existence and nature of the SCR process further strengthens this proposition.²²¹

As suggested previously, judicial analysis of implied or conflict preemption should be influenced by the special certification review process. The SCR procedure provides a feedback mechanism in the aircraft certification process that makes the overall scheme more comprehensive and makes the regulation of aircraft design self-policing. As policing mechanisms, both the FAA regulations and state actions for negligent design serve precisely the same purpose: to protect the public from unsafe designs and to encourage safety improvements in designs when they are identified. As the Supreme Court noted in *Atlantic Richfield*, where state and federal laws serve the same purpose, imposition of more stringent laws by the states is prohibited by the Supremacy Clause.²²² Additionally, as a feedback mechanism, the existence of the SCR process makes some suggestion as to the legislative intent. By including the SCR process,²²³ the inference is appropriate that the intent of the federal legislation was to provide its own internal corrective processes—that state review of designs was not needed to police designs for safety.

In addition to its role as a policing mechanism, the SCR procedure serves as a continuing link between aircraft design certification and pilot training and certification. In this role, the SCR process is a feedback mechanism that ties aircraft design to pilot training assuring that relative safety in design is complemented by appropriate training for pilots.

The relationship between aircraft design and pilot training can be illustrated, in part, by *Piper Aircraft*. In that case, the court focused on the limited forward visibility from the rear seat of the Piper Super Cub²²⁴ and concluded that the manufacturer

²²¹ A very compelling argument for preemption is presented by one commentator who suggests that the courts in both *Lake Aircraft* and *Piper Aircraft* misconstrued the import of both the savings clause and the express preemption provision. Hand, *supra* note 169, at 741.

²²² *Atlantic Richfield*, 435 U.S. at 165.

²²³ The SCR power is exercised under 49 U.S.C. § 44709 (1994). See *supra* note 83 and accompanying text (discussing the SCR power).

²²⁴ The Piper Super Cub (actually a series of models including the PA-18-90, PA-18-108, PA-18-125, and PA-18-150), an immensely popular aircraft, was manufactured by Piper Aircraft for almost 50 years. Introduced in 1949, production continued into the early 1980s. Super Cubs were used by the U.S. Government during World War II as trainers and were procured by the U.S. Army in 1950-51 (as L-21s). JOE CHRISTY, *THE PIPER CLASSICS* 7-8 (1988). The history of the Super Cub goes back to the Piper J-3 from which it evolved. The Piper J-3, which be-

should have raised the rear seat.²²⁵ The court overlooks, however, that for many years pilot training for operation of an aircraft with tail-wheel landing gear has included detailed, specific instruction in the taxi, takeoff, and landing of aircraft with that type of gear and specifically in dealing with the reduced forward visibility that is inherent in that type of design.²²⁶ In a thirty-year-old FAA publication²²⁷ on basic flight training, the following warning is offered:

Since a tailwheel type airplane rests on the tailwheel as well as the main landing wheels, it assumes a nose high attitude when on the ground. In most cases this places the engine cowling high enough to restrict the pilot's vision of the area directly ahead of the airplane. *Consequently, objects directly ahead of the airplane are difficult, if not impossible, to see.* To observe and avoid colliding with any objects or hazardous surface conditions such as chuck holes or mire, the pilot should alternately turn the nose from one side to the other—that is zigzag, or make a series of short S-turns while taxiing forward.²²⁸

As indicated, limited visibility is inherent in a tailwheel aircraft and requires specific pilot awareness and action. Limited visibility, however, is only part of the challenge in flying that type of airplane. The FAA publication adds, “taxiing with a steerable nosewheel [tricycle landing gear aircraft²²⁹] requires less special

came popular in the late 1930s, was a common training aircraft for many years. Prior to World War II, the Cub was used extensively in the Civilian Pilot Training Program (CPTP), and of the more than 435,000 student pilots trained there, “[f]our out of five won their wings in [the Cub], and according to the FAA, three out of four combat pilots in World War II ‘learned their ABCs in it.’” *Id.* at 6. This background on the Super Cub and J-3 is provided to illustrate that the design being attacked in *Piper Aircraft* had been proven by almost 60 years of use prior to the accident.

²²⁵ *Piper Aircraft*, 985 F.2d at 1445.

²²⁶ The court also overlooks the fact that literally *hundreds of thousands of pilots* from the 1930s to the 1980s successfully learned to fly in Cubs (and other very similar models) by applying various pilot techniques to eliminate the hazard of the reduced forward visibility of the Cub. *See supra* note 224 (discussing pilot training in the Cub).

²²⁷ An old publication was selected to see the type of warnings that were offered before *Piper Aircraft* caused the tailwheel aircraft to become notorious.

²²⁸ FEDERAL AVIATION ADMIN., FLIGHT TRAINING HANDBOOK 55 (1965) (emphasis added) [hereinafter FLIGHT TRAINING HANDBOOK].

²²⁹ Many newer aircraft employ “tricycle” gear with a nose rather than tail wheel. While tricycle gear aircraft do not have the forward visibility restrictions found in tailwheel aircraft, they may weigh more and can be mechanically more complex.

pilot technique" than with a tail-wheel type aircraft.²³⁰ The tailwheel design has been used almost since the beginning of manned flight and is well known to require skill to handle. One aviation consultant said the following about tailwheel aircraft:

The tailwheel of an airplane with dynamically unstable main landing gear is serious business. In motion, it's like trying to shoot an arrow feather-end first. The center of gravity is behind the main gear, so . . . the airplane [will] want to swap ends. The resulting maneuver is called a ground loop. The pilot must be trained and experienced to manually overcome the dynamic instability of such a landing gear.²³¹

In regard to one tailwheel aircraft, the PT-17 Stearman, the same author added: "If there is an incompetent pilot in the driver's seat, he is going to go for a ride."²³² Because many aircraft today are tricycle gear airplanes, the FAA has recently amended the Federal Aviation Regulations to legally require training in tailwheel airplanes before a pilot may act as pilot in command.²³³ While the FAA training recommendations regarding tailwheel aircraft were standard training at the time of the accident in *Piper Aircraft*,²³⁴ the regulation legally requiring tailwheel training was not added until after the accident in *Piper Aircraft*.²³⁵ By adding a new regulation specifically addressing the training required for a particular type of aircraft design, the FAA is making a clear statement that they understand the relationship between aircraft design and pilot training. The FAA action recognizes that some aspects of aircraft are best addressed by changing the design, and other aspects, perhaps due to cost, complexity, practicality, or the state of technology, are better addressed with pilot training. The fact that the FAA amended the pilot training requirements and not the tailwheel design certification requirements is evidence that they balanced

²³⁰ *Id.*

²³¹ CHRISTY, *supra* note 224, at 9 (quoting David Blanton, President of Javelin Aircraft).

²³² *Id.* (suggesting that the PT-17 is a difficult aircraft not to ground loop).

²³³ 14 C.F.R. § 61.31(g) (1996). The text of § 61.31(g) provides, in part: "No person may act as pilot in command of a tailwheel airplane unless that pilot has received flight instruction from an authorized flight instructor who has found the pilot competent to operate a tailwheel airplane and has made a one time endorsement so stating in the pilot's logbook." *Id.*

²³⁴ FLIGHT TRAINING HANDBOOK, *supra* note 228, at 53-55 (discussing tailwheel training from 1965).

²³⁵ The accident in *Piper Aircraft* occurred in 1983. *Piper Aircraft*, 985 F.2d at 1440.

both aircraft design and pilot training factors to achieve the required safety objective. For the court in *Piper Aircraft* to presume that all that was needed to make the Super Cub safe was for the rear seat to be raised is to ignore the design tradeoffs that would accompany an alternative design (perhaps a raised seat would only permit short pilots to fit or cause an interference between the pilots knees and the controls) and appropriate pilot training as an alternative way to balance design issues against aircraft cost, complexity, or handling characteristics.

The FAA has taken a similar approach for high performance aircraft by requiring specific training regulations for high performance aircraft to ensure that the more complex systems are adequately understood by the pilots.²³⁶ This training requirement recognizes that high performance airplanes, which are still small enough to be exempt from type rating requirements, can overwhelm a novice pilot and can also quickly build dangerously excessive speed. The high performance training requirement would apply to pilots of the Beech Bonanza.²³⁷ Similarly, the FAA has recently added additional training requirements for pilots of small aircraft that are capable of high altitude flight.²³⁸ The high altitude training requirement recognizes that aircraft handling, aerodynamics, stall, and buffet characteristics, as well as meteorology and pilot physiological factors, are different at higher altitudes than typically found at lower altitudes.²³⁹ One outcome of the Piper Malibu SCR was the recommendation for better pilot training.²⁴⁰ As a high altitude pressurized aircraft,

²³⁶ 14 C.F.R. § 61.31(e). Section 61.31(e) provides in part:

A person . . . may not act as pilot in command of an airplane that has more than 200 horsepower, or that has a retractable landing gear, flaps, and a controllable propeller . . . unless he has received flight instruction from an authorized flight instructor who has certified in his logbook that he is competent to pilot [such] an airplane.

Id.

²³⁷ See *supra* note 96 (detailing Bonanza specifications).

²³⁸ 14 C.F.R. § 61.31(f). The text of § 61.31(f) provides, in part:

[N]o person may act as pilot in command of a pressurized airplane that has a service ceiling or maximum operating altitude, whichever is lower, above 25,000 feet MSL unless that person has completed the ground and flight training specified in paragraphs (f)(1)(i) and (ii) of this section and has received a logbook or training record endorsement from an authorized instructor certifying satisfactory completion of the training. The training shall consist of . . .

Id. (very detailed training requirements are included).

²³⁹ *Id.* § 61.31(f)(1)(i)-(ii).

²⁴⁰ See *supra* notes 165-66 and accompanying text (discussing Piper Malibu SCR).

this new regulation would address the FAA concern with the Malibu as raised in the SCR.

As illustrated above, in *Piper Aircraft*, the court focused solely on the aircraft design, but the comprehensive federal regulations compel that pilot training be pulled into the analysis as well. The SCR process provides a tight link between aircraft design and pilot training because an SCR can result in a legally mandated set of pilot training or experience requirements to be completed before a pilot can operate a particular type of aircraft. The existence of this feedback mechanism, which ties together both aircraft design and pilot training, suggests that the scope of federal aviation regulation is complete and that there is no room for state supplementation without undermining the efficacy of the federal process. The interaction between aircraft certification and pilot training also suggests that the "elaborate and detailed system of [federal] controls"²⁴¹ that the Supreme Court relied on in *City of Burbank* to find preemption in aircraft noise regulation are also present in the complex web of regulations pertaining to aircraft and pilot certification. Just as Justice Douglas expressed concern in *City of Burbank* over the potential for "fractionalized control of the timing of takeoffs and landings,"²⁴² so too can state involvement lead to "fractionalized control" of aircraft design. The cost of developing and certifying an aircraft is already enormous.²⁴³ To develop, test, and certify a design that meets federal regulations in addition to specific, different requirements for fifty states would approach impossibility. The plain intent of the Federal Aviation Act of 1958 was to promote aviation.²⁴⁴ An interpretation that allows each of the states to introduce diverse lay opinions regarding the adequacy of an aircraft design certified under the federal regulations would effectively halt or prohibit any aircraft design that states might choose to target. This is clearly repugnant to the legislative intent of the Act. As Justice Curtis observed in *Cooley*, some subjects "imperatively demand[d] a single uniform rule, operating

²⁴¹ *City of Burbank*, 411 U.S. at 633-34 (quoting *Northwest Airlines, Inc. v. Minnesota*, 322 U.S. 292, 303 (1944) (Jackson, J., concurring); see also *supra* notes 208-16 and accompanying text (discussing *City of Burbank*).

²⁴² *City of Burbank*, 411 U.S. at 639.

²⁴³ See *supra* note 63 and accompanying text (discussing the cost of certifying a new aircraft design).

²⁴⁴ See *supra* notes 39-43 and accompanying text (discussing the legislative intent behind the Federal Aviation Act of 1958).

equally on the commerce of the United States in every port.”²⁴⁵ Where, as in the Federal Aviation Act of 1958, “[t]he grant of commercial power to Congress does not contain any terms which expressly exclude the states from exercising an authority over its subject-matter,” the power of the states must nevertheless be excluded “because the nature of the power, thus granted to Congress, requires that a similar authority should not exist in the states.”²⁴⁶

V. CONCLUSION

The FAA SCR is a feedback mechanism in the complex scheme of federal regulations governing the certification of aircraft design. The SCR process can be invoked by the FAA when a series of accidents call into question the safety of an aircraft. In SCR investigations, the design of the aircraft involved has been previously certified under all applicable FAA regulations but is again subjected to testing, documentation, and evaluation to confirm safety of the design and conformance with certification criteria. The aircraft may be grounded or subjected to operational limitations during the course of the SCR. As illustrated with the Beechcraft Bonanza and Mitsubishi MU-2 SCR investigations, the SCR process assures that certified designs can be continually monitored for safety and that the certification criteria can be re-evaluated when new information warrants such a re-evaluation. The SCR process also serves as a link between aircraft design and pilot training, assuring that appropriate pilot training will be required for specific aircraft designs. When examining the scheme of federal regulation over aircraft and pilot certification, the SCR process illustrates the comprehensive nature of the federal regulations and clarifies the intent that the federal certification requirements be the exclusive requirements for U.S. civil aircraft design.

²⁴⁵ *Cooley*, 53 U.S. (12 How.) at 319.

²⁴⁶ *Id.* at 318.

Tributes

