Safety Reports

Aviation Safety Data Accessibility Study Index

A Report On Issues Related To Public Interest In Aviation Safety Data

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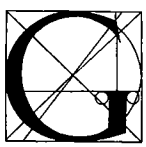

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Aviation Safety Data Accessibility Study Index: Preface

Recently, Senators Wyden and Ford asked the FAA to work with the aviation community to recommend the best means to educate the public and make available information about commercial aviation safety, while at the same time ensuring that the integrity of the safety system is maintained. This document has been developed to stimulate discussion and to obtain feedback on the types of aviation safety data that FAA might make available to the public, how such information might be distributed, and issues and considerations that arise in the distribution of these data. The scope of this review did not include issues related to the release of aviation security data.

This report is a revised version of an earlier paper, "A Review of Issues Related to Availability and Accessibility of Aviation Safety Data," dated October 29, 1996. Availability of the earlier version of this report was announced in the Federal Register on November 13, 1996. In addition, copies of the draft paper were made available to selected aviation organizations and others who requested copies. A public comment period and a docket were established to receive written comments on the draft report. The comment period closed on December 3, 1996. All comments received through December 10, 1996 were reviewed. Comments received on matters discussed in the draft report are reflected in the revised report.

Professor Arnold Barnett of the Massachusetts Institute of Technology and Professor Clinton V. Oster, Jr. of Indiana University made important contributions to this paper. In particular, they provided guidance on statistical analyses of aviation safety data, determining whether observed differences are meaningful, and relating their own experience in examining questions of comparative safety performance among air carriers. R. Davis Balderston of FAA provided input on the availability of existing data. In addition, he made many useful suggestions on the issues related to making aviation safety data both more available and easier to access. Numerous commenters on an initial draft of the paper, representing a cross section of the aviation industry, also contributed to the report. The materials in this document have been prepared by GRA, Incorporated under contract with FAA. They do not represent an official position of the FAA.

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Aviation Safety Data Accessibility Study Index: Introduction and Summary

Recently there have been a number of proposals to make aviation safety data more available and accessible to consumers. (Congress. Senate 1996) Some advocate the ranking of carriers based on safety--much as carriers receive rankings for on-time performance, lost baggage and other consumer complaints. (GAO 1996). The FAA, in response to a request from Senators Wyden and Ford, has undertaken an effort to determine the best means of providing safety information to the public while ensuring the integrity of the aviation safety system. This paper reviews aviation safety data and measurement issues relevant for responding to these proposals, including the ranking of airlines by safety performance.

In addition, the paper examines the more general subject of risk communication and how some non-aviation organizations have approached issues related to the release of information. The purpose of the paper is to identify options that may be available to FAA and others regarding the dissemination of aviation safety information. As such, the report makes no recommendations *per se*.

Today, the Federal government makes a variety of aviation safety data available to the public. Many regard the provision of such information about aviation and other industries as a fundamental role of government, especially in an increasingly complex and dynamic economic environment. For example, data on accidents and incidents are made available by both FAA and the National Transportation Safety Board (NTSB).

Some data are made available routinely while other data are released upon request. Intermediaries and value-added resellers also obtain some aviation safety data from FAA and sell it along with retrieval software and/or interpretive analysis. The development of the National Aviation Safety Data Analysis Center (NASDAC) and the rapid growth of the internet have created opportunities to make FAA's aviation safety data more directly accessible to the public.

Increased data availability and accessibility also create new opportunities for educating the public on the use and interpretation of aviation safety data, as well as for describing how FAA, the airlines, aircraft manufacturers, airports, flight crews, mechanics, and others work together to promote safety. FAA also should explore the ramifications of making additional forms of data available to the public, such as data emanating from surveillance activities and completed enforcement actions. While these data are made available on a case-by-case basis, routine release of such data raises questions about the effects it could have on FAA's ability to collect safety information and to use the information it collects for its own needs, such as the allocation of inspection resources. In

addition, much of these data contain information on individual air carriers, and it is difficult (for most people) to organize these data in ways which facilitate meaningful comparisons among carriers.

A significant question examined by this paper is what information about aviation safety would be useful for informed consumer choice among airlines. While public concern about the safety of U.S. commercial aviation is most acute immediately following an airline accident, it also seems to reflect the public's view of the aviation industry in general, and its view of FAA's stewardship of aviation safety. Whether or not those inside the industry believe that these concerns are justified given the high absolute levels of aviation safety, the public's concerns are real and are likely to have a large impact on the discourse about air safety.

The paper is organized as a discussion of various topics:

- Safety Data
- Analysis and Interpretation of Safety Data
- Availability and Accessibility of Safety Data
- Experience of Other Federal Agencies
- Public Access to Safety Information

The existing high level of safety in the U.S. air transportation system results from the combined efforts of industry and government including the FAA, airlines, aircraft manufacturers, airports, flight crews, mechanics and others. Indeed, there may be a need to provide additional information as to how these groups work together to promote aviation safety. It may also be useful to make the public more aware of the various mechanisms and incentives these parties have to assure a high degree of aviation safety. These actions could be undertaken as part of any effort to make aviation safety data more available and accessible.

Safety Reports

Aviation Safety Data Accessibility Study Index: Safety Data

In the broadest sense, safety data include reports of events, such as accidents and incidents, inspection results, reports of enforcement actions or other sanctions, and other data which characterize the activities of the air transportation system. It must be noted that only accidents (and some incidents) involve measurable harm to persons or property, and that many types of incidents are reported to FAA by the carriers themselves.

It should be noted that there is no consensus among researchers and participants in the aviation industry about what exactly constitutes "safety data." This lack of consensus was strongly expressed in the comments to the initial draft of this report. Although accidents are universally regarded as events that should be avoided and eliminated if possible, there is little or no statistical evidence for U.S. domestic commercial aviation that other forms of "safety data"-incidents, surveillance results, or enforcement actions-serve as predictors of future accidents or are correlated with accident rates for individual carriers. While the remainder of this section discusses types of data that are commonly regarded as relevant to safety concerns and to the fulfillment of FAA's safety responsibilities, the exact nature of the relationships between these data and the safety of airline operations remains the subject of research in the aviation community.

Accident and Incident Data

Aircraft accidents and incidents are events that involve direct or potentially direct effects on the safety of aircraft operations and of persons involved in those operations. Accidents result in death or serious injury to a person in, upon, or about the aircraft, or in substantial damage to the aircraft itself. Incidents are less serious events "that affect or could affect the safety of operations." (FAA, 1996b) Because accidents and incidents, once reported and investigated, are believed to represent a relatively unambiguous record of unfavorable safety events, they are the safety measures most commonly used by researchers for analyzing changes in aviation safety over time and differences among carriers and groups of carriers. However, the raw data on accidents and incidents must be converted to accident and incident *rates* before it can legitimately be used for making comparisons about safety over time, among groups of carriers, or among individual carriers. This type of conversion, which controls for exposure to risk, is called *normalization* and is discussed below in the section on exposure data.

Some observers have suggested that the classification scheme for aviation accidents used by reporting agencies is needlessly arcane, and the Federal Aviation Authorization Act of 1996 directs the NTSB, in conjunction with FAA, to

develop a more comprehensible and refined classification of accidents involving fatalities, injuries, or substantial damage. (Congress. House, 1996) NTSB has recently responded with a proposed classification format that addresses these concerns. (NTSB, 1996)

Inspection and Surveillance Data

Some have argued that it is possible to identify or compile "safety indicators" that provide insights as to whether a carrier is more or less likely to undertake unsafe practices. Researchers, including GAO (1988), have focused on four broad aspects of airline operations that are believed to be important to safe operations.

- Pilot competence
- Maintenance quality
- Financial stability
- Management attitude

GAO (1988) concluded that there were no comparable and objective measures of relationships between airline safety and these four areas. The role of safety indicators was also discussed in a recent report on Australian aviation safety by the Australian Parliament (Parliament of the Commonwealth of Australia, 1995), which noted that "accident statistics are of limited use and there are no...safety indicators that can be used as effective alternatives of the statistics. In short, there is a scarcity of measurements of safety." Recently, however, GAO (1996) recommended that FAA reexamine the feasibility of developing objective measures relating airline safety to carrier performance in these areas.

Some believe that information on factors that could affect airline safety practices can be found in inspection and surveillance reports on airline operations. If these data provide useful information about current or future carrier safety practices, then public reporting of these data could provide a positive incentive for the level of effort carriers put into safety, over and above the obvious self interest of the carriers. Public reporting of inspection and surveillance data could allow consumers to make their own comparisons of carriers based on how well or poorly they have done when inspected by FAA. The degree of compliance with FAA regulations might be an indicator of an airline's diligence in the safety arena. It must be noted, however, that there may be no relationship between inspection results and the probability that a carrier will have an accident in the future, especially if carrier operations improve as a result of FAA findings.

Data from inspection and surveillance reports are not currently available to the public, although results from these oversight activities are sometimes reported publicly. There is a very large number of inspection and surveillance reports filed by FAA inspectors. However, there has been comparatively little systematic analysis of these data, especially in terms of its relationship (if any) to accidents and accident rates. Some analysts have questioned the quality, reliability, and

management of inspection and surveillance data within FAA (GAO 1992, 1995), and consideration of releasing detailed inspection and surveillance data to the public could be made contingent on improvements in FAA's ability to manage and utilize these data adequately for its internal needs. There are also concerns related to the belief that some surveillance reports represent subjective evaluations of a carrier's operations. Additional analyses of these data should be conducted before FAA makes a decision to release inspection and surveillance data on individual carriers to the public on a routine basis.

Exposure Data

Computation of an accident or incident rate requires normalizing information about the level of exposure to risk. For comparative purposes, it is essential that accident and incident data be normalized in some way, since the system's (or a carrier's) exposure to risk changes over time. One carrier's exposure to risk in a particular time period will likely differ from that of another, because different carriers have different levels and types of activity. Measures of exposure to risk commonly used to normalize event data include number of flights, hours flown, passenger enplanements, and passenger miles flown. Villareal (1988) discusses advantages and disadvantages of the various exposure measures used for normalizing safety research data. Most researchers prefer to use the number of flights (measured as departures) for normalizing data, rather than hours or miles flown, because the risk of accident for an aircraft is greatest during takeoff and landing. For consumers, the most relevant measure is also likely to be a flight or a round trip.

Although a commercial aircraft spends only about six percent of its flight time in the takeoff, initial climb, final approach, and landing components of its flight, around 70 percent of "hull loss" accidents have occurred during these stages. (Weener and Wheeler, 1992) Because of this, using an hours flown-based measure or a mileage-based measure of risk can be misleading. This is especially true when comparisons are being made between segments of the industry that have different average flight lengths. Using a mileage-based measure will make a commuter type carrier with very short average flight lengths look more risk prone relative to a major jet carrier flying longer stage lengths on average. (This occurs because a carrier with shorter average flights will make more takeoffs and landings per mile flown, and a carrier is most exposed to the risk of an accident or incident during takeoff and landing.) Prior research has shown the importance of comparing like groups of carriers (termed "peer groups") when comparing safety performance. (GRA 1988)

Accident and incident rates commonly reported to the public by FAA, the NTSB, and intermediaries such as the media and consumer groups thus combine event data-accident counts and incident counts-with exposure data to provide a measure of the frequency with which events have occurred. Thus, if in a hypothetical time period there were two commercial aviation accidents and one million commercial departures, the accident rate for this time period could be

reported as 0.2 accidents per 100,000 departures. This accident rate could also (perhaps more informatively for the average person) be reported as an average of 500,000 departures per accident.

In many cases, the usefulness of reported safety data for the public might come from such small and simple changes in the style of reporting. For example, as part of its proposed reclassification system for airline accidents, the NTSB would begin reporting passenger fatality rates in a "passenger miles per fatality" format rather than the customary "fatalities per million passenger miles" format. (NTSB, 1996) In its discussion of various accident and fatality statistics, NTSB (1996) notes that "none of the statistics, taken alone, can be considered an accurate measure of airline safety and can be misleading."

The accident, incident, and exposure data described above are already available to the public, although it may take some degree of computer and statistical expertise to convert these data into useful information. Since any new FAA system for safety communication is likely to include accident and incident data, the more important question is what additional data should be included. As noted above, some discussion has been given to releasing surveillance and inspection data.

Making reasonable comparisons between carriers with this data also requires some form of normalization, such as a "percentage of satisfactory inspections" format. Because such data occurs on a carrier specific basis, surveillance and inspection data should be examined to see if there are no persistent statistical differences among individual carriers as normalized accident and incident data are. With these new data in mind, it might be useful to distinguish between "safety performance," which would include negative outcomes (like accidents and incidents) and positive outcomes (like safe uneventful flights), and "safety effort," which would include the sorts of items examined in a surveillance or inspection report. The logic of this distinction is that "safety effort" by carriers seeks to ensure that most or all "safety performance" outcomes are positive. As is discussed below, it is well established that carriers cannot be distinguished by "safety performance," but additional research is needed to determine whether this is also true for "safety effort," and whether differences in "safety effort" are informative about "safety performance."

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Aviation Safety Data Accessibility Study Index: Analysis and Interpretation of Safety Data

Recent Research

The overwhelming consensus among researchers is that statistical analyses of such measures as death risk, accident rates, and incident rates can say little about differences among carriers, although there are differences between groups of carriers (e.g., major and national carriers vs. regional carriers) and for the aggregate industry over time. All measures of accident and incident rates have declined markedly over time. (This is so even though the absolute numbers of accidents and incidents per year might be stable or even increasing, because of the overall expansion of the industry.) This basic point might be usefully emphasized, because the average person mainly sees information about the frequency and extent of serious accidents, and rarely sees information about aviation's increasing exposure to risk, due to the rapid growth in the number of commercial aviation flights. When an accident occurs, there is an intense period of media coverage and speculation as to what might have caused it. In such an environment, it may be easy to lose sight of how safe air transport has become.

Many researchers have used normalized accident and incident data to analyze the safety of the U.S. commercial aviation industry, including changes in the level of safety over time. Conclusions common to these studies are that the risk of death or serious injury for air travelers is exceedingly small, that this risk fell dramatically between the 1970s and the 1980s, and has remained at these lower levels since then. For example, a passenger who *randomly* chose a U.S. domestic jet flight between 1967 and 1976 would have a one in two million chance of dying. This death risk fell to one in seven million in the decades 1977-1986 and 1987-1996. Using data from 1990 to the present, the death risk falls to one in eight million. Stated somewhat differently, if a passenger facing a death risk of one in eight million chose one flight at random each day, she would, on average, go for *21,000 years* before perishing in a fatal crash. (Hinson, 1996)

While acknowledging that the overall safety record of U.S. commercial aviation is high and has improved over time, researchers have tried to determine whether measurable differences exist in the safety records of individual carriers. There is no evidence found in the accident and incident safety data for individual carriers that allows distinctions to be made between carriers which belong to homogeneous "peer" groups. (GRA 1988, Barnett-Higgins 1989, Oster, *et al.*, 1992, Barnett 1996) This result is illustrated in Exhibit 1, which shows the possible "safety rankings" of U.S. major passenger carriers for three (overlapping) decades. The rankings are based on the death risk for a person who randomly chose one of the airlines' flights during the decade of interest. In each decade, those airlines that suffered no fatalities are given asterisks; they

are ranked by number of flights performed. The point to be made is that the rankings are very unstable--the carrier ranked first was different in all three periods, and the airline that was best in one period always fell to the bottom half in the other two periods. It illustrates that because fatal air accidents are so rare among major (and other) U.S. carriers, even airlines with the same safety record over the long-run can have differing accident records over shorter spans of time. Thus, on the measure perhaps most important to a passenger, there are no consistent or persistent distinctions among the major jet carriers.

Exhibit 1
DEATH RISK RANKING FOR TEN YEAR PERIODS

Airline	1984-1993	1979-1988	1974-1983
Airline A	1*	6	7
Airline B	4	4	5
Airline C	5	5	1*
Airline D	7	7	2*
Airline E	2*	2*	4*
Airline F	3	3	8
Airline G	6	1*	6
Airline H	8	8	3*

Source: Data adapted from Barnett, 1994.

There is probably a natural human inclination to use available numerical information for ranking purposes, and it is always possible to calculate airline-specific accident rates and use them to order the airlines from highest to lowest. However, it is important that such data be analyzed to determine whether observed accident rates among individual carriers are significantly different. When considering the issue of discernible safety differences between individual carriers, it is useful to recall some basic concepts from statistical analysis. Saying that carrier A is less safe than carrier B is saying that a flight by A is more likely to be involved in an accident or incident than a flight by B. If A and B are equally safe, there is no difference in these likelihoods. Unfortunately, individual carrier safety (or aviation system safety in general) is not directly observable. Therefore, differences in safety must be inferred from the statistical analysis of observable data judged to be relevant for safety concerns. The role of statistical analysis is

to determine whether observable evidence, such as the actual accident rates achieved by the carriers, is consistent or inconsistent with the presumption that the two airlines are equally safe.

Consider, for example, a six-sided die. If the die is fair, there is an equal likelihood, or probability, that any of the sides will be turned up when the die is rolled. In most cases, however, it is impossible to observe directly that the die is fair. One way to test a die's fairness is to roll it repeatedly. Suppose we roll the die six times. It is possible that a fair die rolled six times could turn up the same number on more than one of the rolls. In fact, for a fair die, with each of the sides equally likely to turn up, the probability of the same number turning up four or more times is around 10 percent, which is to say that, on average, such a result would happen one time in ten. For the purposes of statistical analysis, seeing a die turn up the same number four or more times in six rolls would not be conclusive evidence that the die was unfair. Stated somewhat differently, seeing the same number come up four or more times in six rolls is not inconsistent with a presumption that the die is fair.

It is useful to compare this example with a hypothetical record for U.S. domestic carriers over a period of time. Suppose that in that time period, there were six major jet crashes, and four of them were suffered by Airline A. The safety of individual U.S. air carriers is not observable, but this accident record, seemingly skewed in Airline A's disfavor, is observable. Just as with the example of the die described above, it may not be possible to conclude, based on the accident record, that Airline A must have been less safe than other U.S. domestic carriers. In other words, the evidence available may not allow a statistically significant distinction to be made between Airline A and other carriers. Past research on aviation safety has been unable to find statistically significant differences among individual carriers (within peer groups) based on their accident records. This is due in part to the extraordinarily small number of accidents that do occur.

An important implication of the research results described above is that there is currently no evidence in accident data that would support the ranking of individual airlines based on their safety records, at least for U.S. domestic carriers. While there may be apparent differences in carrier safety records at any particular time, due largely to the infrequent but catastrophic nature of an air accident, there is no evidence that such distinctions persist nor that they are predictive of future safety performance. Rankings of airlines based on past accident records therefore provide no information to consumers seeking to make safety-enhancing comparisons for current or future travel choices.

Some observers, who acknowledge that there is no evidence that would support the ranking of air carriers based on their safety records, would like to consider a "rating" system for informing the public about differences between carriers in safety performance, safety effort, and perhaps other areas. An example of such a rating system, which includes (to a small degree) safety information about

carriers, along with other service attributes, to construct a rating scale for airlines can be found in Bowen and Headley (1996). Such an approach is perhaps best left to organizations and firms in the private sector. The role of government is, arguably, to ensure that all carriers meet and maintain common high standards of safety, and to use its regulatory powers to halt deteriorations in safety that might occur at any carrier. If other organizations perceive there is a market for a broader set of information, they can seek to meet that need.

Researchers have had some success in identifying statistically significant safety differences among different groups of carriers. (Higgins 1987, GAO 1988, GRA 1988, Barnett-Higgins 1989, Oster *et al.* 1992, Stouffer 1992, FAA 1996c, GAO 1996) These studies have found that carriers based in the U.S. and other developed countries consistently have lower accident rates than carriers based in less developed countries and that major U.S. domestic carriers using jet aircraft have lower accident rates than smaller U.S. regional or commuter carriers. Some have also found that established U.S. domestic carriers have lower accident and incident rates than "new entrant" carriers (FAA 1996c, GAO 1996), although there is not agreement among experts that the carrier groupings in these studies are appropriately designed. (There are some concerns about the selection of carriers in each group as well as in the types of events included in the measure of accidents.) It should be emphasized that these studies also conclude that there are no significant differences in risk to life or limb when looking at individual carriers that belong to a homogeneous group of air carriers.

To date there has been relatively little research into relationships between accidents and less serious safety measures such as incidents or surveillance data. New research in this area could provide important findings about the possibility of predicting future accident rates rather than analyzing actual rates after the fact. GRA (1988) examined relationships between accident, incident, and enforcement action rates among major, national, and regional carriers. No relationship was found between incident rates and accident rates. However, it found that there was a statistically significant relationship between accident rates and enforcement action rates among national and regional carriers (but not for major air carriers). However, it was unclear whether higher accident rates led to higher enforcement action rates, or vice versa. An analysis (FAA, 1990) of the relationship between Near Midair Collision incidents (NMACs) and actual Midair Collision accidents (MACs) found that while NMACs were significantly related to the level of airport activity (and congestion), there was not a statistically significant relationship between a particular type of incident (NMACs) and a related type of accident (MACs).

Professor Arnold Barnett of MIT has examined the relationship between passenger death risk and the occurrence of nonfatal safety events, such as incidents and nonfatal accidents, and found them to be *negatively* correlated for major U.S. airlines between 1990 and early 1996. The results of this research, shown as Exhibit 2, suggest that if anything, passenger death risk is *lower* on

carriers that experience higher rates of negative nonfatal safety events. In fact, as one tries to refine the safety indicator statistic by removing less serious events from it, it actually worsens as an indicator of passenger death risk. This result should not, of course, be taken literally, but it does illustrate the unclear relationships that exist between the statistic most important to a passenger-the risk of dying-with other statistics deemed relevant for aviation safety concerns.

Exhibit 2
CORRELATION OF NONFATAL EVENT STATISTICS WITH PASSENGER DEATH RISK ON MAJOR U.S. AIRLINES
1/1/90 - 3/31/96

STATISTIC (Per 100,000 Flights)	CORRELATION
Incidents	-0.10
Accidents + Incident	-0.21
Accidents Only	-0.29
Serious Accidents Only	-0.34

Source: Professor Arnold Barnett, Presentation to FAA, December 6, 1996.

There has been no publicly available research into relationships that might exist between carrier accident rates and the information that is contained in FAA inspection and surveillance reports. Inspection and surveillance data may not be easily comparable for individual carriers, and future research activities in this area should be encouraged. It will be necessary to identify relationships between inspection and surveillance results and observed safety performance before actually using the data for carrier specific comparisons. Surveillance data may also be useful for identifying threats to aviation safety that are currently poorly understood, and there are several cooperative programs for sharing and analyzing data under development in the aviation community. These programs would involve the combined efforts of manufacturers, carriers, and regulators, both within the U.S. and internationally.

Value of Safety Information to FAA

The information generated by accident and incident records, and through FAA's inspection and surveillance activities is valuable because it improves FAA's ability to allocate its limited resources to best serve the safety needs of the flying public. Because most research indicates that safety distinctions between carriers (within homogeneous groupings) cannot be drawn using accident and incident

data, inspection and surveillance information is of special importance to FAA. The vast amounts of information contained in inspection and surveillance reports require extensive analysis, and the creation of systems for conducting and disseminating this analysis within FAA is a current and ongoing effort. (FAA 1996a) An example of the use of both accident/incident data and surveillance data can be found in the Department of Defense Air Carrier Analysis System. The Department of Defense, which purchases large numbers of contract flights from civil carriers, uses this system to "score" carriers based on evaluations of their performance in five broad measures of carrier operations-safety, operations, maintenance, financial condition, and service quality. (Ott 1988) However, DOD is a purchaser of contract airlift services and is neither a safety regulatory agency nor a provider of safety information to the public. Some researchers regard the DOD system as overly dependent on heuristic analysis, with insufficient attention given to statistical analysis.

There have been rapid and extensive changes in the U.S. commercial aviation industry since its deregulation in 1978. What was once a highly regulated industry of relatively few stable firms is now a dynamic and complex industry with rapidly changing participants. Many of the changes that have occurred-the development of hub and spoke systems, the increasing sophistication of airline pricing strategies, the rapid entrance (and exit) of new, low-cost carriers-caught many industry experts by surprise.

The primary role for FAA in this changing industry is to ensure that the safety of commercial aviation remains uncompromised amid the turmoil. The collection and analysis of non-accident safety data--incidents and surveillance results-is an essential tool for FAA in this environment. It becomes especially important as FAA's objectives shift from a reactive, learning approach, based on the analysis of past accidents, to a proactive, preventative approach devoted to identifying and remedying potential causes of future accidents.

An important development in FAA's management of aviation safety efforts is the safety partnership program, which will allow FAA to leverage its finite inspector resources. This program will depend on a high degree of cooperation between FAA and established air carriers, and will increase the proportion of safety relevant data that is reported to FAA by established carriers themselves. The implementation of such partnerships will allow FAA to focus its direct oversight efforts on sectors of commercial aviation that could most benefit from more systematic inspection. GAO (1996) identifies new carriers as one class of carriers that should receive more intense surveillance. A recent FAA study (FAA 1996a) also identified the need for more intense surveillance of new carriers and of low cost carriers in general. Other research (FAA 1996c) indicates that low cost carriers might also receive higher levels of surveillance.

It should be noted that more intense levels of surveillance for new and low cost carriers does not necessarily imply that such carriers operate with safety

standards that are less stringent than established carriers. It could equally indicate that new carriers, most of which compete strongly on price, are relatively unknown quantities for FAA. Even though a new carrier may have met all certification requirements, FAA will still know less about the operations and management of a new carrier than it does about the activities of a more established carrier. Especially in an era of constrained federal budgets, it may be most efficient, from a safety standpoint, to concentrate FAA's direct surveillance resources on newer carriers, which face greater financial and managerial uncertainties than an established carrier.

Value of Safety Information to Consumers

Consumer demand for safety information is a demand for information about the integrity of the system that provides air safety, in whole and in its constituent parts. There is a high degree of consumer interest in this topic which may be at the heart of increased calls for FAA to disclose safety information. Public concerns about aviation safety, as expressed in recent polling results, are presented in Attachment A below.

Just as FAA must adapt itself to a rapidly changing industry, consumers are faced with an increasingly confusing and unfamiliar commercial aviation market. While it may be relatively easy for consumers to make decisions about price and schedule choice, it is more difficult for them to evaluate safety in a changing industry. As increasing numbers of consumers fly, there will likely be increased demand for information about the workings of the aviation safety system and about the status of individual participants in that system.

In these circumstances, the proper role of government and FAA may be to take the lead in providing consumers with information about the high level of safety in aviation, both in aggregate and with respect to individual carriers. Consumers are often trying to inform themselves about new carriers offering services in specific markets, and one role for FAA may be simply to provide information on individual carriers to interested consumers. FAA currently fields many telephone inquiries about specific carriers, an indication that there may be a need for a systematic way of providing such information.

Many consumers are likely to get access to any new information released by FAA through intermediaries such as the media or consumer groups who may put their own interpretation on the information. While there is nothing that FAA can (or should) do about this, it is something to keep in mind. The more user friendly and transparent FAA's presentation of safety information is, the more likely it will be that consumers use the information directly, rather than rely exclusively on intermediaries. Clearly presented information will also make it easier for intermediaries to use safety information responsibly.

A significant component of public concern about flying may stem from the near complete loss of control that a passenger experiences; once a flight commences, there is little a passenger can do to affect the risk of an accident. Risk management and risk communication research has identified such loss of control as an important determinant of individual attitudes toward particular types of risk. This factor is compounded by the catastrophic nature of an air accident, however unlikely, including both the high likelihood of death if an accident occurs and the nature of that death. In addition, commercial air accidents can have hundreds of victims, which adds to the notoriety of an air disaster. The salience of these factors in the psyche of a potential passenger means that an air accident is perceived not as a mechanical or human failure resulting in loss of life, but as a disaster that must have had some identifiable cause and that could have been prevented had appropriate actions or precautions been taken. As flying becomes more common in everyday life, a larger part of the population may hold these concerns.

Because a large component of the public perception of aviation risk may not be easily assuaged by quantifiable risk ratios and accident rates, any communication system intended to inform and reassure the public about safety probably has to address more than the likelihoods of various outcomes and events. Education about air safety and about the structure and reliability of the systems in place to ensure it has to become an ongoing effort. It is also the case that the media will always provide substantial amounts of coverage for particularly catastrophic aviation accidents. The best time to present the public with statistical arguments about aviation safety may not be immediately following an accident. Such arguments are unlikely to be well received at that time, and making them may present FAA more as a promoter of the aviation industry and less as a promoter of aviation safety. It may be that FAA should concentrate its efforts on providing information about aviation safety on a regular and frequent basis. The presentation of specific information and/or reassurance about safety in the aftermath of an accident may be more properly left to the aviation industry.

If people are particularly averse to airliner accidents (as they seem to be) then it is necessary to ask whether the current safety investment and regulatory criteria respond to this level of risk aversion appropriately. Existing criteria for analyzing the benefits and costs of FAA investment and regulatory programs assume expected value decision making. That is, individuals are assumed to be willing to pay up to the expected sum of avoided losses to avoid an air accident. (This means that all other factors equal, society would place the same value on the loss of 100 lives, each lost in one of 100 separate auto accidents, as 100 lives lost in a single airplane accident.) If people are especially risk averse toward aviation accidents with a potential large loss of life in each accident, and no risk premium is placed on airline accidents compared to other accidents, then there may actually be an under-investment in air safety from the perspective of what society really wants. Perhaps in response to the strong public concerns about air safety, the DOT and FAA have established an objective of zero accidents. Since

the level of risk in commercial aviation is already so small, it may be informative to communicate the likely expense, in dollars or inconvenience, of further reductions in that risk, since additional funds and energy devoted to aviation safety probably will increase the cost of flying and cause a reduction in funds and energy directed at other social goals. (Keeney, 1995)

Consumers may seek aviation safety information with the hope of making more informed choices among carriers. In this circumstance, safety information is cast in the role of predicting the likelihood of future accidents. If, as most research indicates, a passenger's risk of dying does not significantly differ among the group of carriers from which she must choose, then knowledge about those carrier's accident rates may convey no additional information to the consumer that is relevant for choosing among airlines. Knowing this might in itself be reassuring for consumers. FAA could end up providing information to the public which says that, in most cases, there are no differences in accident rates among available air carriers. Oster *et al.* (1992) argue that the set of carriers from which a consumer chooses is mainly affected by the kind of market that the consumer is traveling in, and that there are no significant differences in risk among carriers serving a particular market. For example, if all carriers in the New York to Chicago market are major U.S. airlines and these carriers do not have significantly different accident rates, then differences in safety should not affect carrier choice.

Because researchers have been able to find some statistically significant differences in safety between general groupings of carriers, further research into the appropriate design of such comparisons and updating existing results is warranted. However, as Oster *et al.* (1992) point out, consumers generally do not choose between carriers in different groups. For example, a passenger traveling between two distant cities rarely chooses between a jet carrier and a turboprop carrier, and a passenger traveling between two nearby cities does not always have the option of choosing a jet carrier. Past investigations by the Antitrust Division of the Department of Justice have shown that jet and commuter airlines seldom serve the same city-pair markets, and are not likely to enter many of the same markets. (Bingaman, 1996) For markets served primarily by commuter carriers, therefore, the relevant safety comparison may be not between commuter carriers and major domestic jet carriers, but between commuter carriers and non-aviation transport, such as automobile, bus, or rail.

Tensions Between FAA and Consumer Needs for Information

Because some safety data, especially incident data, is self reported by carriers, some thought should be given to how these data are developed and what they represent prior to releasing such data or using it as a basis for comparisons between carriers. A carrier that diligently reports incidents could be made to look relatively prone to these events. Such a carrier may then have an incentive to become less thorough in its reporting practices. This is especially important

because some self reported data is relevant for analyzing the safety of other parts of the aviation system. For example, a crowded airport might have a disproportionate number of (carrier reported) near misses, and such data is probably important for analyzing the need for improvements to that airport. A reduction in self reporting by carriers could thus affect not only FAA's evaluation of carrier safety, but also its evaluation of airport safety.

The public availability of carrier reported data has become increasingly important because of FAA's use of safety partnership relationships with established carriers. These partnerships, which place greater self monitoring responsibilities on carriers, necessarily rely on high degrees of trust between FAA and its safety partners. Improper or immature public release of heretofore confidential safety information could have a chilling effect on these relationships. This is an important consideration for FAA because it has found its resources increasingly constrained as the industry becomes more complex, and safety partnerships could be an effective means of leveraging existing inspection resources to allow more direct monitoring of other carriers. Public release of such self reported data may provide consumers with only marginal benefits, at the cost of damaging FAA's ability to fulfill its safety responsibilities.

Surveillance and inspection data has also increased in importance as FAA has moved from a reactive posture, responding to accidents and other safety events, toward a more proactive posture, which seeks to prevent future accidents by identifying their possible causes beforehand. Such data is most effectively gathered and analyzed in an atmosphere of cooperation between FAA and carriers, and several commenters on the initial draft of this report spoke of the chilling effect that public release of surveillance data would have on the level of cooperation between FAA and private participants in the aviation safety system.

The effect of FAA's supervisory efforts and interventions on the level of aviation safety is also an important consideration. It is arguable that the role of FAA is to prevent the development of relationships between "safety indicators" and accident rates. For example, some, but not all research finds a weak correlation between airline profitability and safety. (Rose 1990,1992) Whether or not there is an underlying relationship between financial performance and carrier safety, the effectiveness of increasing surveillance when a carrier is having financial difficulties (or any other operational problems) may prevent direct observation of any relationship between safety indicators such as profitability and actual accidents. This "intervention" model of regulatory effectiveness might imply that FAA's ability to acquire and act on surveillance and inspection data is essential to its ability to maintain aviation safety. To the extent that public release of surveillance data compromises FAA's abilities to acquire relevant data on carrier operations, releasing that data will be costly and could compromise aviation safety. This raises a subsidiary question of whether the public should be notified of the carriers that are placed under intensified surveillance. If a carrier is placed on the increased surveillance list because of poor financial performance, public

knowledge of this may only exacerbate financial distress because passengers may tend to choose other carriers for their air transportation. If it is believed that the heightened surveillance will work to mitigate any negative safety outcome, then the system may be working and disclosure of such information may not be necessary to achieve the desired outcome.

An argument for disclosure of the carriers placed under increased surveillance is that FAA does upon occasion make public information about which carriers are under additional surveillance. (FAA did this after the series of USAir accidents and after the ValuJet accident.) Therefore, if FAA is going to disclose after an accident that the carrier(s) involved had been under heightened surveillance, then perhaps it should routinely report carriers that are under increased surveillance. Otherwise, it may create the impression that such information was being hidden from the public, and came to light only because of the accident.

In the near term, there needs to be a greater understanding among FAA, the airlines, and the public about why FAA may choose to increase the level of surveillance for a particular carrier. Once this is done, FAA should investigate whether the release of such information on a routine basis is warranted and/or whether there is a need for changes in the criteria leading to increased surveillance of an airline (for liability or other reasons). FAA and industry must also consider that making this information available only after an accident or incident can create the impression that the information had been withheld.

A policy of public release of inspection results and surveillance data raises a host of interesting issues. For example, how would it affect the relationship between FAA inspectors and airline personnel? Would it provide positive incentives for carriers to increase compliance with regulations? Does regulatory compliance in and of itself represent an appropriate measure of airline safety? Would the routine release of such information increase or decrease public confidence in the safety of air transportation? Clearly, these issues need to be explored in more detail before reaching a decision about the public release of these data.

Safety Reports

Aviation Safety Data Accessibility Study Index: Availability and Accessibility of Safety Information

Data useful for analyzing commercial aviation safety fall into four main categories: (1) accident and incident data; (2) normalizing data about airline activity levels; (3) descriptive data concerning air carrier operations; and (4) data on FAA surveillance activity. This section identifies and describes data sources falling into each category. The section also analyzes the availability and accessibility of the data sources.

Availability and accessibility are measures of whether and how easily the public can obtain information. Some information is not available to the public, because its dissemination is restricted, such as information that is protected by the Privacy Act. Generally speaking, the public *availability* of information is a "yes or no" question-either the public can get the information or it cannot. On the other hand, the *accessibility* of information to the public is not a "yes or no" question, because it refers to the degree of difficulty involved in getting and using the information. The accessibility of information depends on several factors, including the complexity of the information, how the data is stored, how it can be obtained, and the expertise required of a user.

Accident, Incident, Exposure, and Individual Carrier Data

The NTSB maintains a database on aircraft accidents and serious incidents, and also publishes hardcopy reports on the most serious accidents. FAA maintains the Accident and Incident Data System (AIDS), which contains information on incidents, and also maintains specialized databases on specific types of incidents. Specialized FAA incident databases include Pilot Deviations, Near Midair Collisions, and Operational Errors. In addition, the Aviation Safety Reporting System (ASRS) database contains voluntary reports of safety incidents.

The FAA collects and reports (e.g., FAA (1996b)) a variety of data that can be used to measure or evaluate air carrier safety and the safety of the aviation system. Most data reported today looks at safety levels in a highly aggregated format. FAA does not routinely report safety data for individual air carriers. Databases containing information on NTSB aviation accident reports and safety recommendations are available online at the FAA's Office of System Safety homepage. Monthly flight hours and accident/incident rates for large air carriers, commuters, air taxis, general aviation, and rotorcraft are also available in the Aviation System Indicators at this web site. Descriptive information is available for individual airlines from the carriers themselves and in the Vital Information Subsystem. There is a wide variety of aviation events that are categorized as aviation incidents; information on these is available on FAA's NASDAC system.

Portions of these incident databases could also be made available to the public on the internet. There is thus a wide variety of aviation safety relevant information available online, but it is relatively dispersed and requires some expertise on the part of the user to access, retrieve, and analyze these data.

All of these accident and incident data are available to the public, but obstacles that increase the difficulty of obtaining and using information from these data sources make it less accessible than it could be. The NTSB accident database is available through the Office of System Safety internet site, while some of the other databases are available from commercial vendors or nongovernmental internet sites. All of the data can be obtained in electronic form from the database managers, but considerable expertise and some computer equipment is required to use it. FAA makes a large amount of information available today, but the databases that are available are complex, are not always presented in a user-friendly form, and are not set up for *ad hoc* retrieval.

Inspection and Surveillance Data

Most information on surveillance results and completed enforcement actions is publicly available to the public through the Freedom of Information Act. Some information may be restricted because of Privacy Act requirements, or because decision-making has not been completed. The data sources concerning surveillance results and completed enforcement actions vary in size and form. National and regional special inspection reports, for example, are made available in hardcopy after passing through a review and redaction process. Other inspection results are recorded in the Program Tracking and Reporting System (PTRS), which is a large and complex database containing many different types of information, some of which is restricted. Enforcement data is contained in an independent database. In some cases, FAA publicly announces the results of major enforcement actions or decisions to increase surveillance levels. Decisions concerning public announcement of enforcement actions are made on a case-by-case basis.

Some analysts (GAO 1992, 1995) have questioned whether the quality, reliability, and management of safety data within FAA is sufficient for the internal needs of the agency. While FAA efforts to remedy these problems are intensive and ongoing (FAA 1996a), it is natural to ask if data management systems that are not yet sufficient to FAA's internal needs should be used to provide information to the public. This is especially relevant for data that may be difficult to interpret and compare, such as inspection data.

Safety Reports

Aviation Safety Data Accessibility Study Index: Experience of Other Federal Agencies

Several Federal government agencies have responsibility for encouraging, enforcing, and publicizing the safety of industrial sectors. The experience of other agencies in fulfilling these responsibilities provides a source of information for FAA as it considers how best to make the results of its safety activities more available and accessible to the public. Because of the differences between sectors and the differing public perceptions of the risks that industries and their products impose, agency approaches to risk communication and public data availability vary. This section briefly examines reporting of risk information by federal agencies overseeing safety in three other industries: banking, automobile transport, and nuclear energy.

The FDIC and Measures of the Financial Strengths of Banks

The Federal Deposit Insurance Corporation (FDIC) and other banking regulators have for many years used the CAMEL system for characterizing the level of risk in a given depository institution and for identifying the level of supervision which the FDIC should provide for that institution. For FDIC, the principal use of this system of stratification is to allocate limited supervisory and enforcement resources more effectively. CAMEL ratings are not made available to the public because it is believed that negative information about an institution's financial health could lead to runs on the institutions and increased costs to FDIC. However, because bank deposits are insured against loss due to bank failure by the FDIC, there is limited public demand for the information represented by CAMEL ratings. Indeed, because deposit insurance eliminates much of the public need for information about the financial health of a given depository institution, the importance of the CAMEL rating system for FDIC's internal allocation of surveillance and monitoring resources is especially great. It should be emphasized that the CAMEL system is intended to stratify institutions into risk groups, and is not designed to rank all depository institutions from strongest to weakest.

For FAA and others interested in making public information about aviation safety more accessible and understandable, the simplicity of the CAMEL system, in which a complex system of variables indicative of a bank's financial standing is reduced to a single number, is attractive. Some *caveats* are in order, most importantly that the CAMEL system is not designed for ranking individual institutions. Also, there are tens of thousands of FDIC regulated institutions in the nation, and far fewer air carriers. If FAA were able to borrow from the CAMEL concept and simplify safety information on individual carriers into a single number, it would be hard to counter the natural inclination to use such a number for ranking purposes, even if such a number could not reasonably be used to

forecast future accidents or incidents. Because there can be nothing comparable to deposit insurance in the aviation industry, the inclination to rank and to make possibly unwarranted inferences from rankings would be especially strong.

Federal banking agencies are obliged to publish and make available to the public, on a monthly basis, written enforcement actions and orders directed at individual banks. Publication of enforcement actions may be delayed if immediate publication would seriously threaten the safety and soundness of an insured depository institution. Hearings related to enforcement activities must be public, unless it is determined that an open hearing would be contrary to the public interest. (12 U.S. Code 1818(u))

NHTSA and Automobile Safety

The National Highway Traffic Safety Administration (NHTSA) is charged with reducing deaths, injuries, and economic losses from motor vehicle crashes. Motor vehicle travel is the primary means of transportation in the United States, and traffic fatalities account for more than 90 per cent of transportation-related fatalities. Among many other activities for fulfilling this mission, NHTSA conducts vehicle crash tests and provides a one-to-five star rating on each vehicle's crashworthiness in frontal collisions. These crash tests measure a variety of factors affecting passenger safety in the event of a crash; the ratings of one star (worst) to five stars (best) again represent a reduction of complex data to a single rating number. Because of the design of the crash tests, ratings are meaningful only when comparing vehicles in the same weight class.

Vehicle crashworthiness is not, however, a measure of the likelihood that a vehicle will be involved in an accident, which is related both to vehicle crash avoidance features and, most importantly, to driver behavior. Thus, for automobiles, as in aviation, safety assessment is multidimensional, and cannot be fully addressed with a single measure. Some interested parties, including Congress, felt that the crashworthiness information provided by NHTSA was not comprehensive enough to fully assess overall vehicle safety. For this reason, Congress requested that the National Academy of Sciences conduct an independent study of consumer information needs related to automobile safety. The resulting study "would broadly examine motor vehicle consumer safety information needs and the most cost-effective methods of communicating this information to the public." (TRB, 1996)

Ratings and other information provided by NHTSA assist consumers in including safety as a factor in the car purchase decision-making process. This is especially important for automobile safety and the reduction of motor vehicle casualties because most drivers believe themselves to be of above average driving ability, and because it is difficult to get drivers to change their driving behavior for safety reasons. (TRB 1996) Therefore, NHTSA ratings of vehicle safety can have the effect of raising the average crashworthiness of the nation's auto fleet, directly

through consumer education and indirectly through incentives to producers to improve product quality. NHTSA provides information to the public through a variety of reports, brochures, and releases, many of which are summarized by intermediaries in the private sector. NHTSA also uses the internet for news releases.

The study found that although consumer information about automobile safety characteristics is available, it is not always timely, accessible, or easily interpreted. The study recommends public dissemination of more explicit and detailed information on crashworthiness, occupant restraint systems, and crash avoidance features as well as frank discussion of the uncertainties associated with test results on these subjects. The long term goal of establishing a summary measure of vehicle safety that includes both vehicle crashworthiness and vehicle crash avoidance features is a difficult one, due to the uncertainties of present knowledge. The study strongly endorses research efforts that examine the feasibility of constructing a single overall measure that combines the relative importance of vehicle crashworthiness and crash avoidance features. Research into consumer decision making and the role of safety information in consumer decisions is also proposed.

The NRC and Nuclear Power

The Nuclear Regulatory Commission (NRC) enforces the standards for protecting the public from radiation, which are set by the Environmental Protection Agency (EPA). The NRC provides information to the public about the safety of nuclear power generation and about the mechanisms that are used to ensure that the level of safety remains high. This information is provided in brochures and reports as well as on the internet. Through its systematic Assessment of Licensee Performance Program, the NRC provides the public with safety information about power plant operations. This includes a numerical performance rating with supporting information.

The nuclear power industry has embraced the concepts of self-regulation and self-improvement, and has established a trade organization, the Institute of Nuclear Power Operations (INPO), which works closely with the NRC. This self-regulation by the industry became especially important after the Three Mile Island accident and the realization that a bad accident at one facility could have large consequences for others in the industry. The NRC makes regular inspections of nuclear generating plants, and NRC inspectors are on duty in those plants at all times. Utilities operating nuclear plants are also subject to stringent reporting requirements, some of which require self reporting of out-of-the-ordinary events (the self reporting aspect is less problematic in

the nuclear industry because of the presence of NRC personnel at nuclear facilities). The NRC can exact fines and other penalties for violations of regulatory requirements.

There are many similarities between the nuclear power industry and the aviation industry. Both have relatively few providers who serve an increasingly large portion of the American public. Both have experienced a small number of accidents, and the public regards both nuclear accidents and aviation accidents with a large component of dread. The role of a nuclear power plant control room operator has been compared to that of a commercial airline pilot, since both jobs require the control of highly automated and extremely complex machines. Because of the degree of automation, the machines are largely self-regulating, and both jobs can be rather boring under normal circumstances. Because of the complexity of the machines, both jobs require that the operator or pilot react quickly and intelligently when a problem develops. For both jobs, the consequences of a problem that is not appropriately addressed can be severe. (Rees 1994)

Safety Reports

Aviation Safety Data Accessibility Study Index: Public Access to Safety Information

Although the risk of being killed in a plane crash is infinitesimal for a traveler on a U.S. commercial airline, a passenger has a natural inclination to try to further reduce the odds. Improved access to safety information would have a twofold role for interested consumers: (1) to expedite the flow of potentially relevant safety data and information, and (2) to provide neutral but informative supplementary analyses about safety issues. Fulfilling this role will enable FAA to bear witness to two important if unfashionable truths: (1) for individual U.S. airlines, past nonfatal accidents and incidents have no statistical power as predictors of future crashes, and (2) among U.S. airlines, there is no statistical correlation between past and future mortality risks. Communicating this will involve providing timely and complete access to relevant airline safety data (including data on accidents, incidents, and other relevant events as well as exposure data), presenting basic information about the likelihood of being involved in an aviation accident, and describing the workings of in the overall aviation safety system and its participants. Each of these three communications goals would allow FAA to address public concerns in a distinct way.

Because there is no evidence that individual carriers differ to a significant degree in terms of safety records, airline safety information presented with supplementary analysis need not be prejudicial for any individual carrier, and will enhance public perception of FAA's stewardship of aviation safety. Grose (1995) makes the point that if such information is only made public immediately following an accident, it may actually be counterproductive, since it will give the impression that information had previously been withheld from the public. Although there is no predictive power in airline specific data to date, information released after the fact may inevitably look sinister. FAA's goal should be to educate the public, not merely to provide it with numbers.

The routine provision of aggregate aviation safety data should also be encouraged. Aviation accidents are rare events, but when they do occur they tend to be severe and to have high consequences for those involved. Attempts to reassure the public with technical discussions of probabilities can sound defensive in the days immediately following a major accident. Routine provision of complete information about aviation system safety would also reduce the need for FAA to change the focus of its safety communications efforts as consumer concerns change, say from safety issues to security issues, or from concerns with all carriers to concerns with regional carriers. Presenting historical information in an "event/outcome" framework could also usefully address public concern about safety. FAA and NTSB investigation of an air accident often results in improvements in the aviation safety system that eliminate or reduce the risk of a similar accident. Information of this sort could reassure passengers that

however catastrophic a past accident might have been, a similar one may be much less likely than before.

Finally, the public may lack information about the overall safety process and the complex workings that connect carriers, manufacturers, airports, flight crews, ground crews, and FAA in the provision of a safe aviation system. In fact, since it may be that there are no discernible differences between carriers with regard to accident rates, the greatest effect of an FAA safety communication effort would be to increase public confidence in the aviation safety system and in FAA's stewardship of that system. As FAA and other participants move toward more proactive safety policies, nonaccident information, gathered and analyzed within a cooperative framework, will acquire increasing importance for preventing future accidents. If information on how the safety system works is made available repeatedly and routinely, then it might do much to educate the public not only that aviation accidents are very low probability events, but why they are low probability events. The key point to be made here is that some thought has to be given to how the message about existing safety systems and procedures is delivered and, in particular, when it is delivered.

Even with improvements in FAA's safety information dissemination practices, there still may be strong public concerns about air safety. The nuclear power industry has spent years trying to inform the public of the low risks associated with the use of nuclear power to generate electricity. Despite the weight of statistical evidence and rational analysis, nuclear power is still a technology which makes many uncomfortable.

Much of the data used in safety analysis is now publicly available, but it is not easily accessible, especially to persons who lack knowledge about the specific data sources or who have limited analytic expertise. Even for experts, obtaining the data can be a lengthy, burdensome process. Obtaining data is an especially burdensome process when it can only be obtained through the Freedom of Information Act. One way for FAA to make public access to information easier is to release information that is now available only through a Freedom of Information Act request. In addition to improving access to information now available, the FAA can clarify its policies concerning the public availability of information resulting from its surveillance activities. Clarification of these policies can provide a necessary foundation for improving public access to surveillance-related information.

The internet and the increasing versatility of home pages and web sites for presenting complex information offer a means of improving the public accessibility of available safety information, especially for persons with well developed analytic skills and intensive information needs. Although many public users lack the skill or equipment to use the internet directly, even these users can be helped indirectly by improved access to safety information on the internet, since better access to safety information can help journalists, travel agents, and

consumer group representatives meet the public's safety information needs. FAA, however, can also explore additional ways to make safety information more directly accessible to the public, such as through 1-800 information hotlines, printed materials for distribution in airports and travel agencies, and even video presentations.

There are three general principles that could usefully guide FAA's policymakers as they increase the public availability and accessibility of aviation safety data. First, any information available to some persons outside FAA should be available to all persons outside FAA. Restrictions on access to information, especially through "two tiered" systems such as availability through FOIA, can create an impression that information is being withheld, or that some reports are "secret." Second, information made available to the public should be presented in a way that allows and encourages sensible use of the data. This includes informative discussions of the pros and cons of the various exposure measures that are used for normalizing event data. Third, the release of information to the public should not make safety worse, nor should it make achieving higher levels of safety more difficult. This report discusses the numerous incentive issues that are raised by the public release of safety data that is gathered from carriers through cooperative and self-monitoring programs. FAA and other policy makers must consider the potential costs and benefits from the release of new forms of safety data.

Safety Reports

Aviation Safety Data Accessibility Study Index: Public Concerns About Aviation Safety

Some public survey data report on consumer attitudes toward aviation safety and toward the individuals and organizations that provide and manage air safety. These data indicate that consumers have relatively high levels of confidence in individuals such as pilots, controllers, and maintenance personnel and lower levels of confidence in organizations such as air carriers and the FAA. They also regard potential mechanical, behavioral, and institutional compromises in the integrity of the air safety system as matters of great concern.

In several polls over the past few years, members of the public who had flown commercially were asked about their views on aviation safety. A Roper poll in July 1996 asked if measures to increase airline safety and security "would be worth increased costs and inconvenience to passengers." Seventy eight percent of respondents thought "more extensive inspections of passengers and baggage" would be worthwhile, and 88 percent thought "more extensive inspections of the mechanical safety of the airplanes" would be worthwhile. In a more general result from an ABC News/Washington Post poll of August 1996, 77 percent of respondents "would be willing to pay 10 percent more for airline tickets if the money were used to increase safety and security." Other surveys indicate that around 30 percent of business and nonbusiness fliers use the safety records of carriers as one of the top five criteria in choosing between carriers (Miller 1991), and that consumers regard safety issues as more important than many other issues, such as departure frequency and food quality (Comm 1993).

Other polls give a more detailed view of consumer concerns. Shown in Table 1 are results from a Harris poll investigating attitudes toward a variety of safety issues. Respondents were asked whether particular "threats to air safety" should be matters of great, mild, or no concern.

Table 1

THREATS TO AIR SAFETY	*1996*		*1989*	
	Great Concern	Mild Concern	Great Concern	Mild Concern
Inadequate Regulation	55%	35%	55%	31%
Pilot Error	65%	29%	58%	34%

Poor Ground Control	66%	28%	60%	31%
Airplane Structural Fault	72%	22%	72%	22%
Mechanical Error	78%	19%	72%	23%
Poor Maintenance	83%	13%	80%	14%

Responses from 1996 and 1989 are shown to illustrate the basic stability in the survey results. Related to these concerns is the degree of confidence that fliers have in the organizations and groups involved in the aviation industry. As shown in Tables 2 and 3, this confidence varies widely.

Table 2

Is group doing all it can to maintain air safety?	Princeton Poll, 5/96Degree of Confidence			
	High	Fair	Low	None
Federal Agencies	14%	36%	24%	14%
Pilots	47%	33%	6%	4%
Controllers	36%	40%	8%	5%
Ground Crews	25%	48%	11%	5%
Major (Jet) Airlines	42%	37%	5%	5%
Commuter (Prop) Airlines	12%	33%	22%	15%

Table 3

Feelings about the safety standards of:	Yankelovich poll, 5/96

	Very confident	Fairly confident	Some reservations	A lot of reservations
Commercial Airlines	18%	36%	22%	16%
Discount Airlines	7%	24%	30%	27%

In a similar Gallup poll of July 1996, 13 percent of respondents expressed a great deal of confidence in the FAA's safety efforts in commercial aviation, 50 percent moderate confidence, 26 percent not much confidence, and 9 percent no confidence.

These admittedly sparse data can be interpreted in the following way: aviation consumers are fairly trusting of the individuals (pilots, controllers, maintenance workers) who affect the safety of flying, and are less trusting of institutions, both private and public, that are in the business of providing and ensuring safety (Tables 2 and 3). In spite of these levels of trust, passengers are perhaps aware of the complex set of interactions that must occur in a safe flight. Even though air accidents are extremely rare, any breakdown in this chain of interactions can compromise the safety of a particular flight or aircraft. Therefore, passengers remain concerned about the integrity of each link in the chain, regardless of the trust felt in the intentions of those who manage and maintain the chain (Table 1).

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