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An Investigation of the Role of Politics in the Safety Recommendation Process of the National Transportation Safety Board

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Doctor of Philosophy

January 1999

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Project Demonstrating Excellence (Dissertation)

Abstract

An Investigation of the Role of Politics in the Safety Recommendation Process of the National Transportation Safety Board

This dissertation analyzed the safety recommendations made to the U.S. Federal Aviation Administration (FAA) by the U.S. National Transportation Safety Board (NTSB) to determine whether there was evidence to support the notion that this safety recommendation process was affected by political motivations. The recommendations associated with the investigations of major aviation accidents occurring from 1 January 1993 to 31 December 1997 were scrutinized in order to find patterns of disagreement between the FAA and NTSB over the intent and relevance of those safety recommendations. A number of current and former influential civil aviation safety officials, both within and outside the U.S. government, were interviewed in order to gauge what consensus existed as to the aviation industry's definition of detrimental political influence and how that influence may have been applied in those accidents explored in this study.

The analysis used the interview data, as well as data from NTSB accident reports, NTSB safety recommendations associated with these accidents, and the correspondence between the FAA and NTSB related to those recommendations. While the outcome shows a relationship between higher media visibility accidents and disagreements between the NTSB and FAA, a mechanism that relates higher media visibility to NTSB political influence has not been identified in this study.

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Chapter 1: Definition of the Problem

In 1996, two fatal airline accidents, one involving ValuJet and a second involving TWA, led to unprecedented public concerns in the U.S. about the role of the federal government in addressing aviation. The U.S. National Transportation Safety Board (NTSB) has been at the forefront of these issues due to its central role in investigating U.S. aviation accidents and in making safety recommendations to the Federal Aviation Administration (FAA) and other aviation organizations. Because the NTSB has no regulatory authority or power, its ability to affect changes in aviation policy, regulations, practices, and procedures is based on its ability to make safety recommendations to the government and to industry. Currently, there is a widespread belief in the U.S. aviation industry that these safety recommendations have become negatively affected by political influences. This belief has the potential to undermine the ability of the NTSB to positively influence those in aviation, especially those who are affected by those recommendations.

The intent of this dissertation is to analyze one part of the NTSB's work - safety recommendations made to the FAA - to determine whether there is any evidence that these recommendations are affected by political motivations rather than by engineering, scientific, or technical motivations. The focus of this inquiry is the group of recommendations that came about as a result of major NTSB accident investigations for accidents that occurred between 1 January 1993 and 31 December 1997. This time period was chosen because the beliefs of the negative effects of political influence were associated with either the repercussions of aviation events that occurred during this period or with government officials who are or were a part of the Clinton Administration. Recommendations associated with major accidents were chosen because these accidents

receive the most attention from the media, the public, and the government and are therefore most likely to be subject to political influence.

FAA and NTSB Roles and Responsibilities

The FAA and the NTSB occupy key places within the aviation safety community of the U.S. The NTSB is an independent federal agency with the stated goal of preventing future transportation accidents from occurring. The NTSB provides independent oversight of transportation safety by monitoring the effectiveness of regulatory bodies at the federal, state, and local levels (NTSB 1997g). It is responsible for the investigation of civil aircraft accidents in the U.S. and for the development of safety recommendations to correct any problems uncovered in these investigations. When making these recommendations, the NTSB does not have to consider the costs, benefits, or inconvenience caused by a recommendation (NTSB 1996g). These recommendations may be directed to state, federal, or local agencies or to private organizations, and may call for a variety of actions such as changes in aircraft design, changes in aircraft operating procedures, or evaluations of new technology. The NTSB has no regulatory or law enforcement power for any of its recommendations, so the FAA or any other entity that is given an NTSB recommendation does not have to comply with that regulation. While the recipient of a recommendation does not have to implement the proposed action, it does have to formally respond to the recommendation and specify what action is or is not being taken and why. Over 80% of the NTSB recommendations directed to the FAA have been accepted by the FAA (Lunsford 1996).

The FAA is responsible for developing, administering, enforcing, and revising aviation regulations that protect and improve aviation safety. While the NTSB was established by the U.S. Congress to investigate accidents, make determinations of probable cause, and make safety recommendations, the FAA is charged by Congress with advancing and maintaining the safety of the air transportation system through regulation, surveillance, and enforcement of those regulations. In an accident investigation, it will both support the NTSB and conduct its own review to ensure that safety is maintained (FAA 1997a).

In contrast to the independent NTSB, the FAA is a regulatory agency within the Department of Transportation. Any significant regulatory action or safety related decision of the FAA must consider a number of federal laws, executive orders, and other regulations regarding the actions of regulatory agencies. Some regulations require concurrence of other executive branch departments such as the Office of Management and Budget (OMB), the Department of Justice (DOJ), or the Department of Transportation (DOT). One of the more significant regulations that the FAA must follow is the DOT Order 2100.5, Regulatory Policies and Procedures. This Order implements President Clinton's Executive Order 12866, which requires that all agencies assess the costs and benefits of regulatory actions that have a significant impact. Although Executive Order 12866 only required a cost benefit analysis for significant actions, the DOT Order required a cost benefit analysis of all DOT regulatory actions, including all proposed regulations that may come about as a result of NTSB recommendations to the FAA (FAA 1997b).

Another key difference between the NTSB and the FAA is how the two organizations can communicate their message to the general public. The NTSB is free to make any recommendation it feels is valid and is free to act as advocates for its recommendations. The venues for such advocacy include, but are not limited to, broadcast and print media, gatherings of transportation professionals, Congressional hearings, and the Internet.

In contrast to the NTSB, the FAA is more limited in how it presents its message to the public. Since the NTSB is the lead agency for accident investigations, the FAA acts in a supporting role and therefore the information that it may possess about an accident must be channeled through the NTSB. Because the FAA operates under the direction of the DOT, most significant positions or statements regarding aviation policy has to be approved by the DOT. Other significant positions or statements, such as those involving security issues, may be approved by other entities such as the DOJ or the White House.

Public Perception of the FAA and NTSB

In the last few years, even before the fatal 1996 accidents involving ValuJet and TWA, the Congress, the aviation community, and the public have developed distinctly different views of the motives and the effectiveness of the FAA and NTSB. Because of some actions by the FAA in the immediate aftermath of the fatal ValuJet accident, its stature in the eyes of the public has possibly diminished. One example of this loss of stature was the widespread public interest in Mary Schiavo's best selling book, *Flying Blind, Flying Safe*. In the book, Schiavo, a former DOT Inspector General, claimed that the FAA routinely withheld safety information, allowed airlines like ValuJet to continue flying in

spite of concerns from the FAA's own staff, and supported the idea that the FAA could have prevented the fatal ValuJet accident from occurring (Liss 1997). The fatal ValuJet accident was due in part to the improper carriage of chemical oxygen generators in one of the aircraft's cargo compartments. In its report on that accident, the NTSB raised concerns about the FAA's hazardous materials program in addressing the dangers of chemical oxygen generators, stating that in spite of five related incidents between 1986 and 1994, the FAA took no substantive action before the ValuJet accident (FAA 1994; NTSB 1997a). Representative James Oberstar, a high ranking member of the House Transportation Committee, publicly claimed that FAA resources for the surveillance of new carriers like ValuJet was very inadequate (Oberstar 1997).

A March 1998 *Atlantic Monthly* article offered another expression of differing views of the NTSB and the FAA. The author stated that while some recommendations are seen as impractical, the NTSB has a reputation for technical competence. The author also described the NTSB as playing the role of an unambiguous defender of the public. On the other hand, the article described David Hinson, the FAA administrator at the time of the ValuJet fatal accident, as being out of touch with the public. Specifically, in the days after the ValuJet fatal accident, the article claimed Hinson made the assertion that ValuJet was a safe airline and implied that there was no gray area when it came to safety. Transportation Secretary Frederico Peña was quoted as saying that both ValuJet and the entire aviation system was safe and that if ValuJet were unsafe, the DOT would have grounded the airline. The effect of these statements was to link the reputation of ValuJet to that of the FAA. Further investigation of the accident revealed that there were serious problems with ValuJet prior to the accident. Ultimately, these findings led to a grounding

of the airline and significant changes in FAA leadership (Langewiesche 1998; Liss 1997; NTSB 1997a).

Recommendation Issues Related to the TWA Accident of July 1996

On 17 July 1996, just over two months after the ValuJet accident, a TWA 747 crashed near Long Island after an in flight explosion. For a variety of reasons, that event became the focus of intense scrutiny on the part of the aviation safety community, the public, and the federal political establishment. From the beginning, the NTSB played a key role in the investigation of the accident, by informing the public about the details of the investigation and in raising safety issues associated with the event. While no probable cause has been determined, the investigation revealed that there was an explosion of the aircraft's center fuel tank. The NTSB identified six scenarios that could have led to the explosion and, in December 1996, issued four recommendations to the FAA that called for the agency to require the development and implementation of design or operational changes related to the fuel systems of transport category aircraft (NTSB 1996h; Hall 1997a).

While these recommendations have been the source of controversy between the FAA and NTSB, there is a difference of opinion about the reason for any disagreements. Jim Hall of the NTSB stated that if there was any tension between the NTSB and FAA over these four recommendations, it was because the FAA did not issue a request for comments until April 1997, about four months after the four recommendations were issued (Hall 1997b). This was in contrast to former FAA Associate Administrator for Regulation and Certification Anthony Broderick (1997) who claimed in a December 1997

speech that those recommendations had not been shown to be effective in achieving safety improvements and may not even address the cause of the accident.

The Political Relationship of the FAA and NTSB

The NTSB and the FAA have a formal political relationship that is defined by the laws and regulations that brought them into existence and which continue to define their interactions in areas such as accident investigations. There is an informal political relationship that is more subjective and is based on the perceptions that the public and the government have of these organizations and the perceptions that the NTSB and FAA have of each other. This political relationship faced several challenges due to the aftereffects of both ValuJet and TWA Flight 800, but it is not clear how the relationship may have changed.

In November 1996, *Aviation Week and Space Technology* shed some light on the possible changes when it published the results of an informal survey of aviation analysts and members of Congress on the balance of power between the FAA and NTSB (Mann 1996). The report on the survey did not specify the number of people interviewed, but it did report that the policy and aviation insiders who were surveyed were split into three general camps. The first believed that the two 1996 events drew the two organizations together, the second believed that the relationship worsened, and the third believed that these events caused some friction between the agencies, but that these frictions did not damage the fundamental relationship. Some of those surveyed believed that the FAA lost credibility in the eyes of Congress because of the FAA's actions after ValuJet, including when the FAA announced shortly after the accident that the airline was safe. The

magazine also reported that there was some ongoing resentment of the NTSB on the part of the FAA.

In an August 1997 *Aviation Week* article, Ott (1997) reported the results of discussions with about three dozen aviation safety leaders from government and private industry. The goal was to see what effect the ongoing political situation had on the way that the FAA formulated and executed policy. Those who were critical of the way the FAA formulated and executed policy saw the FAA as being caught between an aggressive NTSB, a critical Congress and media, and politically motivated officials in the DOT and the White House. Walter Coleman, president of the Regional Airline Association said that the Congress, NTSB, and media influence the FAA agenda and set its priorities. He claimed that NTSB exerts heavy pressure by issuing public declarations on recommendations to the FAA. In addition, he said that the FAA's responsibility to perform cost benefit analyses was not understood outside the industry and that pressure on the FAA increases when uninformed people argue that safety is worth any price. An example of the pressure exerted by Congress was given by Barry Valentine, former acting FAA administrator, who said that the FAA was fighting misperceptions and placed in a no-win situation. His example was a case where one congressional hearing chastised the FAA on ValuJet for not being vigilant enough in oversight and, in a later hearing, the FAA was chastised for being too aggressive in shutting down a small regional airline (Ott 1997).

In a different article in that same issue, McKenna (1997) claimed that a common criticism of the NTSB was that its leaders play to Congress and the media in order to embarrass the FAA and airlines over safety issues in part through the use of "sound bite

recommendations" on safety issues. Carol Hallett, president of the Air Transport Association, was more direct in her criticism. Responding to Jim Hall of the NTSB, who publicly criticized the airlines and the FAA for their pace for installing fire detectors in narrow bodied aircraft, McKenna quoted her as saying "suggesting to the press that airlines are not acting responsibly in this matter may advance various causes, but safety is not one of them."

In this case, the NTSB actions and statements may have led to increased Congressional pressure on the FAA. At a 15 May 1997 Congressional Aviation Subcommittee meeting, the FAA was accused of dragging its feet on this fire detector issue. Representative Peter DeFazio of Oregon called the FAA and the industry pathetic for dragging its heels on the issue. Representative James Oberstar of Minnesota told the FAA that, given the elapsed time since the ValuJet accident, there was no reason to not have a regulatory system in place and that having a multi-year time frame for regulations was not acceptable (Air Cargo Report 1997).

In the eyes of many in the aviation safety community, the NTSB has unfairly used accidents like ValuJet to its advantage and in doing so has politicized the process of aviation safety. Anthony Broderick (1997) acknowledged in his November 1997 speech to the Flight Safety Foundation that political influence creates an atmosphere where many resources are allocated to aviation safety programs, and noted that politics can create problems by standing in the way of necessary safety improvements, silencing technical debate, creating false allegations of safety problems. In that same speech, he made several strong statements about the NTSB's role in politicizing aviation safety issues, claiming that it has become more commonplace for the NTSB to show up at accident

sites to propose means to improve safety with smoking debris in the background and that this is harmful to information accuracy but helpful for publicity. Another of Broderick's claims was that, in the last few years, the NTSB has taken positions less on a reasoned analysis of the facts and more on a need to quickly pronounce means to avoid similar events.

While Broderick, other aviation safety experts, and major aviation publications have made comments questioning the NTSB's motives and have even questioned the validity of some recommendations, none of these sources have provided direct and conclusive evidence that one or more NTSB recommendations are motivated or influenced by politics. The NTSB's regular and significant presence in the media, its often strong stands on some safety issues, and the equally strong responses by Broderick and others may contribute to an appearance of political motivation on the part of the NTSB in the eyes of those in the aviation safety community.

The expressed opinions and observations of some members of the aviation safety community exist in spite of laws that reduce the potential for political influence affecting the decisions of the NTSB Board. While all of the NTSB Board members are appointed by the President with the advice and consent of the U.S. Senate, no more than three of the five members may be appointed by the same political party. In addition, the applicable laws stipulate that at least three of the five NTSB Board members should be appointed based on technical capabilities or professional standing. These laws do not mention specific experiences or skills that an NTSB chair should have (U.S. Code 1995).

Personal Involvement

As an airline safety analyst with the Boeing Company, I have been directly involved in several areas of aviation safety and aviation policy development and have worked with representatives from the NTSB, FAA, Transport Canada, NASA, and a range of other organizations in order to try to shape the regulations and practices of civil aviation. In the last few years, some of the opinions expressed by those representatives reflected the kinds of beliefs that were cited earlier. Collectively, these private conversations do not constitute an unbiased sample of the aviation safety community's opinion about the motivations of the NTSB, but the tone of this sample of beliefs was that the safety recommendations of the NTSB under its current chair, Jim Hall, is at times influenced or motivated by politics. Unlike the earlier citations, these observations often cited Jim Hall's past, specifically his close and long standing ties to the family of Vice President Al Gore, his lack of experience in transportation prior to his appointment to the NTSB, and his extensive experience in politics, as supporting evidence for such beliefs. In this study, the investigation of the role of politics in the NTSB recommendation process will not focus on the past actions or associations of any individual. The views expressed during these private conversations and the previously described views of the aviation community do suggest that some individuals within the aviation safety community suspect the motives the NTSB.

Potential Policy Issues

The end result of these suspicions is that those who believe that Hall is too politically motivated also believe that any recommendation of a Jim Hall led NTSB would be

influenced by politics. One could conclude that this belief is counterproductive to aviation safety for at least two reasons First, the NTSB has a central role in shaping aviation safety through the safety recommendations that it makes to the FAA and other organizations. Any widespread belief that some or all of these recommendations served primarily a political purpose, rather than an aviation safety purpose, could undermine the ability of those recommendations to be a force for positive change. Second, a belief that the NTSB is pursuing a political agenda with its safety recommendations could undermine the trust that the aviation community has in the validity of the NTSB's other aviation related work.

Such beliefs may persist because the information that may counter these beliefs is not readily available to the public. Until early 1998, it was possible to access this information only through a few large or specialized libraries. Full accident reports from recent major accident investigations only became available on the NTSB site in the spring of 1998. This information could have been requested from the NTSB or ordered through the National Technical Information Service, but it made it difficult for most people in the aviation community to have ready access to the data.

A second possible explanation for the existence of these beliefs is that the accident reports and recommendations are written in a style that may make it difficult to discern how the analysis of an accident leads to a particular safety recommendation or how the recommendations fit into a larger context. Unless a large number of these reports and recommendations are analyzed, it is difficult to say whether any NTSB recommendation or accident investigation fits into a pattern of politically influenced or politically motivated decisions. A detailed example of how a systematic procedure can be

used to analyze an NTSB accident report and its associated safety recommendations in order to make that information more readily understood is provided in Appendix E.

A belief in the existence of political influence in the NTSB safety recommendation process, even a widely held belief, does not constitute proof that such influence exists. However, the widely reported beliefs about the political dimensions of the NTSB safety recommendation process (Broderick 1997; Langewiesche 1998; Liss 1997; Mann 1996; Ott 1997) suggest that the broader aviation safety community may consider this to be a potentially serious policy matter. If these beliefs were left unchallenged, they have the potential of undermining the credibility of the NTSB in the area of aviation safety among the group of people who are most directly involved with implementing or leading aviation safety related changes. A systematic investigation of at least some aspects of these apparently widely held beliefs would go a long way toward resolving the question of the NTSB's motives.

Research Objective

The objective of this study is to investigate whether there was evidence to support claims that politics may play a role in the NTSB safety recommendation process. The focus of this study was those recommendations that were made to the FAA and which came about as a result of major accident investigations started between 1 January 1993 and 31 December 1997. This time period was chosen because the beliefs of the negative effects of political influence were associated with either the repercussions of aviation events that occurred during this period or with government officials who are or were a part of the

Clinton Administration. This subject is appropriate for PhD related research for the following reasons:

1. The research will provide detailed evidence to either support or refute the widespread belief that the NTSB is causing changes in the air transport system that are ineffective for reducing aviation risks.
2. The analyses necessary to answer these major research questions, might document and describe the overall NTSB recommendation process in a way that might be useful for members of the aviation safety community.
3. The research could serve as the foundation for investigating the recommendation process for those recommendations that are not directed to the FAA.
4. The research had the potential to develop insights into what changes in the NTSB safety recommendation process best reduce either the influence of political motivations or the appearance of the influence of political motivations.

Research Questions

The main research question addressed in this study was whether there was evidence to support the notion that safety recommendations made to the FAA by the NTSB were politically motivated or influenced. Specifically this study attempted to address the question with two general methods. The first was to interview a select group of aviation safety experts to see if there were characteristics that were more likely to be associated with politically influenced or motivated recommendations and then testing the population for those characteristics. The second method was to analyze the intent of a group of

NTSB safety recommendations and to analyze the disagreements that occurred between the FAA and the NTSB. The analysis would show what patterns existed between the intent of a recommendation and the nature of the disagreement and whether those patterns were suggestive of political, rather then technical, motivations on the part of the NTSB and FAA. The answers to the following questions supported the main research question:

- How are NTSB aviation safety recommendations generated?
- What is the process for the FAA evaluation of NTSB safety recommendations?
- What other NTSB and FAA processes are relevant to the safety recommendation process?
- What do the participants say are the roles and activities of the NTSB and FAA in the safety recommendation process?
- What do aviation safety experts outside the NTSB and FAA say are the roles and activities of the NTSB and FAA in the safety recommendation process?
- How do participants in the NTSB safety recommendation process and aviation safety experts define political influence in the safety recommendation process?
- What were the characteristics of NTSB recommendations that were not addressed by the FAA to the NTSB's satisfaction compared to the characteristics of those recommendations that were addressed to the NTSB's satisfaction?
- Were there inconsistencies in the way that NTSB recommendations with similar characteristics were processed by the FAA?

Type of Research

The kind of research in this dissertation is best described as program evaluation where the objective is to evaluate a particular process and to provide alternatives that might improve that process. In this study, that process is the NTSB's assessment of the FAA's response to NTSB safety recommendations. Action research is the specific type of program evaluation that most closely resembles the following work. This type of research has the goal of solving specific problems within a program or an organization. Action research becomes a part of the change process by engaging the people in the program or organization in studying their own problems. Typically, action research has a focus on new approaches that would improve the effectiveness of specific areas of a program or organization rather than on improving the effectiveness of the entire organization or program (Patton 1997). In this study, the new approaches would include changes that could either reduce the influence of political motivations in the NTSB recommendation process or, if no such influence exists, the new approaches could include suggestions on how to eliminate any perceived political influences in that process.

In order to address the major research questions and to support suggestions for improving the NTSB recommendation process, research activities will develop the following kinds of information (Isaac and Michael 1981):

1. Historical: The documentary evidence includes the accident reports, recommendations, and other records related to the major NTSB accident investigations of interest. Other relevant evidence includes the observations, recollections, and opinion of key actors in the recommendation process.

   Descriptive: The evidence provides descriptions of:

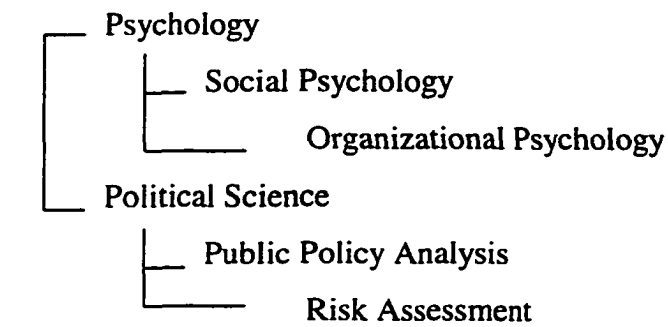
- the population of recommendations sent to the FAA by the NTSB,
- the accident investigations that were the source of the recommendations sent to the FAA by the NTSB,
- the process for developing NTSB recommendations and the FAA process for responding to those recommendations directed to that organization, and
- the decision maker and participant view of how the NTSB safety recommendation process works or should work.

3. Correlational: This evidence describes the relationships between a particular NTSB safety recommendation, the FAA response to that recommendation, and the NTSB's assessment of the FAA's response.
4. Causal: This is the evidence that provides insights into what causes the NTSB to determine that the FAA response to a recommendation is acceptable or unacceptable.

Chapter 2: The Intellectual Roots and Context of This Inquiry

The purpose of my research is to answer specific questions about the aviation safety related recommendations that the NTSB directs to the FAA. While the focus is on safety recommendations and risk assessment, the context of my research is broader. The questions of risk assessment that are raised in this study touch on both political science and social science issues. Figure 1 shows how this research fits within these broader issues. What follows are brief descriptions of these broader issues.

Figure 1: Risk Assessment in a Broader Intellectual Context



Sociology is the scientific study of human social relations or group life. Psychology and political science are two of the major disciplines within sociology. The key goals within sociology include understanding the ways that social structures and institutions influence society. Understanding the patterns of social interaction, whether between individuals, between groups, or between an individual and groups, are the key concerns of the discipline.

While psychology involves the scientific study of human behavior and experience, social psychology is the branch of psychology that studies the behavior of individuals who are influenced by social stimuli. It attempts to understand and explain the thought,

feeling, or behavior of individuals who are influenced by the presence or influence of others. The key items of interest for social psychologists that are relevant in risk assessment are the thinking and judgment of individuals. Also key are how present and previous social contacts with groups, institutions, or cultures shape individual behavior and actions.

One area of social psychology of particular relevance to the research in this dissertation is the study of attitudes, which has been described as the learned dispositions to respond to a class of objects or concepts in either a favorable or unfavorable way. Attitudes are learned in that they are formed through experience and can be based on rational considerations or they can have a strong emotional bias. The learned attitudes in turn affects an individual's reaction to the environment, reactions that may be expressed through opinions. These opinions are equivalent to beliefs or hypotheses concerning the nature of objects or concepts and express one's judgment of the probability regarding their nature (McCormick and Tiffin 1974).

Organizational psychology deals with problems associated with effectively using people in any organized effort. Fundamental ideas in this field include the underlying concept of the organization, how organizations are categorized, how behavior is affected by the expectations people have of the organization, and how authority is granted and exercised within the organization. One common taxonomy or categorization for organizations differentiates the behavior and activities of three types of organizations (Schein 1980):

Formal Organization - This type of organization involves the planned coordination of the activities of a number of people for the achievement of some common,

explicit purpose or goal. This is accomplished through a division of labor and function, and through a hierarchy of authority and responsibility, where the object of coordination is activities, rather than people.

Informal Organization - This type of organization includes planned or unplanned patterns of coordination that arise among members of a formal organization.

Social Organization - Patterns of coordination in this third type of organization arise spontaneously out of interactions of people, without any rational coordination, for the achievement of explicit, common goals.

The aviation safety community can be considered an informal organization composed of individuals who, for the most part, are members of formal aviation or aviation safety organizations. Included in this community are those parts of the NTSB and FAA that are directly involved in the safety recommendation process. While many members of the aviation safety community may have simultaneous membership in a number of formal, informal, and social organizations that are related to aviation safety, there is no formal organizational or leadership structure that links these individuals.

In spite of the informal structure of this community, there are some within the community, such as the chair of the NTSB, who play a key role in influencing the community as a whole. An area of organizational psychology that is of relevance to this study is the study of how the roles that individuals play in a group or organization influence how that person is perceived by the group. In role theory, the people who have interactions with a particular focal person define that focal person's role based on the expectations that others have of the role of the focal person. Handy (1993) wrote that in

organizations individuals spend most of their time with people who are not well known to them and, as a result, individuals make assumptions of others and what their behavior would be in particular situations. In order to make those inferences, data about others is collected and fit into categories in order to make predictions. Handy pointed out that most people are unscientific in their collection of perceptual data about others because little data is collected, and often people are prone to selectively perceiving only that information that supports their initial assumptions. The implications for these limitations are that people may stereotype others based on their perceived roles and treat them according to those stereotypes.

The issue of selective perception is not limited to the context of the organization. Tversky and Kahneman (1974) demonstrated that both the lay public and experts in a particular area tend to use simplifying rules of thumb when making decisions under uncertainty or incomplete knowledge, and that these rules result in distinct kinds of biases. The most important of these biases in policy analysis is what Tversky and Kahneman call representativeness, or the bias of picking the outcome that is most like the input. This can lead to an illusion of validity in that a decision maker's confidence in the outcome of a decision is based on how closely the situation fits another situation that had a desired outcome rather than basing that confidence in the outcome on the underlying facts. For example, Tversky and Kahneman described a test where subjects were shown a brief personality description of several individuals and told that the descriptions were drawn from a population of 100 professionals. Although the subjects were told that the population contained a particular fraction of lawyers and engineers, the subjects consistently evaluated the likelihood that a description belonged to that of an engineer

rather than a lawyer based on the degree to which description fit the stereotype and with little regard to the stated probability of engineers in the sample.

Within organizations, Brown and Kreps (1993) observed that storytelling is used to help members deal with organizational life by reducing both the complexity and the ambiguity of the organization and to help members to interpret events. The stories serve as a vehicle to organize and recreate their experiences as well as to persuade and educate other group members about the organization. These stories are not static, but change over time as members of the organization or the perspectives of members change. In addition, different parts of the organization may have differences in their stories that will point out the value differences that may exist within an organization.

The telling of stories as a means of communicating information within an organization has a parallel within policy analysis. Roe (1989) compared and analyzed the dominant stories of a particular environmental issue in order to determine the different perspectives that different policy makers had on the issue. While the content of the stories could not be validated, Roe analyzed the structure of the stories and determined that the policy makers whose stories followed a conventional narrative structure were more successful in achieving their ends than those whose stories were structured as a critique of a conventional narrative.

Related to the concept of roles and role expectations in organizations is the concept of the voluntary acceptance of decisions made by authorities in organizations. Authority within an organization is considered to be legitimate in the eyes of the members if there is consensus about the basis on which a rule or law is made and the system by which a person is put in a position of authority and if members of the organization

voluntarily submit to the authority. Two types of authority that are relevant to this dissertation are rational and legally based authority where everyone submits to a common set of laws or processes, and a meritocracy that is coupled with a consensus in a system to define competence (Schein 1980). Tyler (1993) wrote that authorities have to be able to shape group behavior by the voluntary acceptance of their decisions if they are to be effective in their role. The legitimacy of some authority is considered to be an attitude that is related to the perceived obligation to accept decisions and follow rules. Tyler also wrote that research supports the idea that the legitimacy of an authority is enhanced if it uses fair decision making procedures and that judgments about the fairness of procedures shape the evaluation of authorities.

Coupled with the study of how authority is accepted is the means by which it is exercised. Handy (1993) wrote that both the source of the power and the means by which the power is used can be varied. That power can be based on position, the possession of unique expertise, or other sources and the influence that flows from that power could be either overt, such as through rules and procedures, or more indirect. In the case of the NTSB, the organization's power is gained through its position within the U.S. federal government and the expertise that the NTSB possesses. Its influence is overt in that it uses various means to persuade other organizations to take action on particular safety issues and because of its ability to inform and influence the public and other parts of the government on those same issues.

A concept related to the acceptance of authority is the idea in the study of the functioning of organizations that once a person becomes part of an organization, there is a psychological contract that operates at all times between every member of an

organization. This contract is an unwritten set of expectations that an individual will have about how the organization will treat him or her rather than a formal set of expectations about salary or other tangible benefits. In addition, the organization has expectations of how the individual will behave toward the organization. The contract may change as a function of how the individual changes, or as a function of organizational changes that may occur due to internal or societal changes (Schein 1980).

Schein wrote that the concept of a psychological contract between members of an organization is an extension of the concept of a social contract between members of a community. Within an organization, key elements of the psychological contract are that a member of that organization will accept the system by which a person is put into a position of authority and the basis on which a rule or law is derived. Enforcement of the psychological contract is possible for both leadership and membership, with the leadership relying on formal processes of enforcement and the membership relying on more indirect ways of enforcement.

These various sociological and psychological issues are relevant to understanding risk assessment because risk assessment and actions taken based on risk assessments are often associated with issues that affect a range of groups and organizations. These groups and organizations may have a variety of agendas and internal structures, but understanding how individuals within these groups behave will enhance one's understanding of the risk assessment process.

Political Science and Public Policy Analysis

Political science is the second branch of scholarly inquiry that is relevant to this research. Dickerson (1990) described political science as a discipline that has its roots in philosophy, political economy, law, and history, and which includes the descriptive study of political institutions. According to Dickenson, the discipline also emphasizes phenomena such as collective behavior and rational choice models of analysis. The emphasis on collective behavior is relevant to this dissertation because the dissertation deals with how the actions and perceptions of groups and individuals affect a specific area of government. The study of rational choice models of analysis in a political context is relevant to this dissertation because of the critical role played by formal risk assessment processes in the FAA and in other U.S. federal regulatory agencies.

Public policy analysis is the structured approach to addressing public policy concerns. Gerston (1997) defined public policy as the combination of basic decisions and actions of those who hold or affect government positions of authority. Public policy professionals apply analytical techniques to social issues for the purpose of enhancing understanding of the policy process and improving the quality of the inputs into the process. Some of these techniques include risk assessment, cost benefit analysis, decision analysis, modeling, and forecasting. Public policy analysis provides a methodology for defining problems, identifying options, analyzing choices, and implementing solutions.

Ideologies or belief systems provide rationales for both expectations of how government should act and frameworks for both policy analysts and decision makers. In the context of U.S. government aviation policy, one of the most relevant belief systems is that of utilitarianism. The basic belief of utilitarianism is that decisions should be

evaluated in terms of their social utility or preferences. The guiding principle is to seek to maximize a quantitatively defined good. A utilitarian policy orientation would weigh policy options by some sort of measure of how much the option contributes to the public good with the highest utility option being considered good or preferable (Heineman et al. 1990).

The primary motivation in policy analysis is to address practical problems at various levels of government. Key issues in public policy analysis include determining the meaning or interpretation given to terms and definitions used in the course of policy development, identifying the groups that are involved in the policy development process or which are affected by the results of that process, understanding the formal and informal rules of the groups and individuals involved in the policy process, understanding the process of political socialization, and understanding the nature of power and influence and how it is used during the political process.

One of the more important public policy issues is that even though policy analysis operates under a utilitarian model combined with rational decision making, the way human beings think and make decisions may not be rational in the objective, scientific sense. The issue of representativeness mentioned in the context of role theory can exist in judgments about the policy making process. An outsider's view of the validity or lack of validity of a process may be based on how well the observed characteristics of a process fits a mental model of how the process should work.

Another key concept in public policy analysis is recognizing the difference between values and objective facts and how these values and facts are incorporated into public policy issues. Values can be defined as the general beliefs or attitudes about the

relative utility, merit, or worth of goods, objects, services, or actions which in turn may guide individual behavior in the policy process (Patton and Sawicki 1993b). One kind of belief or attitude that is relevant to the policy process in general, and to this research in particular, is that when people have a role in the policy making process, they tend to operate within the norms and expectations of that group. These actors will respond to issues within the framework of those norms and expectations of their organization involved (Heineman et al. 1990). Part of the work of this dissertation is to explore the perceptions of how much or how little the NTSB is operating within the norms and expectations of the aviation safety community when it comes to pursuing NTSB safety recommendations.

A key objective in public policy analysis is to work on behalf of the public interest. That public interest often manifests itself as a problem that affects one or more individuals or groups within society and which the public wants to have resolved. A public policy problem usually exists because the expectations of one or more individuals or groups are not being met. The definition of the problem, the scope of the problem, the values of those affected by the problem, and the options for dealing with the problem all contribute to how the problem should be addressed or whether the problem should be addressed at all. The analysis of public policy issues often revolve around understanding and defining the problem well so that the best approach to the problem can be selected and the right problem is addressed in the first place (Patton and Sawicki 1993b).

A policy issue becomes relevant based on the values of the groups or individuals involved. This is illustrated in the classic dilemma of the "tragedy in the commons" where individual owners share a common grazing area, but because each individual has

an incentive to increase the size of his or her own herd, the result is an overgrazed commons that affects all the herd owners. The values of the owners included the freedom to use the commons for individual benefit without concern for the collective impacts of these individual decisions. This leads to a public policy impact of an overgrazed commons that no longer benefits the individuals (Hardin 1968).

Risk Assessment

The discipline of risk assessment deals with a variety of issues that vary with the field using the discipline. In engineering, risk assessment has to do with making decisions about whether a system can meet the requirements that are placed on it. Because of its role in making decisions, risk assessment is also used as a management tool outside the realm of engineering. The context of a risk assessment may vary, but the process of performing a risk assessment and making decisions based on a risk assessment can be standardized (Stewart and Melchers 1997).

Within the regulatory agencies of the U.S. federal government, risk assessments are often formally incorporated into the policy decisions regarding technological risks in areas such as transportation. Risk assessment in the regulatory context is broadly defined as the description of potential losses from a given hazard. The assessment process consists of a paradigm of four conceptual steps that were first described by the National Academy of Sciences in 1983 and which have become generally accepted by the U.S. government (Commission on Risk Assessment and Risk Management 1996; Lave 1982; Russell and Gruber 1987):

1. Stating objectives and assumptions,
2. Hazard identification,
3. Exposure assessment, and
4. Risk characterization.

The four major conceptual steps of risk assessment define the most important questions faced by the discipline: what objectives should be chosen and what assumptions made, how are hazards identified, how to measure and assess the impact of exposure to that hazard, and how to characterize the risk so that it integrates the results of the conceptual steps. Risk characterization involves evaluating the strengths and weaknesses of the assumptions, the data, the uncertainties in the analysis and the conclusions, and communicating those results to those who are affected by the risk or who must decide how to react to those risks.

Risk assessment is a combination of both science and values, and both play a role in the first conceptual step of stating objectives and assumptions. The responsibility for completing this conceptual step is usually the domain of the relevant experts, but the choice of what assumptions to make may not be up to the experts. If the risk assessors were the only parties involved, then the choice of objectives and assumptions would be based on the values inherent in the scientific or technical disciplines of those assessors. If the assumptions and objectives were imposed from outside the risk assessment process, then those choices would represent other kinds of values.

Risk is generally defined as the product of the consequences associated with some situation and the probability that a particular outcome will occur (American Association

of Cost Engineers 1995; Atomic Energy Commission 1974; Stewart and Melchers 1997). One way to differentiate hazards and risks is to define a hazard as any threat to humans and what they value, and risk as a quantitative measure of hazard or consequences expressed as a conditional probability of experiencing harm (Hohenemser, Kates, and Slovic 1983). One of the simplest examples is that of a coin flip. If one flips the coin and chooses tails, the unwanted outcome is the coin landing heads up. For a fair coin, the likelihood of this outcome is 50%. Other examples of risk are workplace injuries and health risks from exposure to carcinogens.

While there is no universally accepted definition of the basic definitions of the components of risk, the following definitions are generally agreed upon within the field of risk assessment (Kaplan 1997):

- *Risk* has three components: the hazard, the likelihood or probability of the hazard, and the consequences should the hazard occur. Risk is often associated with quantifiable impacts such as potential economic loss, but risk can also be associated with effects that are not easily quantifiable such as social equity, safety, and distributive impacts.
- *Probability* or *likelihood* has three major meanings: the frequency of an event, the degree of confidence that an event will occur, or the probability of a frequency when a repetitive situation exists but no experiment has taken place. The probability associated with a specific risk can be one value associated with one particular outcome for a hazard, or it can be a distribution of values associated with a variety of potential outcomes for a hazard.

- *Consequences* can be in one of three forms: a vector of several different classes of consequences, a time dependent consequence, or an uncertain outcome that is a function of time or other independent variables.

Risk assessment is an applied rather than a theoretical discipline and this is reflected in the second step of hazard identification. This step would include the collection of the relevant facts and data about the hazard and identifying what system or organism is affected. If the hazard has occurred before, the knowledge of its existence is sufficient. If the hazard is not well understood, then the assessor must make an effort to at least prove that the hazard is possible. Depending on the context of the risk, it may require the knowledge and practice of one or more relevant scientific, engineering, or mathematical disciplines in order to validate the existence of a risk.

Science rather than values is more predominant in the third step of exposure assessment. Mathematics, in the form of probabilistic modeling and statistical inference, is a key discipline for understanding and describing the pattern of exposure. Key to understanding the negative consequences associated with a hazard is an understanding of the scientific or technological processes that control the exposed organism, population, or system. In addition, this third step includes analyzing or speculating about the causal relationship that exists between the exposures to a hazard and the observed outcomes. Because full knowledge of the underlying processes is usually not possible, the use of scientific and other knowledge must be supplemented with inferences that extrapolate from both the data, and the understanding of the underlying processes.

The fourth step of risk characterization includes presenting a decision maker with a synopsis of all the information that contributes to a conclusion about the nature of the risk and includes evaluating the assumptions and the magnitude of the uncertainties involved in the assessment. This step represents the transition between the more objective tasks of risk assessment and the more subjective and value laden tasks of managing risks. It integrates the results of other parts of risk assessment, evaluates the strengths and weaknesses of the analysis and the conclusions, and communicates these results to the risk managers, stakeholders, and to others. This task creates a synopsis of all the information that contributes to a conclusion about the nature of the risk and about the assessment of that risk.

Although risk assessment often uses the tools of science, engineering, and mathematics in order identify and assess risks, it is by no means a precise science. It is often performed because complete information about a hazard is not available or a complete understanding of the mechanisms that cause the hazard is not possible. Uncertainties can exist about the probability or the likelihood that a hazard will occur with a particular level of consequences. This kind of uncertainty exists because knowledge of the probabilities and sets of possible outcomes that characterize a probability distribution of risk is based on experimentation, statistical sampling, and other statistical tools that all have some level of uncertainty associated with the data, or with the models or assumptions used (Vesely 1984). Estimates about a risk can come from a range of sources such as historical data, modeling, comparison with alternatives or similar activities, or contrasting with other risks (Wilson 1987).

Risk Assessment and the Regulatory Process

One area where risk assessments are used as a basis of decision making is in the regulation of risks by the U.S. government. A formal risk assessment is often used as a basis for actions or decisions related to managing risk. While the risk assessment is based on principles that are in many ways similar to the principles of engineering, sciences, and mathematics, the regulatory decision makers who evaluate the assessment of a risk will make decisions that take social, political, and economic concerns into account.

There are a number of federal agencies that rely on formal risk assessments in order to enforce regulations or to direct resources and, although these assessments often include the same kinds of techniques and methods used in risk assessments in industry, these risk assessments differ in that the scope of those affected by the assessments tends to be much broader. The risk assessment process often explicitly includes social dimensions of risk such as the level of social acceptability for a particular level of risk. For example, in risk assessments performed to address issues of safety, risk has some empirical value that is a function of probability of an event and the severity of harm, but safety is a social value that is a function of several factors such as the acceptability of risks. The concept of acceptability of risk implies questions like "In whose view is it acceptable?", "Acceptable in what terms?", or "Acceptable for whom?". The concept emphasizes that safety decisions are relativistic and judgmental and that safety is not an absolute, measurable property of things (Lowrance 1976).

Values and Risk Assessment

Even though the normative, value laden aspects of regulatory decisions regarding risks are more often associated with how the risks are managed, values can also enter into the usually objective and scientific aspects of risk assessment. One way that this can happen is when the first step of a risk assessment, stating the objectives and assumptions, is driven in part or in whole by the philosophy or objectives of the entity performing the assessment. One example is the federal guidance for the research and development activities in the area of toxic substances and hazardous waste. Federal strategy in these areas calls for using scientifically sound and demographically sensitive assessments of risk as well as considering the costs and benefits when assessing risks (Office of Management and Budget 1997).

For the U.S. federal regulatory agencies, the current direction on the use of risk assessment comes from the Executive Branch, specifically Executive Order 12866, which was signed by President Clinton in September 1993. This Executive Order was part of the Clinton Administration's efforts to reform the regulatory process for both new and existing regulations. The Administration's regulatory philosophy includes the use of cost benefit analysis and an acknowledgment that qualitative measures of costs and benefits such as economic, environmental, public health, safety, distributive impacts, and equity be considered. Principles of regulation include considering the degree and nature of risks posed by various substances or activities within its jurisdiction when setting priorities, designing the most cost effective regulations, and proposing or adopting regulations where the intended benefits justify the costs (Clinton 1993). While the NTSB does not have to justify it recommendations with any kind of risk assessment or cost benefit

analysis, regulatory agencies such as the FAA must consider such assessments when responding to an NTSB recommendation.

For risk assessments performed in a regulatory environment there are two kinds of relevant issues: those that are normative and which are a function of fairness and social justice, and those that are empirical and a function of measurable probability and size of beneficial effects. Normative realities include safety, the degree to which risks are judged acceptable, the distribution of costs and benefits, the degree to which efficacies are judged desirable, equity, fairness, and social justice. The empirical realities in risk assessment include risk, the measure of probability and severity of effects; efficacy, the probability and intensity of beneficial effect; and cost, which could be either measurable in financial terms or non-measurable social costs.

Previous Related Research

While no previous academic works were found that attempted to deal with the issue of political influence on the safety recommendations of the NTSB made to the FAA, other aspects of the safety recommendation process have been addressed. Manos (1991) investigated the decision making process of the FAA Office of Accident Investigation in order to evaluate its decision making process during the years 1983-1988. This office was responsible for coordinating NTSB recommendations that were sent to the FAA. Manos made a number of recommendations to improve the decision making process, but did not find any indication that the FAA or the NTSB were not following acceptable procedures for making decisions.

Mucho (1990) evaluated the safety proposal process of the NTSB during the period 1980-1989, looking at the use of resources needed to execute the process as well as the decision process for evaluating safety proposals. Mucho found that the group responsible for evaluating safety proposals had two major problems: a lack of a group leader or facilitator and a reliance on subjective judgments and experience for evaluation recommendation proposal. According to that study, the evaluators did not always have access to sufficient background information and the decision making group relied on consensus rather than a standard set of criteria to reach their decisions.

Contributions of the Research

The NTSB and FAA are formal organizations with well defined objectives and well defined protocols on matters related to the NTSB recommendations to the FAA. These protocols are understood by both sides and are described in various public documents, therefore any dialog between the two groups on these recommendations can be evaluated with respect to those protocols. In contrast, the aviation safety community is an informal group that exists across a number of public and private organizations around the U.S. and the world and which includes individuals who are not a part of any formal organizations with an aviation safety related mission. This informal group is important to the safety recommendation process because of the indirect influence it has over the public's approval of the formal process that exists between the NTSB and FAA. A number of individuals and organizations within this group shapes the public opinion and the regulatory and political agenda through lobbying activities, public speeches, and through other means.

Potentially, the most important contribution of this research will be that the resulting analysis will help to either support or refute perceptions on the part of the aviation safety community that the integrity of the NTSB safety recommendations to the FAA is undermined by the influence of politics. The research is important to the NTSB and FAA because the research findings will serve as a process evaluation for the two organizations. Any findings that imply that the formal process is not effective in addressing aviation safety concerns may serve as a catalyst for improving that process. Findings that indicate that the process has not been undermined will help to prevent unnecessary tampering with the process.

The group that benefits the most will be the aviation safety community. No matter what the research findings are, one of the outcomes of this dissertation will be a systematic and objective method to determine whether there is evidence of political influence in a formal aviation safety process. The current study could be used as a starting point for other investigations of possible influences in the recommendation process. This type of approach may prove useful in other situations where two or more organizations are evaluating proposals for enhancing safety and reducing risk.

The major research questions in this dissertation concern the possible existence of NTSB political motivations behind one or more safety recommendations to the FAA. Addressing those questions will require addressing several questions related to how the aviation safety community views the NTSB safety recommendation process. Those questions are:

- What is a consistent and useful characterization for both the NTSB recommendations made to the FAA and the FAA's response to those recommendations?
- What patterns exist in both the NTSB recommendations and the FAA responses to those recommendations?
- How does a selected sample population of members of the aviation safety community define politics in the context of aviation safety issues?
- In what ways does a sample populations of the aviation safety community perceive the NTSB recommendations to the FAA to be politically motivated or influenced?

The results of this work could well be of interest to those groups that are directly involved in other kinds of risk assessments within the federal government. While the NTSB's relationship with the FAA is unique, the use of risk assessments as part of public policy development is common throughout the U.S. Insights about how affected parties may accept the process as well as the results of the process might well be applied to ongoing regulatory issues within the U.S. government.

Chapter 3: Methods and Findings

The intent of this study was to determine whether there was evidence to support the claim that NTSB process for making and resolving safety recommendation directed at the FAA was influenced or motivated by politics. There were 269 recommendations that fit the criteria for inclusion in this study. Those criteria are explained in detail later. Searching for evidence of NTSB political influence or motivation among these 269 recommendations was a two step process. The intent of the first step was to find a useful definition of politics that would allow individual recommendations to be categorized as either subject to potential political influence or not subject to such influence. Of the 269 recommendations, 63 had one or more of these political influence characteristics. The intent of the second step was to develop a procedure for identifying whether there was a significant difference in the way that the NTSB treated those recommendations that had the characteristics identified with potential political influence. Part of that second step included identifying an objective indicator of a conflict between the NTSB and the FAA over the resolution of a recommendation. Of the 269 recommendations, 48 had this indicator of a conflict over their resolution. The procedures for developing definitions of political influence characteristics, identifying the recommendations that had those political influence characteristics, and identifying the recommendations where the NTSB and FAA were in conflict over their resolution are explained in detail later.

The goal of the two step process was the presentation of evidence showing whether the recommendations with the political influence characteristics were disproportionately represented among those recommendations where the NTSB and the FAA may have been in conflict. This two step process required the use and analysis of

two different kinds of information. The first step identified three characteristics associated with political influence based on the personal observations, impressions, and opinions of six experts from the aviation safety community. The second step of the analysis used the information in the formal correspondence between the NTSB and the FAA in order to find those cases where the NTSB and FAA may have been in conflict over the resolution of the recommendation. The information developed in these two steps was used to determine whether the recommendations with the political influence characteristics were disproportionately represented among those recommendations where the NTSB and FAA were in conflict over their resolution.

Using a medical analogy, the characteristics of political influence are like risk factors that are associated with a particular medical condition. For some specific population, a relationship between risk factors and a particular medical condition is suspected if the proportion of risk factors is significantly higher in the subpopulation with the medical condition compared to the subpopulation that does not have this condition. In this study, the specific population is analogous to the 269 recommendations, the risk factors are analogous to the political influence characteristics, and the 48 recommendations where the NTSB and the FAA disagreed over the resolution of the recommendation are analogous to the subpopulation with a particular medical condition.

This chapter will discuss in detail the data that was used, how it was gathered, why it was relevant to the research questions, and what limitations were imposed by the type of data and the scope of data used. This chapter will also describe the method used to determine if some recommendations may have been affected by influences that an interviewed group of aviation safety experts deemed to be political in nature. The

researcher's prior relationships with the research subjects, the NTSB, and the FAA will be discussed, as will the protections afforded the human subjects during and after the data gathering phase.

Step 1: Finding Useful Indicators of Political Influence and Motivation

The key research questions in this study revolved around the perceived existence of political influence in the NTSB recommendation process. There was no previously existing documented definition of politics or political influence for this process that could be used for this study. Speeches, quotations, and other comments from some leading aviation safety experts were not comprehensive enough to use as a basis for characterizing the definition of politics and political influence. In order to acquire a working definition of politics and political influence in the NTSB safety recommendation process, a sample of members of the aviation safety community was chosen to represent those in the community who were familiar with the NTSB recommendation process or who had dealt with the policy ramifications of the recommendations. The views of this sample were reviewed in order to find characteristics that could be associated with a politically influenced or motivated NTSB recommendation. These characteristics were identified for later use in the second step of the analysis.

This method of elite or specialized interviewing is often used in policy analysis when there is little or no existing literature on the subject, or when the insights of experts and those who were close to the process would be useful (Patton and Sawicki 1993a). These insights were useful for determining what parts of the safety recommendation process had to be examined in order to address the research questions of this study.

Sampling a larger cross section of the aviation safety community would not have been desirable or effective at eliciting this information for two reasons. First, a random sample of the aviation safety community would not have necessarily had direct experience with the NTSB safety recommendation process or with those directly affected by the process. Second, a large sample of interviews would have required significant resources in order to process the kinds of open-ended interviews that were necessary for that part of the research.

Appendix A contains a list of the six interview subjects, the date of the interviews, and the relationship of the subjects to the aviation safety community. The appendix also has a description of the interview procedure and a descriptions of the procedures used to protect the human subjects. These six were chosen in order to satisfy several objectives. In this study, it was necessary to understand the thought process of the decision makers and other participants who were responsible for dealing with those NTSB recommendations directed at the FAA, therefore, the selected interviewees had to include one or more representatives from NTSB and FAA and the interviewees had to be directly involved in the NTSB recommendation process. Two persons from the FAA Office of Accident Investigation, an office directly involved in dealing with NTSB recommendations, were interviewed. Also interviewed was one person from the NTSB Office of Safety Recommendations and Accomplishments. The other three interviewees were chosen to represent the perspective of former NTSB staff and the perspective members of the aviation safety community who had no previous formal connection to either the NTSB or FAA. One interviewee was former NTSB chair Jim Burnett and a second was a former NTSB field investigator. The sixth interviewee was a Washington,

DC based lobbyist who had been involved in a number of airline safety and airline regulatory policy issues. The minimum desired range of subjects was covered by the first five interviews. The former NTSB field investigator, the sixth and final interviewee, had not been sought out, but was included because of his insights into the NTSB recommendation and accident investigation processes.

The interviews were conducted either by phone or in person and the procedure was to initiate a discussion about how the interviewee would describe or define politics or political influence in the NTSB recommendation process. The emphasis in the interviews was on the first hand experiences of the interview subjects with the NTSB recommendation process and with the formulation of aviation safety policy. The interviewees were encouraged to talk at length about their impressions of the NTSB accident investigation and safety recommendation process and to offer their insights as to the role of politics in those processes. Notes and audio recordings of the interviews were later reviewed in order to determine the range of definitions of what constituted politics and political influence, and the extent to which these definitions were shared by the interviewees. The product of this comparative narrative analysis was a working definition of politics and political influence that was applied in the evaluation of other evidence in this study. The highlights of the comments from the six interview subjects are provided in Appendix A. What follows is a synopsis of those interviews and a listing of the political influence characteristics that were implied from the interviews.

Synopsis of Interview Information

There were many comments about the influence of politics in the safety recommendation process, but there were no clear definitions about what actions or characteristics could be considered political. Part of that difficulty was illustrated by a comment by Jim Burnett who stated that when the FAA does not respond to the aviation industry's influence, then the industry calls it politics, but when the FAA does respond to the industry, then the industry calls it commerce. In spite of these differences in definitions, some consistencies emerged from the interviews:

- The FAA has not agreed with all of the tactics that the NTSB used against the FAA to further the NTSB's safety agenda and both the NTSB and FAA recognize the political nature of some of these tactics.
- Political influence can be applied from both inside and outside of the NTSB.
- How the NTSB closes a recommendation is based in part on how other involved organizations may react to the closure.
- Attempts by the aviation industry, the public, or the media to influence the recommendation process are not likely to be successful.

There were five characteristics of politically influenced recommendations or actions that were shared by several interviewees:

1. Accidents that were selected as major investigations, but that did not fit the profile of other major investigation accidents. Two of the six interviewees identified two such accidents, a February 1996 accident involving a DC9 and an April 1996 event involving a Cessna.

2. Accidents that attracted significant public and media attention had a higher potential for attempts at political influence. Four of the six interviewees identified different accidents with this trait. In each case the attempts at influencing the investigation of the accident originated outside of the NTSB and were focused on issues related to the suspected cause of the accident.
3. A high NTSB media presence that is associated with a recommendation. Two of the six interviewees identified different accidents, TWA Flight 800 in July 1996 and the fatal ValuJet event in May 1996, as having this characteristic.
4. The recommendation were considered to be not technically sound or well thought out. Three of the six interviewees implied that this characteristic was present in some of the recommendations associated with the fatal ValuJet accident and with TWA Flight 800.
5. Support for a current recommendation was generated by using the example of a past recommendation that was not adopted. Two of the six interviewees identified the ValuJet accident as having this characteristic.

The overall impression given by the collective comments of the interviewees is that there are two distinct aspects to politics in the pursuit of NTSB aviation safety recommendations. One is the political influence on a recommendation and the second is the politics associated with a variety of issues and events surrounding the safety recommendation. While several of the interviewees were not happy with the realities presented by this second aspect of politics, there was no consensus that this second aspect influenced the recommendations themselves. There was also no consensus that the

recommendations themselves were totally free of direct influence due to reasons separate and distinct from scientific, technological or practical considerations. It is the goal of this particular study to explore the possible existence of direct influence on the outcome of the recommendations.

The formal recognition of a disagreement and the logic behind the disagreement is included in the formal exchanges between the two organizations. This documentation of the process allowed the use of the primary analysis method of the case-control study where the recommendations that had a formal NTSB disagreement were considered cases and those that did not have such a disagreement were considered controls.

Given the restricted scope of this study and the data used to analyze the recommendation responses, only the first three of the five characteristics are both relevant to this study and stand out as factors that are possibly associated with a formal disagreement:

1. Accidents that were selected as major investigations, but that did not fit the profile of other major investigation accidents.
2. Accidents that attracted significant public and media attention had a higher potential for attempts at political influence.
3. A high NTSB media presence that is associated with a recommendation.

The aviation authorities and media reports cited in the first chapter supported the interviewee comments and insights concerning the third characteristic. The first two characteristics applied to all the recommendations associated with an accident while the third one applied to specific recommendations. The recommendations that

had the third characteristic included any recommendation associated with the 737 rudder system, the carriage of hazardous cargo, fuel tank explosion hazards, airframe or control surface icing, and flight and duty time restrictions. All of these issues were either identified by the interviewees as instances where the NTSB had a high media presence or where a recommendation was associated with the NTSB's Most Wanted Transportation Safety Improvements program. This program is an ongoing effort by the NTSB to highlight particular recommendations or issues that it wants addressed.

The fourth characteristic of a lack of technical soundness is beyond the scope of this study because the study assumed that any technical disagreements would be addressed using the procedures and tools of engineering or science. The fifth characteristic of previous recommendations affecting a current one is beyond the scope of this study since this study focused only on recommendations that occurred in conjunction with major accident investigations begun between 1 January 1993 and 31 December 1997. While some recommendations are explicitly linked to one or more earlier recommendations, there is no requirement for either the FAA and NTSB to point out relationships between past and present recommendations.

Limitations of Political Definition Data

The data used to define the meaning of politics and political influence in the recommendation process consisted primarily of interview data, but also included data from other sources such as speeches and interviews from the media. The most important limitation was the number of people used and the scope of their experience. The six people who were interviewed did not represent all levels of those who are in the aviation

safety community. For the most part, they represented present or past holders of high level or influential positions within the aviation safety community. All of the interviewees had dealt directly with the leadership of the NTSB, FAA, and other aviation safety related organizations in matters related to accident investigation and accident prevention. As a result, they were not a representative sample of those in the aviation safety community.

Another limitation of the data is that the interviewees may not remember critical details, or they may have consciously or unconsciously altered the details of their recollections. The narratives given by the interviewees often referred to events that had taken place as far back as 1982. The interviewees may have incorrectly related sequences of past events or the relationships between those events. Inferences reached by the interviewees and relayed during the interview may be in disagreement with either other interviewees who were making inferences based on the same data or with information compiled from non-interview sources. While it was possible to seek out corroborating evidence that validate the remembered factual details, it was beyond the scope of this study to do so.

One of the more influential organizations in the aviation safety community is the Boeing Company. Although Boeing aircraft were involved in 18 of the 32 major accidents included in this study, no current Boeing employee was interviewed because of the potential conflicts of interest. Although none of the research in this dissertation used any proprietary information or information directly related to any ongoing accident investigation, if I had interviewed any current Boeing employee, any notes or audio recordings associated with this study could have been made part of the evidence in one or

more legal proceedings related to accidents involving Boeing aircraft. There was the possibility that the interviewees could have been the subject of sanctions by management if their involvement in this project were known and if management disagreed with either the findings of this research or with the nature of the issues raised by the research. That potential for negative consequences for participants could have prevented Boeing interviewees from being open and honest about their views of the NTSB safety recommendation process.

The limited number of interview subjects and the subjects' high level perspective on aviation safety issues kept their views on the recommendation process from being representative of the entire aviation safety community. This group was chosen primarily to provide insight into the influence of politics on one specific safety process. The intent of using them was not to develop a detailed description of how all members of the aviation safety community feel on the subject, but rather to define a set of attributes for political influence in the NTSB safety process.

Background of NTSB Recommendations to the FAA

Before describing in some detail the recommendations that were included in this study, it is necessary to describe the process by which the recommendations are created by the NTSB and how they are subsequently addressed by the NTSB and FAA. Both the NTSB and FAA have formal procedures for creating and reviewing either the recommendations or the responses before they are transmitted between the organizations.

It is within the jurisdiction of the NTSB to investigate accidents, determine the probable cause or causes, and to make recommendations to reduce the likelihood of

recurrences of similar accidents. If a recommendation is directed to the FAA, the FAA's Office of Accident investigation serves as the focal point for receiving, processing, managing, and tracking the recommendations and serves as the intermediary between the FAA and NTSB on all NTSB safety recommendation issues. The office assigns actions related to the recommendations to the appropriate FAA program offices, and once those offices respond, the Office of Accident Investigation coordinates reviews of the recommendations to ensure that they address the relevant issues and are consistent with previous FAA actions taken on similar matters. This office also serves as the FAA coordinator between the FAA program offices and the NTSB in order to resolve any controversial recommendation issues.

The FAA offices assigned to deal with an NTSB recommendations must designate a coordinator, conduct a technical evaluation to determine the feasibility of implementing the recommendation, and prepare proposed responses to the recommendation. These offices are responsible for following up on all correspondence from the NTSB (FAA 1995).

Step 2: Identifying Difference in the Treatment of Recommendations

In this second step of the analysis, the objective is to show whether those recommendations that have the political influence characteristics identified in the first part of the analysis are treated differently by the NTSB. The focus in this second step is on the recommendations and not on the accidents associated with the recommendations. The analysis methods described later in this chapter are focused on a specific set of

recommendations associated with major NTSB investigations of accidents that occurred between 1 January 1993 and 31 December 1997.

The derived political influence characteristics from the first step did not serve as an indicator of a potentially politically influenced or motivated recommendation. Such an identifier is needed for the analysis techniques in the second step. The key assumption is the following - *if a recommendation is influenced or motivated by NTSB political concerns, then it is more likely then otherwise that the FAA's response will not address the NTSB's concerns and that the NTSB would in turn find the FAA's proposed resolution to be unacceptable.* A related assumption is that the FAA responses are not influenced by the same characteristics that are suspected to affect the NTSB. In the second step of this analysis, a higher rate of disagreement between the NTSB and the FAA might suggest that some of the NTSB's decisions were based on political considerations.

For every recommendation, the NTSB classifies the actions taken on each one using one of the 14 categories listed in Appendix B. The nine that were relevant to the recommendations in this study were simplified into the four categories listed in Table 1. Recommendations that have been assigned the categories Closed – Unacceptable Action or Open – Unacceptable Action/Response are the recommendations that possess the designated indicator of a potentially politically motivated or influenced recommendation. The following sections describe the data used in this second step of this analysis of the recommendations, the methods used to analyze the recommendations, and the findings of that analysis.

Table 1: Recommendation Categories Used in This Study

Categories Used in This Study	Equivalent NTSB Categories
Closed Acceptable (CA)	This group included the NTSB categories Closed - Acceptable Action, Closed - Reconsidered, Closed - Acceptable Alternate Action, and Closed - Exceeds Recommended Action.
Closed - Unacceptable Action (CUA):	This was the same as the NTSB category.
Open and Acceptable (OA)	The group included the NTSB categories Open - Acceptable Response, Open - Await Response, and Open - Acceptable Alternate Response.
Open - Unacceptable Action/Response (OUR)	This was the same as the NTSB category.

Analysis Data

There were two types of data used in this part of the analysis: the political influence characteristics from the first step of the analysis and the recommendations associated with major accident investigations in the period under study. The key assumption of the previous section limits the recommendations that can be analyzed to those where the NTSB has had at least one opportunity to categorize the FAA's response to the recommendation. More formally, the recommendation data selected for analysis had to meet the following requirements:

1. They were associated with major NTSB aircraft accident investigations that began between 1 January 1993 and 31 December 1997.
2. They were issued on or before 1 July 1998.

3. They were not superseded by another recommendation or eliminated because the NTSB considered it to be no longer applicable.
4. The NTSB formally responded to at least one FAA response to the recommendation.

In all 349, recommendations met the first two requirements, 12 were eliminated by the third requirement, and 68 others were eliminated by the last requirement, leaving a total of 269 recommendations for further analysis. From 1 January 1993 to 31 December 1997, there were 32 major accident investigations that had at least one recommendation that met all four requirements. The date, aircraft type, and number of included recommendations for those 32 accidents are listed in Appendix D. Table 2 shows the distribution of these 269 recommendations among the 32 accidents. Appendix F identifies each of the recommendations included in this study.

Table 2: Distribution of NTSB Recommendations Among the 32 Accidents

Number of Accident Related Recommendations in Study	Number of Accidents	Number of Recommendations
1-5	12	33
6-10	10	71
11-15	5	69
16-20	4	69
21+	1	27
Total	**32**	**269**

Documentary Data

When the NTSB investigates an accident, much of the information related to the accident is placed in a public docket file which, as the name implies, is accessible to the general public. The file contains inputs from the NTSB and from parties supporting the NTSB investigation process and may include detailed technical analyses and interim reports. For the major accident investigations that are the focus of this study, there are formal accident reports which contain a synopsis of the data in the public docket, an analysis of the accident, the NTSB conclusions about the circumstances of the accident, and the NTSB determination of probable and contributory causes to the accident.

During the course of the investigation, the NTSB may make recommendations to one or more organizations to address safety issues uncovered during the course of the investigation. In the major investigations in this study, the recommendations were approved by the appointed Board members, with the actual content of the recommendation coming about from a combination of inputs from the appointed Board members, NTSB technical staff, and other organizations that support the accident investigation. Recommendations also go through a formal internal review process before being voted on by the Board.

While the organization that has a recommendation directed to it is not obligated to implement the recommendation, it is obligated to formally respond to the recommendation. The recommendation remains open until either the recommendation is superseded by another recommendation, until the recommendation is addressed to the satisfaction of the NTSB, or until the NTSB determines that the responding organization will not address the recommendation to the NTSB's satisfaction.

Two kinds of NTSB related documents were used in this second step of the analysis, formal correspondence between the NTSB and the FAA concerning the resolution of a recommendation and the official NTSB final report of an accident. Both kinds of documents were available to the public through printed documents or electronic databases. An FAA database of correspondence related to the resolution of NTSB recommendations was used for two reasons: it was frequently updated, and it was easily accessible through a Web based interface. The quality of the data through the Web access interface was checked by requesting a sample of the same information directly from the FAA Office of Accident Investigation and by comparing the FAA data with NTSB documents on those same recommendations.

The second kind of documents used were the final accident reports that the NTSB had issued for the accidents included in this study. Appendix D contains a list of the accidents included in this study and indicates whether the accident had a report published by 1 July 1998. The References section of this document provides details of all those Appendix D accidents that have final NTSB reports. By 1 July 1998, 29 of these major accidents had a published final report. The fatal 1996 accident involving ValuJet had a published report by this date, but the accidents involving TWA Flight 800, the USAir 737 at Pittsburgh, and the 1997 accident involving a Brasilia aircraft did not have published reports. The published reports were used to provide insight into the rationale for the recommendations associated with a particular accident and were used to provide insight into the relationship between the recommendations and the events associated with the accident. Sixteen of the 29 final reports were analyzed in order to determine a general pattern of what kinds of events were associated with a recommendation and the intent of

the recommendation given the context of the accident. Appendix E provides details on the analytic method for uncovering the relationship between the recommendations and the events related to the accident.

Analyzing the Recommendations with Case-Control Studies

Analyzing the interview and documentary data in order to determine if recommendations are influenced by political considerations is analogous to a medical question of asking if a population exposed to a particular set of risk factors were more prone to having a particular medical condition. The structure of the data in this study resembled the structure of data in a case-control study. This kind of study is often employed in the field of epidemiology (Ahlbom and Norell 1984). In a case-control study, the population would be divided into two groups designated as cases and controls. In each group some, but not all, of its individual members have been exposed to the characteristic suspected of being associated with the particular medical condition. The cases would be those individuals that had the particular medical condition and the controls would be the individuals that did not have this condition. The analysis of the data in this kind of study consists of a comparison of the proportion of exposed individuals in the case group to the proportion of exposed individuals in the control group.

The data derived in the first and second step of this analysis are equivalent to the data used in a case-control study. The 269 recommendations in the study are equivalent to the underlying population. The characteristics of politically motivated or influenced recommendations are equivalent to risk factors for a particular medical condition. The recommendations that had at least one of the unacceptable NTSB categorizations listed in

Table 1 are equivalent to the cases and those without either of these designations are the controls. The 48 recommendations designated as cases are listed in Appendix G.

This case-control study model was used to determine if some characteristics were disproportionately present in recommendations that had a formal disagreement. The basic instrument used in this case-control study was a comparison of recommendations exposed to characteristics to those that were not exposed. The basic technique is illustrated in the 2 x 2 contingency table in Table 3 where Nc is the number of cases, Nk is the number of controls, N is the total number of cases and controls, Te is the total number of recommendations exposed to the characteristic of interest and Tne are the number not exposed. By comparing the ratios of exposed to unexposed among the cases and controls, that is by comparing the ratios a/b with c/d, then it is possible to determine if there is any association between exposure and the occurrence of the outcome of interest. The ratio (a/b)/(c/d) produces what is called the relative risk and this gives a value for how much more frequently exposure to the characteristic of interest happens in cases compared with controls.

Table 3: Organization of Case-Control Study Data

	Exposed to Characteristic		
	Yes	No	
Cases	a	b	Nc
Controls	c	d	Nk
	Te	Tne	N

Relative Risk = (a/b)/(c/d)

A goodness of fit test can be performed on the data in this contingency table in order to either accept or reject the hypothesis that the population of cases and controls

given by the values a, b, c, and d are due to random variation. The assumption is that the sample of N recommendations is from a larger population with a given probability of either having a recommendation being a case or having a recommendation with a given characteristic. If the expected value of a, b, c, and d are all in excess of 5, the appropriate test would be a chi-square test with one degree of freedom because two parameters corresponding to the probability of being a case and the probability of being exposed to the characteristic would be estimated by Nc/N and Te/N respectively and the corresponding estimated value for *a* would be (NcTe/N). Estimates for b, c, and d could be derived in a similar fashion. The assumption of independence of having a particular characteristic and being a case would be rejected at the 0.05 level if the chi-square value for a 2 x 2 table were in excess of 3.84 (Guttman, Wilks, and Hunter 1971).

One kind of bias that exists in this kind of study design is when two or more characteristics may influence the occurrence of the outcome of interest in ways that are dependent on one another. If that is suspected, then the basic relative risk calculation could be adjusted. For example, if in addition to the characteristic in Table 1, there were a second characteristic, then the basic table can be expanded as in Table 2 in order to separate the effects of the two characteristics. In this table, the relative risks of the second characteristic stratified or controlled by the first characteristic are given by (a/b)/(c/d) and (e/f)/(g/h). Stratifying the data in this fashion to create two separate relative risk ratios will help uncover situations where there is a mixture of effects. For example, if one characteristic is shown to have a high relative risk, then a possible explanation is that the characteristic is some sort of causal factor. There may be a second characteristic that is associated with both a high relative risk and the first characteristic. A stratified table, like

the example in Table 4, will allow a separation of the effects of two possibly related characteristics.

Table 4: : Case-Control Data for Two Characteristics

	Exposed to Characteristics Combination				
Characteristic 1	Yes		No		
Characteristic 2	Yes	No	Yes	No	
Cases	a	b	e	f	Nc
Controls	c	d	g	h	Nk

In short, the relative risk value indicates whether the recommendations identified as cases and those identified as controls are significantly different with respect to their exposure to a particular characteristic. That relative risk value compares the data in the rows of Table 3 and Table 4. Another way of evaluating the level of disagreement between the NTSB and the FAA is to compare the proportion of NTSB and FAA disagreements between the recommendations with a characteristic and those without that characteristic. For example, this would involve a comparison between the data in the columns of Table 3 or Table 4, specifically the number of cases divided by the total number of recommendations in that column. The relative risk value measures whether the recommendations with disagreements are more likely to have a political influence characteristic while comparing the data in the columns shows whether recommendations with a particular political influence characteristic are more likely to contain disagreements.

Table 5 breaks down the 269 recommendations by accident, and identifies which accidents were associated with the 48 cases in the case-control study.

Table 5: Breakdown of Recommendations by Accident and Unacceptable Status

Date	Aircraft	Total	Unacceptable Status
31 March 1993	747-100	8	3
6 April 1993	MD11	13	0
14 April 1993	DC10-30	7	3
19 April 1993	MU2B-60	8	0
18 August 1993	DC8-61	1	0
26 October 1993	King Air	15	1
1 December 1993	Jetstream 31	8	3
7 January 1994	Jetstream 41	7	2
1 February 1994	Saab340B	3	0
2 March 1994	MD82	5	5
27 April 1994	PA31	4	0
18 June 1994	Learjet 25D	6	0
2 July 1994	DC9-30	17	4
8 September 1994	737-300	18	10
31 October 1994	ATR72	27	3
22 November 1994	MD82/Cessna	17	2
13 December 1994	Jetstream 31	7	1
14 December 1994	Learjet 35A	1	0
16 February 1995	DC8-63	6	2
8 June 1995	DC9-32	15	2
21 August 1995	Brasilia	13	0
12 November 1995	MD83	13	0
20 December 1995	747-100	17	2
6 January 1996	DC9-32	6	1
19 February 1996	DC9-32	8	1
11 April 1996	Cessna 177B	1	0
11 May 1996	DC9-32	4	0
6 July 1996	MD88	2	0
17 July 1996	747-100	5	2
19 November 1996	Beech 1900	2	1
22 December 1996	DC8-62	1	0
9 January 1997	Brasilia	4	0

Second Step Analysis Results

The second step of the analysis consisted of deriving the relative risk for the case-control study and comparing the fraction of NTSB and FAA disagreements between those recommendations that had suspected political influence characteristics and those that did not. The case-control study provides the relative risk for the rate of recommendations that had an unacceptable NTSB category (OUR or CUA) and that were exposed to the following three identified characteristics of politically influenced recommendations:

1. Accidents selected as major investigations that did not fit the profile of other major investigation accidents.
2. Accidents that attracted significant public and media attention had a higher potential for attempts at political influence.
3. A high NTSB media presence associated with a recommendation.

The 48 recommendations that were classified as cases are given in Appendix G, and the 63 recommendations affected by one or more of these characteristics and are in Appendix H. The relative risk values are calculated for the three characteristics are included in the information associated with Tables 6, 7, 8, and 9. Each of these tables shows the proportion of disagreements between sets of recommendations that had one or more political influence characteristics and those that did not. The chi-square values for the relative risk calculation were provided in Table 7 and Table 8, but were not appropriate for Table 6 because the expected value of one of the four cells was less than five. In all of these relative risk calculations, the number of cases was 48 and the number of controls was 221.

Table 6: Major Investigations Suspected of Being Chosen for Political Reasons

Chosen for Political Reasons	Percent with Disagreement	Number of Recommendations
Yes	10.0%	10
No	18.1%	259

Relative Risk = 0.50

Table 7: Major Investigations with High Media Interest

High Media Interest	Percent with Disagreement	Number of Recommendations
Yes	27.8%	54
No	15.3%	215

Relative Risk = 2.12

Chi-square value = 4.54 with one degree of freedom, p = 0.033

Table 8: Recommendations with a High NTSB Media Presence

High NTSB Media Presence	Percent with Disagreement	Number of Recommendations
Yes	28.6%	42
No	15.9%	227

Relative Risk = 2.12

Chi-square value = 3.92 with one degree of freedom, p = 0.048

The Table 6 relative risk value implies that those accidents that were suspected of being chosen as major accident investigations for political reasons were not significantly less than the typical investigation to have an unacceptable NTSB category. The relative risk values for the second and third characteristics given in Table 7 and Table 8 imply that recommendations with either of these characteristics are more than twice as likely to have an unacceptable NTSB category.

By coincidence, the relative risk values for the second and third characteristics were identical. Because of the significant correlation between the second and third characteristics, there was a possibility that the two may influence on one another. There was only one recommendation with the third characteristic that did not also have the second characteristic. The stratified relative risk calculations and the comparison of the fraction of disagreements are given below in Table 9.

Table 9: High Media Interest and NTSB Media Presence

High Media Interest	High NTSB Media Presence	Percent with Disagreement	Number of Recommendations
Yes	Yes	29.3%	41
Yes	No	23.1%	13
No	Yes	0%	1
No	No	15.4%	214

High NTSB media presence in the presence of high media attention
Relative risk = 1.38

High NTSB media presence in the absence of high media attention
Relative risk = 0.0

This part of the analysis indicates that none of the three characteristics had an unambiguous positive relationship between their presence in a recommendation and a formal disagreement between the NTSB and the FAA. However, there were indications that recommendations associated with a high media interest or a high NTSB media presence were more likely to result in a formal disagreement between the NTSB and FAA. At first glance, Table 6 indicates that the recommendations associated with investigations chosen for political reasons are less likely to be in disagreement. However,

given the relatively small number of recommendations in this category, it is not clear that this indicates a general underlying trend. A chi-square calculation was also not appropriate for the relative risk for this characteristic for the same reason.

The results for the other two characteristics are more noteworthy. Tables 7 and 8 show that the recommendations associated with high media interest accidents and with high NTSB media presence were both almost twice as likely to have a formal disagreement between the FAA and NTSB. For Tables 7 and 8, the chi-square values associated with the relative risk values were also significant at the 0.05 level. The correlation of the third characteristic with the second one made stratification of these two factors necessary in order to try and separate the effects of the two characteristics.

Table 9 shows that for those recommendations associated with high media interest accidents, the percentages of formal disagreements were similar given either the presence or the absence of a high NTSB media presence. The relative risk value for high NTSB media presence in the presence of a high media attention accident was 1.38. The relative risk value of 0.0 for the recommendations associated with a high NTSB media presence but not associated with a high media interest accident is of questionable validity since only one recommendation had both characteristics. The chi-square calculation was not appropriate for Table 9 due to the distribution of the recommendations.

Either high NTSB media presence or high media interest alone has about double the likelihood of having an unacceptable NTSB characterization compared to recommendations without a high NTSB media presence. The stratified relative risk of 1.38 indicates that recommendations associated with both high media attention accidents

and high NTSB media presence are about 40% more likely to have had an unacceptable NTSB categorization compared to recommendations in high media attention accidents that do not have high NTSB media presence. This is supported in Table 9 by more basic measure of the percentage of recommendations with a disagreement of 29.3% compared to 23.1%. Individually, the relative risk values of these two characteristics are significant at the 0.05 level, but the validity of relationship could not be further supported with a chi-square test on the stratified relative risk.

The analyses associated with the second and third characteristics suggested, but did not prove, that a cause and effect relationship existed between these characteristics and the unacceptable categorizations. Various limitations in the data used in this study did not allow for the elimination or confirmation of three plausible relationships for these two characteristics:

1. Exposure to the characteristic caused or contributed to the outcome.
2. Other factors caused or contributed to both the characteristic and the outcome.
3. The observed relationship was an artifact of the study design.

Limitations of Recommendation Data

The data related to the NTSB safety recommendations was limited in four ways:

1. The data did not represent all of the written information related to the debates between the FAA and NTSB. Only the formal correspondence between the FAA and the NTSB was included in the FAA database. This formal correspondence may have been edited in ways that do not reflect the overall tone or context of the discussions between the two organizations. These recommendation documents

represented only the consensus views of the two organizations and not dissenting views of those involved. The internal communications of the NTSB and FAA that were related to the formal correspondence were not reviewed.

2. The accidents included in this study had an NTSB public docket file containing background information associated with the accident, but this information was beyond the scope of this study and was not reviewed to either validate or expand upon the information NTSB accident reports or FAA recommendation database.
3. By limiting the set of recommendations to those that were associated with major accidents occurring from 1 January 1993 to 31 December 1997, other recommendations from other accidents, from NTSB safety studies, or from earlier years were not considered. These other recommendations may have provided a broader context for analyzing the recommendations of interest.
4. While other relevant commentary from the news media, testimony before the U.S. Congress, and other sources could have provided a broader context for the analysis of the recommendations, only those sources cited in the first chapter were used.

Limitations of the Case-Control Study

This study did not explore the possible influences that could support or refute the three alternative explanations for the analysis results. These three alternative explanations remain valid for a number of reasons. The interviews did not include a representative cross section of all those directly involved in developing and addressing these recommendations. The Freedom of Information Act also limited the ability to review additional internal correspondence of both the NTSB and FAA. The Act allows public

access to a range of records held by the FAA, NTSB, and other executive branch agencies, but excludes access to personal notes of NTSB and FAA employees and to internal government communications such as documents associated with FAA and NTSB deliberations on NTSB safety recommendations (U.S. House 1993). These sources of information could have identified other characteristics associated with perceived political influence or motivation or could have identified other indicators of political influence.

Without a more comprehensive understanding of the details of the NTSB recommendation process, the analysis of this recommendation data only suggested that a the presence of two political influence characteristics – a high media interest in an accident associated with a recommendation and a high NTSB media presence associated with a recommendation – is associated with an increased likelihood that the NTSB will categorize the FAA's response to the recommendation as unacceptable.

Other Analyses

Two other analyses of the recommendation and accident report data were attempted in order to reveal any additional insights to complement the case-control study of the recommendations. The recommendations were reviewed and categorized by the NTSB's intent. Those categorizations are listed in Appendix C. No statistically meaningful pattern was observed between the intent categories and the NTSB and FAA disagreements over the resolution of the recommendations. The correspondence between the FAA and the NTSB were also reviewed in order to categorize the reasons for disagreements among the 48 recommendations that were the cases in the case-control study. No statistically meaningful pattern was observed in that analysis either.

Chapter 4: Interpretations

The intellectual traditions that formed part of the foundation of this study included aspects of sociology, particularly how attitudes are formed with respect to organizational expectations, and aspects of political science, especially the role of risk assessment in regulatory affairs. By systematically reviewing one aspect of aviation safety, this study attempted to see if some of the apparently broadly held views about the role of the NTSB in the safety recommendation process were backed up by some of the data related to this process. The analysis of that data did not conclusively prove that political influence was a part of the NTSB safety recommendation process, but it did provide some indications as to why the beliefs about the process may persist.

Organizational Attitudes

Within organizations, attitudes about an organization and particularly about the leadership of the organization have been shown to be developed in part by factual data about the organization and in part from the informal rules of thumb used to interpret that factual data. While members of the aviation safety community may easily possess the facts of an accident, they are not able to possess the details of how the NTSB and FAA interpret and analyze those facts during the safety recommendation process. The analysis of the documents and the interviews in this study revealed that many of the details about the generation of NTSB recommendations and the FAA response to those recommendations are not explicitly included in the formal communications between the two organizations. As a result, those who are members of the aviation safety community have a restricted understanding of the process. Instead of having an opportunity to rely on

their own ability to interpret the assumptions and methods of analysis of the FAA and the NTSB, interested persons who are not directly associated with the process must rely on the interpretations of those within the process or the interpretations of outside observers such as the media and other aviation safety experts.

Judging by the widely varied views of the interview subjects, the aviation safety community may have some common perceptions about the role and the effects of politics on the safety recommendation process, but those perceptions are not backed up by this study's analysis of the recommendation process. There was a consensus on only three potential characteristics associated with political influence and no consensus on what exactly defined a politically influenced or motivated recommendation. The consensus characteristics were present in the narratives of both the interviewees and in the commentary of some of the more widely known members of the aviation safety community. A reasoned analysis of these characteristics did not reveal a consistent and statistically significant pattern between those characteristics and unacceptable categorizations by the NTSB of the FAA responses to NTSB recommendations.

This consistent pattern in the expressed beliefs of some members of the aviation community suggests that the community shares common beliefs about the roles of the NTSB and the FAA. The inconclusive results of the case-control study suggest that the informal rules of thumb used by members of the aviation safety community to understand their observations about the safety recommendation process have resulted in beliefs or suspicions about the process that are not supported by the available data.

The nature of the safety recommendation process itself may have contributed to this state of affairs. The NTSB had not completed some of the major investigations by the end of the study period, so the 349 published recommendations did not represent the full set of recommendations that will come from the 32 accidents included in the study. Of these 349 recommendations, 80 were not be evaluated by the methods used in this study because either the FAA had not acted on the recommendations or the NTSB had not responded to the FAA actions. There were some major accident investigations that began between 1 January 1993 and 31 December 1997, but which were not included in this study because no recommendations had been issued to the FAA. Of the 269 recommendations that were included in this study, 106 had not been closed as of 1 July 1998. The closure of the other 163 recommendations occurred throughout the study period. Any member of the aviation safety community who attempted to understand the outcomes of those safety recommendation directed to the FAA would have been faced with a situation where almost 40% of the recommendations had not run the full course of the safety recommendation process. Any judgments and conclusions about this process may therefore be made either less or more valid as more recommendations complete the process. Using an earlier time period for this study would have permitted the use of a population with a larger percentage of closed recommendations. However, the purpose of this study was to investigate the role of political influence in the recommendation process. The aviation safety literature cited in the first chapter and the six interviewees from the third chapter did not associate the period prior to 1993 with the kind of perceived political influence that was the focus of this study. Therefore, using

recommendations from an earlier time period would not have been as relevant to address the research questions in this study.

Because of the spread of time over which recommendations are addressed and the apparent influence of the role of the media, recommendations associated with prominent accidents may have had a disproportionate effect on the views that the narratives that would shape the views that the aviation safety community had toward the recommendation process during the period of the study. The three most prominent were the fatal accidents involving a USAir 737 in 1994, a ValuJet DC9 in 1996, and a TWA 747 in 1996. All three were also controversial in that some of the recommendations associated with the accidents were the subject of ongoing debates both within and outside of the aviation safety community. There were a total of 269 recommendations that were the focus of the analysis. Of the 27 recommendations associated with the three most prominent accidents, 11 of them, 41% of the total, had at least one unacceptable NTSB categorization compared with 37 out of 242, or 15%, of those recommendations that were associated with the other 29 accidents. It is plausible that the visibility of these disproportionately contentious recommendations may have led to the kinds of aviation safety community viewpoints that were reflected in the interviews and the media reports reviewed in this study.

Risk Assessment

The NTSB safety recommendations to the FAA and the FAA responses to those recommendations represent only part of a risk management process. Of the two agencies, the FAA is more formal and direct in its use of the principles and techniques of risk

assessment in carrying out its mission. The formal correspondence between the two organizations only hinted at how the FAA used those techniques and principles to support their responses to the NTSB recommendations.

The four part risk assessment paradigm employed throughout the U.S. federal government includes stating objectives and assumptions, identifying the hazard, performing an exposure assessment, and characterizing the risk. The statements by the FAA in the formal responses to the NTSB sometimes touched on one or more of these parts of the paradigm, but not in a way that would be clear or explicit to anyone reading those statements. A clearer explanation of how risk assessment figured into the FAA responses may exist in other FAA or NTSB records that were not reviewed for this study.

Risk assessment information is not the only information that would have been relevant for forming opinions of the recommendation responses. As a regulatory agency, the FAA has to adhere to a number of laws and internal rules concerning the creation of regulations and is subject to oversight by Congress and agencies such as the Office of Management and Budget. As a result, the FAA is constrained with respect to how it may address a particular recommendation. The effect that these constraints have on the FAA's underlying assumptions and on its evaluation of what actions it may take sometimes are directly related to the disagreements with the NTSB. Because the FAA does not make such constraints clear in their responses to the NTSB, the FAA limits its opportunity to inform the general public and the aviation safety community about the context of its actions.

Responding to risks involves a combination of normative issues such as safety, the acceptability of risks, or the distribution of costs and benefits, and empirical issues

such as the measurement of risk or the evaluation of costs associated with addressing risks. Neither types of issues were addressed consistently and explicitly in the formal communications between the NTSB and FAA, although both kinds of issues were implied in the documentary and the interview data. Because the details of how these issues affected NTSB and FAA actions were beyond the scope of this study, it made the results of this study less robust than would have been the case if a more complete picture of FAA and NTSB actions and attitudes toward risk and safety were available. The implications for the members of the aviation safety community are that it is more likely that beliefs in how the safety recommendation process works have developed without the benefit of crucial information that would have allowed for a better understanding of the influences that affect the process.

Chapter 5: Conclusions and Recommendations

The first part of this last chapter summarizes and draws conclusions about the research results and the interpretations of the previous two chapters and discusses their implications for the NTSB, FAA, and the aviation safety community. The second part of this chapter provides two sets of recommendations. The first set of recommendations is for future research that could expand upon and further validate the current research effort. The second set of recommendations is for actions that the FAA and NTSB could take to provide a greater understanding of the NTSB safety recommendation process as it applies to the FAA.

Conclusions

The main research question in this study was whether there was evidence to support the notion that safety recommendations made to the FAA by the NTSB were politically motivated or influenced. An assumption in the study was that for a recommendation to have been influenced or motivated by political considerations, a necessary but not a sufficient condition was that the NTSB assigned an unacceptable categorization to the FAA response to that recommendation.

An analysis of interviews of selected aviation safety experts and a review of documents related to the NTSB safety recommendation process identified three characteristics as being associated with politically influenced recommendations. The analysis suggested that two of the characteristics, high media attention directed at the accident associated with the recommendation and high NTSB media presence associated with a recommendation, were related to an increased likelihood of a formal NTSB

disagreement. The results of the statistical analyses of these characteristics did not support a statistically significant association. Also, the statistical analysis and an analysis of other data were not sufficient to determine a model of how the characteristics were related to formal NTSB disagreements with the FAA. Specifically, it was not clear if the observed effects were due to the characteristics having caused the disagreement, if one or more other factors caused both the disagreement and the characteristics, or if the observed effects were an artifact of the study design.

An analysis of the relationship between the intent of a recommendation and unacceptable NTSB characterizations of the recommendations showed that while the distribution of recommendations with formal NTSB disagreements was related to the intent of recommendation, there was insufficient evidence in the formal communications between the FAA and NTSB to come to conclusions about either the validity of the arguments used by both sides or the effect that the disagreements had on the eventual disposition of the recommendations.

Overall, the analysis of the information reviewed for this study suggested that the presence of either of two derived political influence characteristics – a high media interest in an accident associated with a recommendation or a high NTSB media presence associated with a recommendation – is associated with an increased likelihood that the NTSB will categorize the FAA's response to the recommendation as unacceptable. While this outcome shows a relationship between higher media visibility accidents and disagreements between the NTSB and FAA, a mechanism that relates higher media visibility to NTSB political influence has not been identified in this study.

If this study had found evidence to support the belief that political influences affected the safety recommendation process, the implications for the respect given to the authority of the NTSB and its safety recommendation process would be significant. The fact that the study did not provide conclusive evidence of any such political influence showed that a belief in such influences has a weak foundation. Any belief in a politically influenced or motivated NTSB safety recommendation process must be reconciled with the results of this study. Specifically, a belief in political influence in the NTSB's safety recommendation effort is not sufficient proof for the existence of such influence. This study showed that it was possible to address this kind of issue in a systematic and rational fashion; therefore, any belief in a politically motivated or influenced NTSB safety recommendation process must withstand the kind of scrutiny demonstrated in this study, using either this study's methods or methods that are deemed to be more appropriate, before any such belief can be considered legitimate.

Another important implication is that there is a body of knowledge about risk assessment, regulatory policy, and group behavior that can be used to objectively address issues related to the perceived existence of political influence in other aviation policy contexts. While the specific issues and organizations may change, other factors such as the regulatory environment, the air transportation system, and the behavior of human beings will be largely the same. These same tests and procedures that were used in the context of the FAA and the NTSB can be used in situations where two or more organizations are dealing with technically or operationally related aviation safety issues and there is a suspicion or belief that changes are occurring for reasons that are not technically sound.

Recommendations

While this research attempted to objectively address the issue of perceived political influence and political motivation in the NTSB safety recommendation process, it was at best a first step at formally addressing this issue. Resolving this issue can be done effectively only if the NTSB and FAA make changes that would reduce the appearance of political influence or motivation and which would make it easier for outsiders to judge the quality of the process. Additional changes should be made in order to improve the quality of future evaluations of this safety recommendation process.

Recommendations to Future Researchers

- Interviews: Open-ended interviewing of the selected members of the aviation safety community was vital in identifying some of the issues that exist regarding the possibility of political influence and motivation in NTSB safety recommendations. Such interviews should be expanded to include members from organizations that are directly affected by many of the recommendations, such as airlines and aircraft manufacturers.
- Methods: Additional methods of analysis should be investigated to see if they can more effectively define and describe the perception of political influence or motivation on the part of the NTSB in their safety recommendations. Such methods may include the following:
  - ◊ Formal interviews or surveys of the aviation safety community that are based on insights gathered from open-ended interviews with selected members of the same community, and

- ◊ Reviews of an expanded range of documentary material that includes the memos, notes, or other materials that support the formal dialog between the NTSB and the FAA.

- Definitions:
  - ◊ In this study, the aviation safety community was as an informal group whose membership was spread across a number of aviation related organizations. The characteristics of involvement within the aviation safety community should be defined to the point that an individual could be judged to be either within or outside of that community based on whether that person had enough of those characteristics.
- Scope of Research:
  - ◊ The findings in this study should be updated once all major accident investigations started between 1 January 1993 and 31 December 1997 have been completed and at least 90% of all the recommendations for these accidents have reached a closed NTSB status. Waiting for the closure of all the recommendations may take several more years, and this delay may significantly reduce the benefits gained from waiting to analyze all the recommendations.
  - ◊ Future investigations into the political aspects of NTSB aviation safety recommendations should be expanded to include other time periods, and should include recommendations that came about through sources other than major accident investigations.

- ◊ The influence of prior recommendations on a particular recommendation should be considered if the prior recommendation intended to address the intent of a particular recommendation but that prior recommendation was not adopted.
- ◊ Comparative studies using a similar methodology should be conducted for other modes of transportation covered by the NTSB.
- ◊ Comparative studies should be conducted of other national organizations with a similar mission to that of the NTSB to see if similar patterns of suspected political influence exist.

Recommendations to the NTSB and FAA

- NTSB Actions:
  - ◊ Develop a categorization for the intent of a recommendation. When a recommendation is made, assign a category to the recommendation and provide an argument for that intention.
  - ◊ If probable or contributory causes are given for an accident, state whether a recommendation associated with that accident would have addressed one of those contributory or probable causes. Provide an explanation if the recommendations that were issued did not address one or more probable or contributory causes.

- ◊ For each recommendation issued as a result of an accident or incident, require that the NTSB state whether the recommendation would either prevent similar accidents or incidents, reduce the likelihood of similar accidents or incidents, or reduce the magnitude of the negative effects of similar accidents or incidents.
- ◊ For each recommendation, require a statement that provides sufficient detail so that the recommended actions are clearly understood by most of the general public. That statement should be made through a channel, such as the NTSB Web site, that is widely available to the general public and the aviation safety community. For example, recommendations for aircraft system changes should be accompanied by drawings or animation that would clearly indicate what effect the change will have on the operation of the system.
- ◊ For each recommendation, provide the results of the voting of the NTSB board members. If the voting was not unanimous, provide a synopsis of the dissenting opinions. The recommended NTSB action would result in actions that are similar in style to what happens when the U.S. Supreme Court decides on a case.

- FAA Actions:
  - ◊ If a cost benefit analysis is used as a justification to either follow or not follow an NTSB recommendation, make the results of that analysis and the assumptions of the analysis a part of the formal communications to the NTSB. This information should be included in the FAA's Web accessible database of NTSB recommendations and FAA responses.

  If specific laws passed by Congress or specific regulations of the Department of Transportation, Office of Management and Budget, or other Executive Branch agencies dictate that the FAA is unable to comply with an NTSB recommendation, require that this information be included in the official response to the NTSB.
- Joint FAA and NTSB Actions:
  - ◊ Generate a joint position paper, press release, or other official document which clearly explains the different roles that the NTSB and the FAA play in the enhancement and regulation of aviation safety. That document should explain how the creation and resolution of safety recommendations are accomplished, what factors go into the decisions regarding a recommendation, and what limitations the two agencies have with respect to the decisions that can be made.

◊ For a specific accident or set of NTSB recommendations, allow a third party to have access to the safety recommendation process on both the NTSB and FAA side in order to perform an independent audit of the safety recommendation process. This third party should observe the process and write a report on the process that will be made widely available to the public. This third party should not have any possible conflict of interest with the FAA, the NTSB, or other parties affected by that accident or set of recommendations under study.

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Appendix A: Interview Subjects and Interview Procedure

Interviewees	Date	Subjects Covered
Dave Thomas, Director, FAA Office of Accident Investigation	6 November 1997	The role of the FAA in addressing safety recommendations from the NTSB; suspected political influence in the recommendation process; the role of politics and the media in promoting aviation safety recommendations
Judy Leach, FAA Office of Accident Investigation	6 November 1997	Dual interview with Dave Thomas
Bonnie Wilson, lobbyist with Airports Council International - North America and co-chair of the Wildlife hazards Working Group	6 November 1997	NTSB use of the public policy process to pursue agenda; politically motivated and influenced actions of the NTSB with respect to safety recommendations; public and Congressional impressions of the NTSB and FAA
Jon Van Woerkem, Deputy Director of the NTSB Office of Safety Recommendations and Accomplishments	6 November 1997	NTSB safety recommendation process; political influences in accident investigations; safety recommendations to the FAA; FAA relationship with the NTSB
Jim Burnett, lawyer in private practice, former NTSB member and chair	10 February 1998	Role of the NTSB chair in promoting safety recommendations; how chairs can resist political influence on recommendations; legislative and executive branch political pressures on the NTSB
Eugene Carroll, Continental Airlines, former NTSB investigator in charge	13 May 1998	NTSB use of the media, selection of accidents for major investigations; relationship of NTSB field offices with NTSB headquarters

Interview Procedure

The interviews were open-ended in that the subjects were not limited in what parts of the topic they could discuss. The interviews with Thomas, Leach, Van Woerkem, and Wilson were conducted in person. The interviews with Burnett and Carroll were conducted by phone. In each case, the subject consented to the use of a tape recorder. The interviewer also made written notes during the interview. Each subject was provided

with the same general information and were asked to address the same issues. Specifically, during the course of the interview, each subject was provided the following information or instruction:

- A description of the intent of the research to determine if there was evidence of political influence or motivation on the part of the NTSB in the NTSB safety recommendation process,
- A request to talk about the subject's views on the role of politics in the NTSB safety recommendation process,
- A request to state what the subject considered to be a definition of political influence, and
- A request to identify accidents or safety recommendations that were influenced by politics.

Highlights of the Comments from the Six Interview Subjects

The open-ended interviews were conducted in order to better understand the aviation safety community's perception of the roles played by both the NTSB and FAA in the safety recommendation process. The information from the interviews was used to illustrate how representatives of the NTSB, FAA, and other organizations define political influence in the safety recommendation process and how politics affects the relationship between the NTSB and FAA. The interviews did not provide a consistent or coherent definition of political influence or what aspects of the safety recommendation process are affected by political influence. Nevertheless, there was general agreement that politics is

relevant to the relationship of the FAA and the NTSB when it comes to events and situations surrounding the recommendations.

The interviews provided insights into how the NTSB and the FAA leadership view each other's role in the response to both safety recommendations and issues surrounding the recommendations. It was clear from the interviews that the differences in the formal roles played by these two organizations have led to conflicts, some of them public, over how to best address some aviation safety issues. Based on the views expressed in the interviews, there were a number of distinct areas of perceived political influence in the recommendation process, including how accidents are chosen to be major investigations and how public and media attention on particular accidents affect how the NTSB and FAA respond to a recommendation. From these and other areas of perceived political influence, it was possible to define an implied set of characteristics that would constitute evidence of political influence or motivation on the part of the NTSB in the safety recommendation process. Based on an analysis of the safety recommendations, the FAA responses to the recommendations, and the NTSB responses to the FAA, it was possible to determine which recommendations possessed these implied characteristics of political influence and whether the outcomes in these recommendation responses show any indication of being influenced by these characteristics.

At the time of the interviews, three of the interviewees, Jon Van Woerkem of the NTSB, Judy Leach of the FAA, and Dave Thomas of the FAA, were directly involved in the safety recommendation process. Two others, former NTSB member and chair Jim Burnett and a former NTSB investigator had been directly involved in the safety recommendation process in the past. Van Woerkem in the NTSB Office of Safety

Recommendations and Accomplishments and both Leach and Thomas are in the FAA Office of Accident Investigation. None of them indicated that they thought the recommendations themselves were politically motivated. Thomas specifically stated that the NTSB does not use politics to choose a particular recommendation and that, in a politicized process, the FAA would reject most recommendations. He implied that, for the FAA, the key test of a recommendation is whether it is based on valid technical issues. Van Woerkem echoed this FAA sentiment in stating that the head of the NTSB, Jim Hall, is not political with respect to the accidents he is investigating. Van Woerkem stated that while there is a formal process for creating recommendations involving several levels of approval, some recommendations could be written by the appointed Board members rather than by NTSB technical staff. The former NTSB investigator supported this view by recalling that, for recommendations associated with other than major investigations, the recommendations proposed by the technical staff were usually accepted by the Board without changes.

Jim Burnett, NTSB member or NTSB chair at various times from 1981 to 1991, identified two points in the NTSB safety recommendation process where political influence may have an effect: when a particular recommendation is in development and when the NTSB is deciding how to close a recommendation. The aviation industry may exert indirect pressure on the NTSB staff but the influence on the closing of a recommendation is internally generated by the NTSB itself. He stated that the decision on closure is political in that the NTSB must use their political judgment about whether it is worth it to keep fighting on a recommendation where there is disagreement on how it

should be treated. Although he considers this a political type of judgment, it is one that is based on the work done by the NTSB staff.

The NTSB is responsible for investigating all accidents involving civil aircraft in the U.S. and only a small fraction of these investigations become the subject of a major NTSB investigation. Accidents involving multiple fatalities on airliners usually become major investigations, but some other accidents, such as those involving smaller general aviation aircraft or non-fatal jet airline accidents, do not become major investigations. While none of the interviewees offered a definitive picture of what is or is not political when it comes to the selection of an accident as a major investigation, they had varying views on what major investigations were motivated by what they considered to be political reasons. Van Woerkem of the NTSB considered the 19 April 1993 MU2B-60 accident investigation to be political in that the accident was caused by propeller related problems that had been previously identified by the NTSB. This accident caused the death of the governor of South Dakota, but Van Woerkem insisted that the governor's death did not lead to the major investigation. On the other hand, he asserted that the 18 August 1993 DC8 accident was also political in that it showed that a particular NTSB concern, flight crew fatigue, was associated with the causes of a specific accident. The former NTSB investigator stated that the 19 February 1996 gear up landing accident involving a DC9 became a major investigation in part because of a desire by NTSB leadership to increase the stature of NTSB field offices in major investigations. This was not made a major accident investigation until several months after the accident.

Several of the investigations included in this study were affected in various ways by public and media attention. The FAA interviewees argued that the 11 April 1996

accident involving a Cessna 177B became a major investigation because of such pressures, but that the resulting recommendations were not politically motivated. Although the following accidents had unprecedented media and public attention, Van Woerkem specifically excluded the fatal accidents involving TWA Flight 800 accident (17 July 1998 event involving a 747) and ValuJet (11 May 1996 event involving a DC9) from the list of politically motivated investigations. He did say that politics were a factor in TWA Flight 800 until there was no longer any suspicion of a criminal act as the cause. On the other hand, Burnett identified the fatal ValuJet accident as one that captured and held the public's and the media's interest for much longer than comparable accidents. He stated that if it were not for that kind of attention, the industry may have been able to resist changes related to aircraft cargo area fire detection and suppression, specifically the kinds of changes that were first called for in recommendations related to a 1987 incident involving a fire in flight that occurred under circumstances similar to what happened with ValuJet.

While Burnett implied that it was a legitimate tactic to use past recommendations that were not incorporated to support current recommendations and induce changes, other interviewees indicated that they thought that this was a political tactic that had negative effects on the FAA's public image. One of the interviewees, a lobbyist for an airport operator industry group who frequently deals with the FAA on regulatory matters, believed that the NTSB was an organization that would take advantage of available political opportunities and would use the public policy process coupled with the public's perception in order to drive its agenda. The lobbyist identified the tactic mentioned by Burnett, using past NTSB recommendations that were not approved and associating them

with recommendations from a more recent major accident that has the public's attention. This interviewee believed that this tactic puts political pressure on the FAA to explain why the original recommendation was not followed and makes the FAA look bad in the eyes of the public. For the recommendations related to class D cargo spaces that came about in the wake of the fatal ValuJet accident, the FAA interviewees stated an earlier class D cargo recommendation was closed in 1993 and that this did not become a highly sought after recommendation by the NTSB until after the ValuJet accident. It was listed as one of the NTSB's Most Wanted Transportation Safety Improvements in aviation about two months after the accident but prior to a new recommendation being published the following year. The FAA considered this treatment of the issue to be political in nature.

The lobbyist also said that the general relationship between the FAA and the NTSB appeared to be an antagonistic one where the NTSB had a tendency to portray the FAA in a negative light after a major accident. The FAA interviewees echoed this sentiment when they shared their view that when the NTSB presents issues associated with safety recommendations, the NTSB has a responsibility to instill confidence in the institutions that are affected by the recommendations. The interviewees felt that the NTSB has emphasized particular events and then claimed that the situation needed to be fixed, rather than responding in what the interviewees thought would be a more responsible manner.

Comments of several of the interviewees seemed to be congruent with respect to the role of the media. The FAA interviewees believed that because of the public's need for immediate gratification that is fed in part by the press, it is a political no win situation

in that the FAA looks bad no matter how it responds to the public's demands for action. These interviewees mentioned TWA Flight 800 as one such case because they claimed that the NTSB was under pressure by the press to come up with something to address the suspected causes of the accident. There was a further claim on the part of the FAA interviewees that the NTSB was pressured to make recommendations after a draft of the recommendations was leaked to the press.

Four of the interviewees made comments supporting the idea that how recommendations are promoted by the NTSB after they had been formally issued constitutes an NTSB motivation that is not based on the technical aspects of the recommendations. According to Leach and Thomas of the FAA, the NTSB does not use politics to decide on a recommendation, but the Board will use politics to coerce the aviation industry into taking action when industry leadership shows a reluctance to take action. The airports lobbyist believed that the NTSB is aware of the political costs of forcing marginal issues and looks for opportunities to push particular issues at times when it may have a higher public profile and be more acceptable politically. According to the lobbyist, the issues that the NTSB is willing to actively support are those where the NTSB can appear to point out the definitive answer that would have prevented an accident. When the NTSB does that, the lobbyist implies that the NTSB is guilty of using fear mongering and finger pointing to achieve its ends and in doing so is being political in its approach to the recommendation.

The interviewees pointed to the role of NTSB leadership in how recommendations are addressed and what is emphasized. Van Woerkem claimed that the current NTSB chair Jim Hall is good at politics and likes to be at the forefront of issues in his dealings

with the Congress and the media. Burnett's view was that Hall is reluctant to become involved in unstructured TV interviews but has been more aggressive than his recent predecessors in using the media to promote the NTSB's agenda. Dave Thomas of the FAA views Hall's attitude to be that of a politician who thinks he is not getting the full story from the FAA and the industry and, as a result, demands to have more information related to safety issues. In Thomas' mind, this was in contrast to some previous NTSB chairs who believed in the system and did not try to demand as much information from the FAA and the industry. The former NTSB investigator who was on the staff during the tenure of Jim Burnett claimed that Burnett sought media attention on behalf of the NTSB and wanted the NTSB to be seen as the organization that was taking the lead in aviation safety improvements.

Burnett declared that although the background elements that lead to a potential for political influence on the NTSB have not changed since the early 1980s, the way that an NTSB chair deals with political pressure influences how much pressure is applied. In Burnett's view, a chair who is effective at resisting industry influence will find that efforts to influence the NTSB safety initiatives will be directed elsewhere.

Protection of Human Subjects

The interviews were conducted either in person or by phone. In both cases the subjects were told the following about the purpose of the interview and how their privacy would be protected:

- The purpose of the interview was to support the interviewer's doctoral research at The Union Institute.

- The interviewer would take notes during the interview in order to record conversations and impressions.
- Any notes would remain in the personal possession of the researcher and would not be used or seen by any other person.
- If the subject consented, the interview would be recorded by a portable tape recorder and any recorded conversation would remain in the possession of the researcher and would not be heard by any other person.
- No interviewed subject would be directly quoted or otherwise identified in any subsequently published document without their consent.
- A subject could order a halt to any audio recording at any time.
- Prior to publication, any subject who was directly quoted or otherwise identifiable would be given the opportunity to review the appropriate part of the dissertation.

Appendix B: NTSB Recommendation Categories

Closed - Exceeds Recommended Action	Action on the recommendation has been completed by the addressee and surpasses what was envisioned by the Board.
Closed - Acceptable Action	Action on the recommendation has been completed by the addressee and complies with the recommendation
Closed - Acceptable Alternate Action	Addressee responds with an alternative action which meets the objectives of the recommendation.
Closed - Unacceptable Action	Addressee responds by expressing disagreement with the need outlined in the recommendation, has no further evidence to offer, and concludes that further discussion would not change their position, or the NTSB time frame goals for action are not met.
Closed - Unacceptable Action/No Response Received*	A response has not been received within 270 days of the issuance of the recommendation.
Closed - No Longer Applicable*	The recommended action has been overtaken by events.
Closed - Reconsidered	Addressee rejects the recommendation and supports the rejection and the NTSB agrees with the rationale. This status is also used when the recipient of a recommendation was in compliance before the recommendation was issued or when the recipient was incorrectly chosen and cannot perform the recommended action.
Closed - (any open status)/Superseded*	Applicable to recommendations held in any open status where a new, more appropriate safety recommendation is issued.
Open - Await Response	Recommendation issued and no substantive response from recipient.
Open - Response Received*	Response received but the staff evaluation has not yet been approved by the Board Members.
Open - Acceptable Response	Response by addressee indicates a planned action which would comply with the recommendation
Open - Acceptable Alternate Response	Response by addressee indicates an alternative plan or implementation program which would satisfy the objective of the recommendation when implemented.
Open - Unacceptable Action/Response	Addressee disagrees with the need outlined in the recommendation or attempts unsuccessfully to convince the Board than an alternate course of action is acceptable.
No Initial NTSB Status*	NTSB has not yet responded to the addressee's initial response

* Category not used or not relevant to the recommendations included in this study.

Appendix C: Characterization of Actions on NTSB Recommendations

Each recommendation in this study was analyzed in order to create a synopsis of the recommendation and the responses to that recommendation. The synopses were included into an electronic database and included the following elements:

- Written descriptions of the problem to be addressed, the recommended FAA action, and the actual FAA response, and a comment field
- Recommendation code associated with a derived category for the recommended FAA action (listed in the table below)
- NTSB identification number for the recommendation
- NTSB report number for the accident associated with the recommendation
- Yes/No variables for six characteristics
    1. Issued before the accident report
    2. Issued after the accident report
    3. Recommendation on NTSB's Most Wanted Transportation Safety Improvements list (specific issues of high interest to the NTSB)
    4. Last NTSB status designation was one of the open ones (Status designations listed in Appendix B)
    5. Last NTSB status designation was Closed - Unacceptable Action
    6. At least one status designation of Open - Unacceptable Action/Response

	Derived Recommendation Code Categories
1	Aircraft operational procedures, training, operations, limits, or management
2	Air traffic control equipment, procedures, training, management, or evaluation of the above
3	Evaluate, review, or research issues related to aircraft operations, components, materials, or human factors
4	Required installation, replacement, or retrofit of components or systems
5	Required changes in maintenance procedure, training, tests, or management
6	Provide or elicit information, advice, suggestions to regulators, aircraft operators, or crew members
7	Design requirements, certification or design review, for aircraft capability or physical design
8	FAA organizational or management activities other than ATC or FAA flight operations
9	FAA flight operations changes in equipment, procedures, training, or management
10	Verify or ensure that information is given to operators or that procedures are complied with
11	Required inspection or investigation of components or systems
12	Evaluation of equipment, maintenance, operations, or requirements of operators or repair stations
13	Required airport operational actions
14	Defining or clarifying terminology or definitions

Appendix D: Major Accidents Included in Study

Date	Aircraft	Recommendations	Report Number
31 March 1993	747-100	8	NTSB/AAR-93-06
6 April 1993	MD11	13	NTSB/AAR-93-07
14 April 1993	DC10-30	7	NTSB/AAR-94-01
19 April 1993	MU2B-60	8	NTSB/AAR-93-08
18 August 1993	DC8-61	1	NTSB/AAR-94-04
26 October 1993	King Air	15	NTSB/AAR-94-03
1 December 1993	Jetstream 31	8	NTSB/AAR-94-05
7 January 1994	Jetstream 41	7	NTSB/AAR-94-07
1 February 1994	Saab340B	3	NTSB/AAR-94-06
02 March 1994	MD82	5	NTSB/AAR-95-01
27 April 1994	PA31	4	NTSB/AAR-94-08
18 June 1994	Learjet 25D	6	NTSB/AAR-95-02
2 July 1994	DC9-30	17	NTSB/AAR-95-03
8 September 1994	737-300	18	Not yet Issued
31 October 1994	ATR72	27	NTSB/AAR-96-01
22 November 1994	MD82/Cessna	17	NTSB/AAR-95-05
13 December 1994	Jetstream 31	7	NTSB/AAR-95-07
14 December 1994	Learjet 35A	1	NTSB/AAR-95-04
16 February 1995	DC8-63	5	NTSB/AAR-95-06
8 June 1995	DC9-32	15	NTSB/AAR-96-03
21 August 1995	Brasilia	13	NTSB/AAR-96-06
12 November 1995	MD83	15	NTSB/AAR-96-05
20 December 1995	747-100	17	NTSB/AAR-96-04
6 January 1996	DC9-32	6	NTSB/AAR-96-07
19 February 1996	DC9-32	8	NTSB/AAR-97-01
11 April 1996	Cessna 177B	1	NTSB/AAR-97-02
11 May 1996	DC9-32	4	NTSB/AAR-97-06
6 July 1996	MD88	2	NTSB/AAR-98-01
17 July 1996	747-100	5	Not yet Issued
19 November 1996	Beech 1900	2	NTSB/AAR-97-04
22 December 1996	DC8-62	1	NTSB/AAR-97-05
9 January 1997	Brasilia	4	Not yet Issued

Appendix E: Major Accident Report Evaluation Procedure

This procedure is derived from the event sequence analysis techniques previously described by Yellman (1997) and Curtis (1996b).

Steps in the Accident Report Evaluation

1. Review the NTSB aircraft accident report to determine the sequence of events and actions associated with the accident.
2. List these events and actions in as great a level of detail as the material will allow.
3. Rearrange the listing so that the events are in a roughly chronological order.
4. Using one's judgment, identify those events or conditions that are relevant to the accident in that if the event did not occur, the result would have been either:
    * The accident would not have occurred (**bolded for emphasis**),
    * There would be a reduced likelihood of the accident occurring, or
    * The severity of the accident would likely have been reduced.
5. For each of those events identified in the previous step, characterize the event using the categorization described in the next section.
6. Associate each NTSB recommendation listed in the accident report with one or more of the events associated with the accident sequence of events.
7. Associate each NTSB probable or contributing cause listed in the accident report with one or more of the events associated with the accident sequence of events.

Categorization of Events in an Accident Chain

1. Action Slip: Correct intention, incorrect action. Typically an omitted item or the substitution of an incorrect action in a routine or well known procedure
   - 1.1 Distraction or preoccupation: Interruption or task overload
   - 1.2 Stress or time pressure
   - 1.3 Boredom or lack of stimulation
   - 1.4 Fatigue
   - 1.5 Ergonomics
   - 1.6 Communications
   - 1.7 Coordination
   - 1.8 Inadequate knowledge
     - 1.8.1 Inadequate training or briefing
     - 1.8.2 Training or briefing not provided
     - 1.8.3 Lack of skill or talent
     - 1.8.4 Lack of situational awareness
     - 1.8.5 Inadequate planning

2. Mistaken Intention: Correct execution of an incorrect plan due to misunderstanding or misinformation
   - 2.1 Incorrect interpretation of displays, rules, manuals, etc.
     - 2.1.1 Misleading rules, manuals, etc.
     - 2.1.2 Ergonomics of displays
   - 2.2 Communication difficulty
   - 2.3 Coordination
   - 2.4 Inadequate knowledge
     - 2.4.1 Inadequate training or briefing
     - 2.4.2 Training or briefing not provided
     - 2.4.3 Lack of skill or talent
     - 2.4.4 Lack of situational awareness
     - 2.4.5 Inadequate planning

3. Inadequate Performance
   3.1 Design failure or deficiency
      3.1.1 Single component, device, or system
      3.1.2 Combination of components, devices, or systems
   3.2 System Complexity
      3.2.1 Tight Coupling: very little time between the ability to detect an error or failure and the consequences of that error or failure
      3.2.2 Hidden Dynamics: important information about what is going on in some part of the system or what is going to be happening is hidden or becomes unavailable
      3.2.3 Common Modes: Situations where an error or failure can make a backup procedure or system unavailable or a situation where one supposedly independent action affects another
   3.3 Task Overload: characteristics - ignoring significant information, passivity, indecisiveness, use of inappropriate procedures, degradation of skills, and misdiagnosing the problem
   3.4 Lack of skill
      3.4.1 Inadequate training or experience
      3.4.2 Training not provided
      3.4.3 Inadequate supervision
      3.4.4 Lack of physical or mental capacity
   3.5 Environmental stressors: temperature, vibration, noise, sleep or rest related
   3.6 Fatigue induced by the work (as opposed to sleep loss induced fatigue)
   3.7 Sensory or perceptual problem: illusions, difficult to perceive
   3.8 Inadequate judgment
   3.8 Organizational shortcomings
      3.8.1 Procedures inadequate, ineffective, unnecessary or missing
      3.8.2 Motivation, morale, or crew coordination
      3.8.3 Inadequate training or briefing
      3.8.4 Training or briefing not provided
      3.8.5 Inadequate personnel screening and retention
      3.8.6 Inadequate operational planning

4. Violation: Either a deliberate action not in accordance with rules and recognized procedures with a positive intent or a failure to take appropriate care

4.1 Individual

4.1.1 Habitual violation due to a training, selection, or supervision problem

4.1.2 Non-habitual violation not related to training, selection, or supervision

4.2 Group: habitual general practice which may be sanctioned by supervisors and either known or not known to higher authorities

5. Defenses, Barriers, and Safeguards: Equipment, policies, procedures, designs, or organizational structures that serve to prevent, mitigate, avoid, or adapt to risks. Composed of two dimensions and 30 subcategories

A. Functions served

1. Create awareness and understanding of risks
2. Detect and warn of danger or abnormal conditions
3. Recover from danger or abnormal conditions
4. Contain problems or events
5. Provide protection or escape from out of control hazards

B. Modes of application

1. Engineered safety devices
2. Policies, standards, and controls
3. Procedures, instructions, oversight, and supervision
4. Training
5. Protective equipment
6. Organizational structures and culture

Reason for Performing This Procedure for the Accidents of Interest

This procedure has several purposes:

- Provides a brief synopsis of those events that were associated with each accident.
- Forms a foundation for categorizing preventive actions, recommendations, and probable causes for later analysis.
- Forms a framework for identifying patterns of events and preventive actions that are associated with the accidents used in the study.

Example Analysis

The following example is a 6 April 1993 accident involving a China Eastern Airlines MD11.

Event	Failure Type/Preventive Action	NTSB Reference
The accident flight was a scheduled flight between Shanghai and Los Angeles. There were 235 passengers and 20 crew members on board.		1.1, p. 2
About 20 minutes prior to the event, the four members of the relief crew assumed flight responsibilities. The captain was occupying the right seat because he was providing instruction to the first officer in the left seat.		1.1, p. 2
In order to improve aerodynamic efficiency and reduce specific fuel consumption, the MD11 is designed to operate in the cruise regime with less stability margin than some other transport category airplanes. The aircraft was intentionally designed to be flown with minimum positive or even neutral static stability. With low static stability, light control forces could produce severe flight loads.	Failure Type: 1. Design deficiency in the area of aircraft performance. The stability margin of the aircraft and the response to pilot inputs to the control made pitch upsets and pilot induced oscillations more likely. 2. Hidden dynamics - the fact that the aircraft has less stability margin is not apparent to the pilot until control forces are already producing severe flight loads. Preventive Action: **NTSB (A-93-148)** Establish high altitude stall margins for MD11 airplanes in order to limit the effects of high altitude pitch upsets. [FAA]	1.16.2; p. 30-31; 3.2, p. 56 4, p. 57 Contributed to consequence of probable cause
Due to a certification requirement, the slat input system incorporates an extend bias. Due to this bias, the handle will move aft if it is not securely held in the selected detent position on the flap/slat module.		1.6.2, p. 8
Prior to the accident, the NTSB was aware of eight events involving deployment of the slats in flight with one event due to an inadvertent slat deployment in cruise due to the first officer resting his arm on the flap/slat handle while operating	Failure Type: Design deficiency. The flap/slat system allows the deployment of slats during cruise as a result of inadvertent crew actions that are neither unusual or infrequent in the MD11 cockpit.	1.17.2, p. 33-36; 3.1, p. 54; 3.2, p. 56

Event	Failure Type/Preventive Action	NTSB Reference
the number two FMC through the number two MCDU. Douglas in an All Operators Letter advised flight crews to exercise caution to prevent movements of objects or hands from unintentionally displacing the flap/slat handle and causing a slat extension. The NTSB also concluded that the flap/slat handle system design and operation was found to be deficient.	Preventive Action: **NTSB (A-93-81)** Issue an AD requiring MD11 operators to install an interim flap/slat handle system or device to prevent the inadvertent deployment of the slats, when such a system or device becomes available. [FAA] **NTSB (A-93-82)** Issue an Air Carrier Operations Bulletin to POIs to verify that MD11 operators have advised flight crews of the potential for an inadvertent in flight slat extension if contact is made with the flap/slat handle. [FAA] **NTSB (A-93-83)** Require and expeditious installation of a redesigned flap/slat actuating system, when it becomes available for retrofit, that will prevent uncommanded and inadvertent deployment of the leading edge wing slats on MD11 airplanes. [FAA]	Probable cause
Prior to the accident flight, the flap/slat handle of the accident aircraft had been modified in accordance with all applicable manufacturer's service bulletins and FAA airworthiness directives.		1.6.1, p. 8; 1.17.3, p. 36-38
The flight crew operating manual included a note to not manipulate the flap/slat handle unless flap extension is desired.		Figure 4, p. 14
About 13 minutes prior to the event, several system faults or malfunctions occurred, including failures associated with the number two Flight Management Computer (FMC). These faults would have required a flight crew member to perform manual inputs through the number two Multifunction Control Display Unit (MCDU) keypad on the right side of the center pedestal to restore the navigation data to the number two navigation display.		1.6.5, p. 16
Shortly before the incident, meal service was completed and the cabin crew had dimmed the lights for a movie		1.1, p. 1
Placards attached to each seat in English and Chinese advised		1.15, p. 27

Event	Failure Type/Preventive Action	NTSB Reference
passengers to fasten seat belt while seated."		
CEA requires the flight attendants to make an announcement en route advising passengers to put on seat belts when the cabin lights are dimmed for a rest period.	Failure Type: Defense not effective. CEA seat belt announcement did not provide sufficient instruction or incentive to encourage more passengers to keep their seat belts on at all times in their seats Preventive Action: Require flight attendants to visually confirm that passengers have their seat belts on at the start of a rest period.	1.15, p. 27 3.2, p. 56 Contributed to accident severity
At the time of the event, the seat belt sign was not illuminated prior to the initial pitch oscillation.		1.1, p. 2; 2.6, p. 51
Prior to the event, the captain noted an optimum Mach speed indication that was below the selected Flight Management Computer (FMC) command speed indication on the right Primary Flight Display airspeed indicator. He attempted to correct the secondary indication with FMC inputs made through the number two Multifunction Control Display Unit (MCDU), but without success.		1.1, p. 2
Upon initial movement of the flap/slat handle out of the UP/RET position, the inboard slats extend. The extension cycle can be interrupted if the flap/slat handle is returned to the full forward, retract position within 2-3 seconds after initial aft movement of the handle. If the handle is repositioned after this period, the inboard slats will begin to retract while the outboard slats continue the extension cycle until the inboard slats reach a position to command the outboard slats to retract. The only indication of a slat extension in the cockpit is an annunciation on the PFD.		1.6.2, p. 8, 10; 1.17.1, p. 32; 2.2.1, p. 43
The slat system on each wing has two slats inboard and six slats outboard of the engine.		Figure 1, p. 9
The number two Multifunction Control Display Unit (MCDU) is located on the right side of the center pedestal, forward and below the flap/slat handle.		Figure 2, p. 11; Figure 5, p. 15; 1.6.5, p. 16
The NTSB concluded that an inadvertent movement of the	Failure Type: Action slip and equipment deficiency. Correct	1.17.2, p. 34

Event	Failure Type/Preventive Action	NTSB Reference
flap/slat handle initiated the slat extension cycle and that this most likely occurred during the restoration of the number two FMC through inputs into the number two Multifunction Control Display Unit (MCDU). Flight tests after the accident indicated that the handle could be dislodged either by the right seat pilot by either striking the handle on the right rear corner or by catching the handle knob with a shirt sleeve.	intention of the captain to input data into the MDCU but incorrect execution because of the inadvertent movement of the flap/slat handle. This inadvertent movement was facilitated by several factors: 1. The placement of the MCDU that allows a flight crew member's arm to be in close proximity to the flap/slat handle 2. The design of the flap/slat handle that allows deployment of the slats due to a inadvertent contact by a flight crew member. Preventive Action: **NTSB (A-93-81)** Issue an AD requiring MD11 operators to install an interim flap/slat handle system or device to prevent the inadvertent deployment of the slats, when such a system or device becomes available. [FAA] **NTSB (A-93-82)** Issue an Air Carrier Operations Bulletin to POIs to verify that MD11 operators have advised flight crews of the potential for an inadvertent in flight slat extension if contact is made with the flap/slat handle. [FAA] **NTSB (A-93-83)** Require and expeditious installation of a redesigned flap/slat actuating system, when it becomes available for retrofit, that will prevent uncommanded and inadvertent deployment of the leading edge wing slats on MD11 airplanes. [FAA]	2.2.1, p. 44; 2.3.1, p. 46; 4, p. 58-59 Consequence of probable cause
The autopilot was engaged at the time of the inadvertent slat extension.		2.3.1, p. 46
At the time the slats began to extend, the attention of the captain and most likely the first officer was directed at the MCDU keypad and the data entry process. Except for the illumination of a SLATS annunciation on the PFDs, the extension of the inboard slats would not have been noticed because the inboard slats do not significantly affect pitch attitude when the autopilot is engaged. The captain did not notice the slats were deployed until the aircraft began to	Failure Type: 1. Tight coupling. A flight crew member only has a very short period of time to recognize a slat extension and react to it before the outboard slats are committed to a full extend cycle. There are no prominent indications (pitch up, buffet, and stall warning) until it is too late to reverse the slat extend cycle. 2. Inadequate performance due to task overload. The flight crew	1.1, p. 3; 1.17.1, p. 33; 2.3.1, p. 46; 4, p. 58-59

Event	Failure Type/Preventive Action	NTSB Reference
experience buffet, the nose had begun to pitch up (at least seven seconds after the first slat disagree indication), and the stall warning system activated.	was preoccupied with the MCDU and did not notice the SLATS indication on the PFD. 3. Defense inadequate. The SLATS annunciation was not sufficient to draw the attention of the flight crew in time for the crew to prevent extension of the outboard slats. Preventive Action: Redesign the aircraft warning system and the slat extension system to provide both a more prominent warning of inadvertent slat extension during cruise and also to allow more time for the flight crew to arrest and reverse an inadvertent deployment. **NTSB (A-93-82)** Issue an Air Carrier Operations Bulletin to POIs to verify that MD11 operators have advised flight crews of the potential for an inadvertent in flight slat extension if contact is made with the flap/slat handle. [FAA]	
The captain of the relief crew had completed recurrent training about one month prior to the accident. Instruction included information regarding inadvertent or uncommanded inflight extension of the slats. The captain was instructed to act promptly and smoothly to return the flap/slat handle to the UP/SLAT RET position should the SLATS annunciation would illuminate on the captain's PFD during cruise. Douglas did not provide specific training related to high altitude upsets and stall warnings. Douglas recommended that pilots target a pitch attitude and minimize control commands, but the NTSB stated that this could conflict with a pilot's trained response to react to the stall warning. In addition, pilots were not warned about the possible	Failure Type: Defense not effective due to inadequate training. Douglas did not provide specific data, guidance, or training that would have allowed MD11 operators and their pilots to avoid overcontrol problems during high altitude upsets. The information that was provided was intended to help pilots recover from abnormal conditions, but the information was also counter to most pilot stall recovery training. Preventive Action: **NTSB (A-93-82)** Issue an Air Carrier Operations Bulletin to POIs to verify that MD11 operators have advised flight crews of the potential for an inadvertent in flight slat extension if contact is made with the flap/slat handle. [FAA]	1.17.1, p. 32; 2.3.1, p. 49; 3.2, p. 56; 4, p. 57-58 Contributing cause 1

Event	Failure Type/Preventive Action	NTSB Reference
overcontrol related pilot induced oscillations that may be encountered when they delay pitch recovery while trying to silence the stall warning.	**NTSB (A-93-143)** Require Douglas to provide data needed to upgrade MD11 simulators to accurately reflect the aircraft's longitudinal stability and control characteristics for high altitude cruise flight and to develop optimum techniques for recovery from high altitude upsets, including those accompanied by stall warnings. [FAA]	
If a pilot attempts to override the autopilot by direct control column force, the pilot will experience significant resistance. If the autopilot is disconnected while the pilot is exerting force on the control column to counter autopilot resistance, an abrupt change in the elevator position will be induced before the pilot can react to the lessening control column load. Douglas test pilots state that the typical pilot reaction to this abrupt elevator command is to overcorrect in the opposite direction and with more elevator deflection than would have been commanded by the autopilot.		1.16.2; p. 31-32
The NTSB concluded that the captain's initial reaction to counter the pitch up was to exert forward column force, and the control force at the time the autopilot disconnected resulted in an abrupt nose down elevator command. The captain's subsequent commanded elevator movements resulted in three violent pitch oscillations that resulted in the occupants experiencing severe positive and negative G-forces.	Failure Type: Action slip. The captain had the correct intention, but as a result if inadequate guidance and training, the captain did not have the information needed to avoid pilot induced oscillations. Preventive Action: **NTSB (A-93-143)** Require Douglas to provide data needed to upgrade MD11 simulators to accurately reflect the aircraft's longitudinal stability and control characteristics for high altitude cruise flight and to develop optimum techniques for recovery from high altitude upsets, including those accompanied by stall warnings. [FAA] **NTSB (A-93-144)** Require operators to provide specific training for the recovery from high altitude upsets, including those accompanied by stall warnings. [FAA] **NTSB (A-93-145)** Establish high altitude stall margins for the MD11 in order to limit the effects of high altitude pitch upsets.	1.1, p. 3-4; 2.3.2, p. 47-48; 3.2, p. 56; 4, p. 57 Consequence of probable cause

Event	Failure Type/Preventive Action	NTSB Reference
	[FAA] **NTSB (A-93-147)** Conduct a thorough review of the MD11 high altitude cruise longitudinal stability and control characteristics, stall warning margins, and stall buffet susceptibility to ensure that pilot responses to routine pitch attitude upsets do not result in hazardous pitch oscillations, structural damage, or any other condition that could lead to unsafe flight.[FAA]	
The NTSB believed that throughout the recovery sequence, the captain used more control force than was desirable or necessary because of the aircraft's low stick force characteristics and that he delayed control responses until the stall warning deactivated. The FDR data showed that the corrective elevator control responses were applied coincident with stall warning activation and deactivation. The NTSB stated that the captain responded rapidly to stall warnings with corrective elevator control, but that earlier responses and lesser control inputs would have been more effective in stabilizing pitch oscillations.		2.3.2, p. 47-48
The stall warning system was designed so that the warning cuts off one second after the point where the stall warning condition (initiation threshold angle of attack) ceases. The intent was to prevent secondary stall warnings that might be induced if the stall warning stops exactly when stall warning conditions cease. The NTSB stated that this delay seems to have caused the pilot to maintain nose down elevator commands that much longer, which tended to push the pitch oscillations that much further into the nose down regime.	Failure Type: Action slip. The captain had the correct intention, but as a result if inadequate guidance and training, the captain did not have the information needed to avoid pilot induced oscillations. Preventive Action: **NTSB (A-93-146)** Evaluate the dynamics of the MD11 stall warning system to ensure that the "on" and "off" logic are consistent with providing the pilot timely information. [FAA]	2.3.2, p. 48; 3.2, p. 56; 4, p. 57 Contributing cause 2
The CVR provided no useful information due to a failure of a capacitor on a circuit board. No similar failure had been observed in over 20,000 other CVR units. The fault detection circuit of the CVR unit was neither designed or required to detect such a failure.		1.11, p. 18 2.4, p. 50
For the accident flight, the FDR did not record valid information		1.11, p. 17

Event	Failure Type/Preventive Action	NTSB Reference
for slat position, pressure altitude, roll angle, or total air temperature due to a failure due to a malfunction of the Digital Flight Data Acquisition Unit.		1.12.2.2, p. 20
Fire blocking material under the dress covers of the passenger seat cushions had deteriorated to the point that the material no longer provided fire protection of the seat cushions.	Failure Type: N/A Preventive Action: **NTSB (A-93-148)** Require that fire blocking materials of the type identified in the accident aircraft (CEA MD11) be replaced with new materials that meet the fire retardant requirements. [FAA] **NTSB (A-93-149)** Amend the regulations to require a test on the fire retardant properties of fire blocking materials after they have been subjected to in service wear. [FAA] **NTSB (A-93-150)** Conduct research on the effects of actual in service wear on the continued airworthiness of fire blocking materials and based on these results, require in service tests to verify compliance. [FAA] **NTSB (A-93-151)** Inform other certification authorities of the findings regarding the deterioration of the fire blocking materials noted in this accident investigation with the view toward replacing them, as required. [FAA] **NTSB (A-93-152)** Direct Principal Maintenance Inspectors of the need to periodically inspect fire-blocking materials for wear and damage and to replace defective materials. [FAA]	2.7, p. 52; 4, p. 57-58

Appendix F: Recommendations Used in Study

Date	Aircraft	Report #	Recommendatio
31 March 1993	747-100	AAR-93/06	A-93-136
			A-93-137
			A-93-138
			A-93-139
			A-93-140
			A-93-141
			A-94-09
			A-94-10
6 April 1993	MD11	AAR-93/07	A-93-143
			A-93-144
			A-93-145
			A-93-146
			A-93-147
			A-93-148
			A-93-149
			A-93-150
			A-93-151
			A-93-152
			A-93-81
			A-93-82
			A-93-83
14 April 1993	DC10-30	AAR-94/01	A-94-25
			A-94-26
			A-94-27
			A-94-28
			A-94-29
			A-94-30
			A-94-31
19 April 1993	MU2B-60	AAR-93/08	A-93-153
			A-93-154
			A-93-155
			A-93-156
			A-93-157
			A-93-158
			A-93-159
			A-93-160
18 August 1993	DC8-61	AAR-94/04	A-94-107
26 October 1993	King Air	AAR-94/03	A-93-161
			A-93-162
			A-93-163
			A-93-164
			A-93-165
			A-93-167

Date	Aircraft	Report #	Recommendation
			A-93-168
			A-94-84
			A-94-85
			A-94-86
			A-94-87
			A-94-88
			A-94-89
			A-94-90
			A-94-91
1 December 1993	Jetstream 31	AAR-94/05	A-94-113
			A-94-114
			A-94-115
			A-94-116
			A-94-117
			A-94-70
			A-94-71
			A-94-72
7 January 1994	Jetstream 41	AAR-94/07	A-94-173
			A-94-174
			A-94-175
			A-94-176
			A-94-67
			A-94-68
			A-94-69
1 February 1994	Saab340B	AAR-94/06	A-94-61
			A-94-62
			A-94-63
02 March 1994	MD82	AAR-95/01	A-95-18
			A-95-19
			A-95-20
			A-95-21
			A-95-22
27 April 1994	PA31	AAR-94-08	A-94-111
			A-94-112
			A-94-211
			A-94-212
18 June 1994	Learjet 25D	AAR-95/02	A-94-186
			A-94-187
			A-94-188
			A-95-35
			A-95-36
			A-95-37
2 July 1994	DC9-30	AAR-95/03	A-94-208
			A-94-209
			A-94-210
			A-95-40

Date	Aircraft	Report #	Recommendation
			A-95-41
			A-95-42
			A-95-43
			A-95-44
			A-95-45
			A-95-46
			A-95-47
			A-95-48
			A-95-49
			A-95-50
			A-95-51
			A-95-77
			A-95-78
8 September 1994	737-300	N/A	A-95-25
			A-95-26
			A-95-27
			A-96-107
			A-96-108
			A-96-109
			A-96-110
			A-96-111
			A-96-112
			A-96-113
			A-96-114
			A-96-115
			A-96-116
			A-96-117
			A-96-118
			A-97-16
			A-97-17
			A-97-18
31 October 1994	ATR72	AAR-96/01	A-94-181
			A-94-182
			A-94-183
			A-94-184
			A-94-185
			A-96-120
			A-96-48
			A-96-49
			A-96-50
			A-96-51
			A-96-52
			A-96-53
			A-96-54
			A-96-55
			A-96-56

Date	Aircraft	Report #	Recommendation
			A-96-57
			A-96-58
			A-96-59
			A-96-60
			A-96-61
			A-96-62
			A-96-63
			A-96-64
			A-96-65
			A-96-67
			A-96-68
			A-96-69
22 November 1994	MD82/Cess	AAR-95/05	A-95-30
			A-95-31
			A-95-32
			A-95-33
			A-95-34
			A-95-86
			A-95-87
			A-95-88
			A-95-89
			A-95-90
			A-95-91
			A-95-92
			A-95-93
			A-95-94
			A-95-95
			A-95-96
			A-95-97
13 December 1994	Jetstream	AAR-95/07	A-95-100
			A-95-116
			A-95-117
			A-95-118
			A-95-119
			A-95-98
			A-95-99
14 December 1994	Learjet 35A	AAR-95/04	A-95-79
16 February 1995	DC8-63	AAR-95/06	A-95-110
			A-95-111
			A-95-112
			A-95-113
			A-95-38
			A-95-39
8 June 1995	DC9-32	AAR-96/03	A-95-71
			A-95-72
			A-95-73

Date	Aircraft	Report #	Recommendation
			A-96-78
			A-96-79
			A-96-80
			A-96-81
			A-96-82
			A-96-83
			A-96-84
			A-96-85
			A-96-86
			A-96-87
			A-96-88
			A-96-89
21 August 1995	Brasilia	AAR-96/06	A-95-81
			A-95-82
			A-95-83
			A-96-142
			A-96-143
			A-96-144
			A-96-145
			A-96-146
			A-96-147
			A-96-148
			A-96-149
			A-96-33
			A-96-34
12 November 1995	MD83	AAR-96/05	A-96-128
			A-96-129
			A-96-130
			A-96-131
			A-96-132
			A-96-133
			A-96-134
			A-96-135
			A-96-136
			A-96-137
			A-96-138
			A-96-139
			A-96-140
20 December 1995	747-100	AAR-96/04	A-96-150
			A-96-151
			A-96-152
			A-96-153
			A-96-154
			A-96-155
			A-96-156
			A-96-157

Date	Aircraft	Report #	Recommendation
			A-96-158
			A-96-159
			A-96-161
			A-96-162
			A-96-163
			A-96-164
			A-96-45
			A-96-46
			A-96-47
6 January 1996	DC9-32	AAR-96/07	A-96-166
			A-96-167
			A-96-168
			A-96-169
			A-96-170
			A-96-171
19 February 1996	DC9-32	AAR-97/01	A-97-03
			A-97-04
			A-97-05
			A-97-06
			A-97-07
			A-97-08
			A-97-09
			A-97-10
11 April 1996	Cessna 177B	AAR-97/02	A-97-21
11 May 1996	DC9-32	AAR-97/06	A-96-25
			A-96-26
			A-96-27
			A-96-28
6 July 1996	MD88	AAR-98/01	A-96-76
			A-96-77
17 July 1996	747-100	N/A	A-96-174
			A-96-175
			A-96-176
			A-96-177
			A-97-11
19 November 1996	Beech 1900	AAR-97/04	A-97-01
			A-97-36
22 December 1996	DC8-62	AAR-97/05	A-97-48
9 January 1997	Brasilia	N/A	A-97-31
			A-97-32
			A-97-33
			A-97-34

Appendix G: Recommendations with One or More Unacceptable NTSB Recommendation Categories

Date	Aircraft	Report #	Recommendation
31 March 1993	747-100	AAR-93/06	A-93-136
			A-93-137
			A-93-139
14 April 1993	DC10-30	AAR-94/01	A-94-26
			A-94-27
			A-94-28
26 October 1993	King Air	AAR-94/03	A-94-89
1 December 1993	Jetstream 31	AAR-94/05	A-94-115
			A-94-116
			A-94-117
7 January 1994	Jetstream 41	AAR-94/07	A-94-67
			A-94-69
02 March 1994	MD82	AAR-95/01	A-95-18
			A-95-19
			A-95-20
			A-95-21
			A-95-22
2 July 1994	DC9-30	AAR-95/03	A-95-40
			A-95-41
			A-95-48
			A-95-51
8 September 1994	737-300	N/A	A-95-25
			A-95-26
			A-95-27
			A-96-107
			A-96-109
			A-96-111
			A-96-112
			A-96-113
			A-96-118
			A-97-18
31 October 1994	ATR72	AAR-96/01	A-96-49
			A-96-63
			A-96-64
22 November 1994	MD82/Cess	AAR-95/05	A-95-92
			A-95-97
13 December 1994	Jetstream	AAR-95/07	A-95-116
16 February 1995	DC8-63	AAR-95/06	A-95-110
			A-95-112
8 June 1995	DC9-32	AAR-96/03	A-96-86
			A-96-87
20 December 1995	747-100	AAR-96/04	A-96-153
			A-96-155

Date	Aircraft	Report #	Recommendation
6 January 1996	DC9-32	AAR-96/07	A-96-170
19 February 1996	DC9-32	AAR-97/01	A-97-05
17 July 1996	747-100	N/A	A-96-175
			A-96-176
19 November 1996	Beech 1900	AAR-97/04	A-97-36

Appendix H: Recommendations with Political Influence Characteristics

The following three characteristic were identified by the interviewees in this study as being associated with politically influenced recommendations:

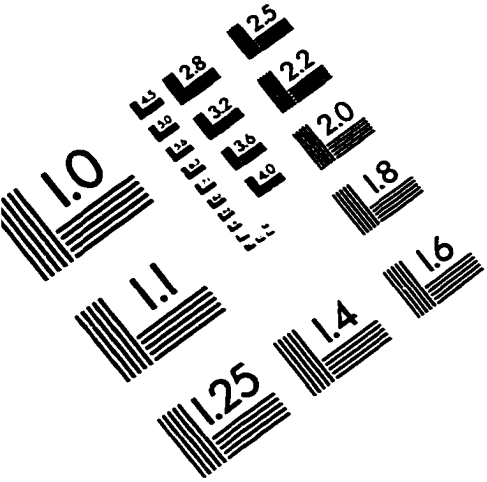
1. The selection of accidents for major investigations
2. The presence of high media interest in an accident
3. A high NTSB media presence associated with a recommendation (including placement on the NTSB's Most Wanted Transportation Safety Improvements list.

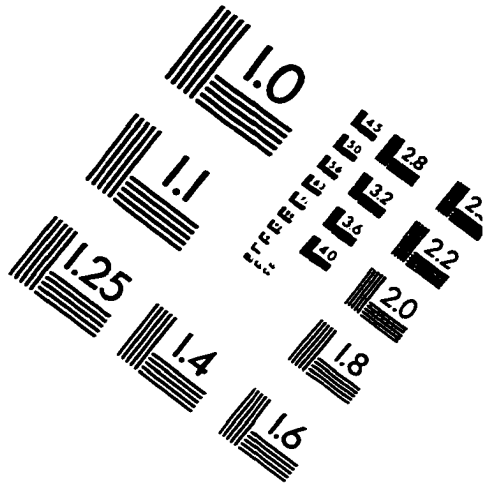
The following chart indicates which recommendation was associated with one of the three characteristics and whether the NTSB had at least one unacceptable status associated with the recommendation. The recommendations are identified by date of the accident, NTSB report number, and NTSB recommendation number.

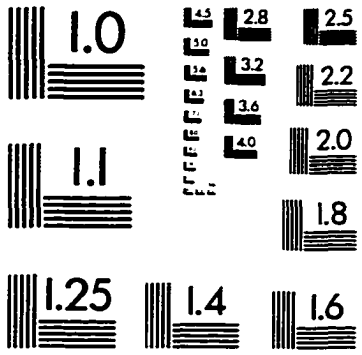
Date	Report #	Recommendation	Characteristic	Conflict
8 September 1994	AAR-98/g	A-95-25	2, 3	Yes
		A-95-26	2, 3	Yes
		A-95-27	2, 3	Yes
		A-96-107	2, 3	Yes
		A-96-108	2, 3	No
		A-96-109	2, 3	Yes
		A-96-110	2, 3	No
		A-96-111	2, 3	Yes
		A-96-112	2, 3	Yes
		A-96-113	2, 3	Yes
		A-96-114	2, 3	No
		A-96-115	2, 3	No
		A-96-116	2, 3	No
		A-96-117	2, 3	No
		A-96-118	2, 3	Yes
		A-97-16	2, 3	No
		A-97-17	2, 3	No
		A-97-18	2, 3	Yes
31 October 1994	AAR-96/01	A-94-181	2, 3	No
		A-94-182	2, 3	No
		A-94-183	2, 3	No
		A-94-184	2, 3	No
		A-94-185	2, 3	No
		A-96-120	2	No
		A-96-48	2	No
		A-96-49	2	Yes
		A-96-50	2	No

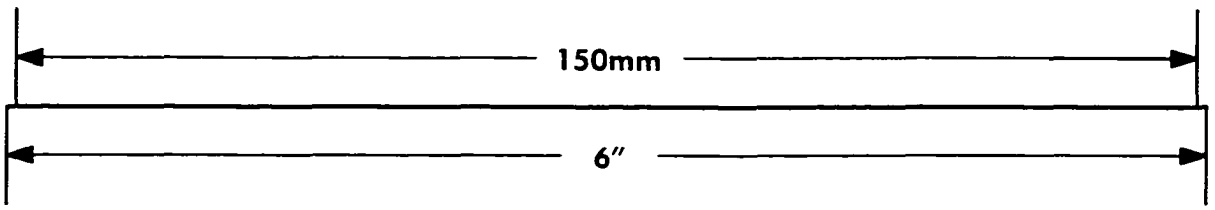
Date	Report #	Recommendation	Conflict	Conflict
		A-96-51	2, 3	No
		A-96-52	2, 3	No
		A-96-53	2, 3	No
		A-96-54	2, 3	No
		A-96-55	2, 3	No
		A-96-56	2, 3	No
		A-96-57	2	No
		A-96-58	2, 3	No
		A-96-59	2	No
		A-96-60	2, 3	No
		A-96-61	2, 3	No
		A-96-62	2	No
		A-96-63	2	Yes
		A-96-64	2	Yes
		A-96-65	2	No
		A-96-67	2	No
		A-96-68	2, 3	No
		A-96-69	2, 3	No
16 February 1995	AAR-95/06	A-95-113	3	No
19 February 1996	AAR-97/01	A-97-03	1	No
		A-97-04	1	No
		A-97-05	1	Yes
		A-97-06	1	No
		A-97-07	1	No
		A-97-08	1	No
		A-97-09	1	No
		A-97-10	1	No
11 April 1996	AAR-97/02	A-97-21	1	No
11 May 1996	AAR-97/06	A-96-25	2	No
		A-96-26	2, 3	No
		A-96-27	2, 3	No
		A-96-28	2, 3	No
17 July 1996	AAR-98/c	A-96-174	2, 3	No
		A-96-175	2, 3	Yes
		A-96-176	2, 3	Yes
		A-96-177	2, 3	No
		A-97-11	2	No

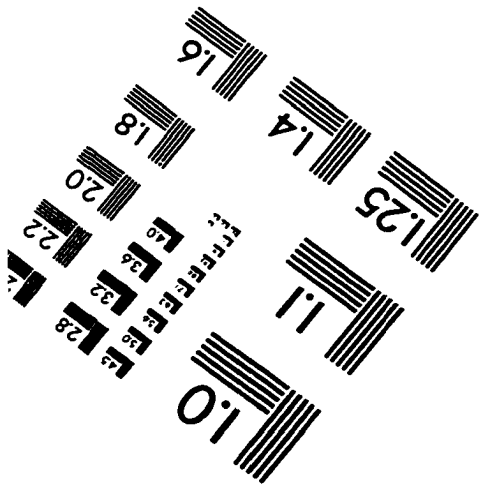
IMAGE EVALUATION TEST TARGET (QA-3)

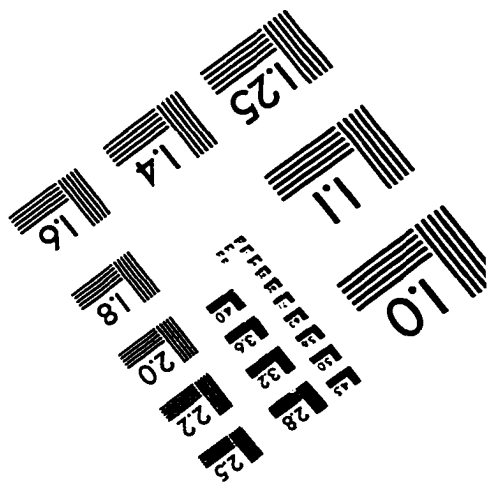












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