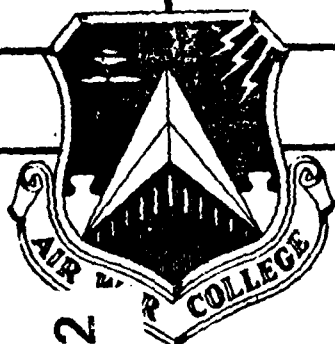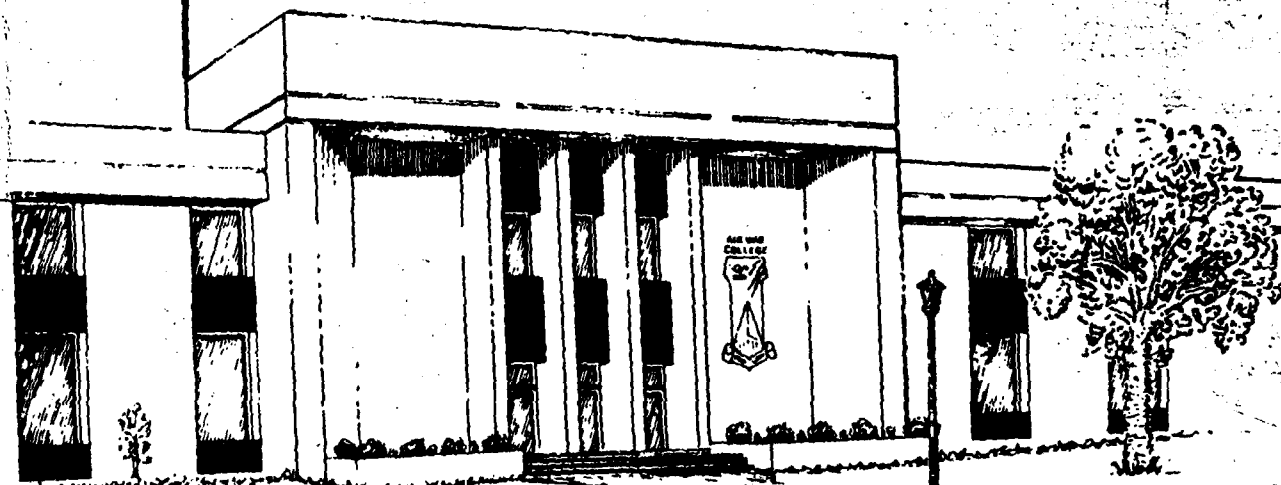④

# AIR WAR COLLEGE

## RESEARCH REPORT

A CASE STUDY OF SMALL GROUP DECISION-MAKING AS
INFLUENCED BY THE ABILENE PARADOX:
THE "CHALLENGER" MISHAP

COMMANDER JAMES Y. GASKINS

1988

AIR UNIVERSITY
UNITED STATES AIR FORCE
MAXWELL AIR FORCE BASE, ALABAMA

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by

James Y. Gaskins
Commander, USN

A RESEARCH REPORT SUBMITTED TO THE FACULTY
IN
FULFILLMENT OF THE RESEARCH
REQUIREMENT

Research Advisor: Dr. Bart Michelson

MAXWELL AIR FORCE BASE, ALABAMA
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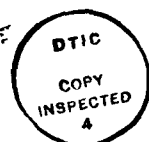
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## ABSTRACT

On 27 January 1986 a group of decision-makers
representing the public and private sectors of leadership in
our national space exploration program evaluated the risk
associated with known discrepancies in solid rocket motor
seals. The risk assessment that was made led the group to
agree that the discrepancies were within an acceptable margin
of safety and authorized the launch of the Space Shuttle
"Challenger".

Two phenomena which describe flawed decision-making
processes, groupthink and the Abilene Paradox, provide a
framework for a study of the agreements which culminated in
the launch of "Challenger". Analysis of the pitfalls of the
decision-making process reveals various phenomena. One of
them is known as groupthink or, e.g., a mode of thinking
that people engage in when they are deeply involved in
cohesive in-groups. They exhibit the desire...for unanimity
which overrides their motivation to realistically appraise
alternative courses of action. Another pitfall in the
decision-making process is described in the Abilene Paradox.
It is described as a phenomenon which occurs when
decision-making groups take actions in contradiction to
available information when dealing with problems. The
mismanagement of agreement is central to the issue of
understanding dysfunctional organizational behavior.

BIOGRAPHICAL SKETCH

Commander James Y. Gaskins (BA, Elon College, North Carolina) has been involved in the decision-making process in small groups throughout his Naval career. His assignments include Search and Rescue pilot at Naval Air Station, Kingsville, Texas; fleet pilot operating the US Navy's Light Airborne Multipurpose System (LAMPS) helicopters embarked in frigates and operating in the Atlantic Ocean, Mediterranean Sea, and Persian Gulf theaters. Commander Gaskins is a graduate of the Air War College, class of 1988 and will hold a Master of Science in Personnel Management from Troy State University.

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CHAPTER I

INTRODUCTION

## BACKGROUND, PURPOSE, AND RESEARCH QUESTIONS

Orientation    The decision-making process of small executive groups is frequently flawed and therefore prone to produce less than optimal results. The phenomena known as groupthink, described by Irving L. Janis, and the Abilene Paradox, described by Jerry B. Harvey, provide the framework for this research. These two phenomena outline the dilemma that has beset many small but influential decision-making bodies with catastrophic results, e.g., the loss of the Space Shuttle "Challenger." Review of the phenomena and supporting documentation indicates that lessons learned from these studies can be adapted and employed by similar decision-making groups.

How do the phenomena groupthink and the Abilene Paradox influence the process of decision-making in small groups? In order to answer the basic research question, the dynamics of groupthink, the dynamics of the Abilene Paradox, and their cumulative effects on small group decision-making will be presented.

The purpose of this study is to research the effects that the Abilene Paradox has on small group decision-making in order to reveal symptoms of defective decision-making. Preventive actions to deter the phenomena of the Abilene

Paradox and techniques to cope with the dilemma of mismanaged agreement will also be presented.

In 1972, Irving L. Janis published Victims of Groupthink, an analysis of decision-making fiascoes in foreign policy. Included are decisions by Admiral Kimmel's advisory group that was involved with the failure to improve defenses at Pearl Harbor prior to 7 December 1941, Kennedy's advisory group that supported the Bay of Pigs invasion, the Truman advisory group that concluded that North Korea could be invaded without involving China in the Korean War, and the Johnson "Tuesday Lunch Group" that supported escalating bombing of North Vietnam as a means of getting the United States out of the Vietnam War. (25:i-vi) A 1982 revision of Groupthink further develops the thesis and details the Nixon advisory group and its decision to cover up the Watergate breakin. (23:vii-x)

Janis defines groupthink as "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group. Their desire...for unanimity overrides their motivation to realistically appraise alternative courses of action." (23:9) Groupthink, a destructive variable in the group decision-making process, has symptoms which can be identified by three main types: 1. overestimations of the group--its power and morality, 2. close mindedness, and 3. pressure toward uniformity.

These types will be further defined to present a basis for Harvey's Abilene Paradox. (23:174-175)

Harvey defines the Abilene Paradox as a phenomenon which occurs when decision-making groups take actions in contradiction to the information they have when dealing with problems, thus compounding rather than solving them. He argues that the mismanagement of agreement, not the inability to manage conflict, is the "single most pressing issue of modern organizations." (17:67) The Abilene Paradox is most liable to emerge in strong, hierarchical organizations. While many organizations, especially those in high technological research and development, must address the management of conflict due to "excessive" communication among factions, the military represents an institution where obedience is paramount and dissent is often viewed as disloyal. In such cases, the route to Abilene is wide, direct, and downhill. (51:3)

Five psychological concepts used to explain the Abilene Paradox are action anxiety, negative fantasies, real risk, separation anxiety, and the psychological reversal of risk and certainty. (17:70) The ultimate result is a mismanagement of agreement within the group, rendering defeat for stated goals and compounding problems in lieu of developing solutions. Harvey offers a diagnostic survey for detecting the onset of the Abilene Paradox, along with strategies for confrontation and communication to alleviate

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counterproductive decision-making. Timely identification of the symptoms of defective decision-making would permit constructive intervention and allow for more effective management of agreement.

ORGANIZATION OF STUDY

Chapter Two reviews related literature, and the author describes the dynamics of groupthink as a foundation for the Abilene Paradox. The dynamics of the Abilene Paradox is presented as a case study of the decision-making techniques which led to the ill-fated launch of the United States Space Shuttle "Challenger".

Chapter Three employs a case study to demonstrate an application of the Abilene Paradox. This case study of the decision-making process that evolved during the prelaunch phase of the United States Space Shuttle "Challenger" will present a vivid example of the Abilene Paradox.

Chapter Four contains the findings of the author's literary research and case study. These findings substantiate the thesis that the dilemma presented by the Abilene Paradox can be identified and dealt with effectively.

Chapter Five summarizes the symptoms of mismanaged agreement and recommends preventive measures that are available to members and leaders of decision-making bodies. The author presents alternatives to counterproductive decision-making.

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Chapter Six presents a summary of the original problem, i.e., adverse influences on small group decision-making. In conclusion, a brief restatement of findings and recommendations for further study is provided.

# CHAPTER II

## REVIEW OF RELATED LITERATURE

### GROUPTHINK

Irving L. Janis' Victims of Groupthink, an analysis of decision-making fiascoes in foreign policy, defines "groupthink" as a psychological drive for consensus at any cost. It is a drive which suppresses dissent and appraisal of alternatives in cohesive decision-making groups. His theory is based on the assumption that "the chances for successful outcomes resulting from decisions reached by poor decision-making procedures are very low." (39:431) Janis' conclusions are based on an historical analysis of the decision-making activities of governmental policy-making groups that produced either major calamities or remarkable accomplishments. His conclusions represent a major departure from conventional concepts of performance that are expected of highly cohesive groups. (39:430)

The case studies that Janis provides include the fateful decisions of the advisory group that led Admiral Kimmel to the decision that increased conditions of readiness immediately prior to the infamous surprise attack on Pearl Harbor on 7 December 1941 were not warranted; the inner-workings of the Presidential advisory group that supported President Kennedy's decision to proceed with the ill-fated Bay of Pigs Invasion; the Truman advisory group

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that perceived that North Korea could be invaded without risk of the Chinese being drawn into the Korean War; and the "Tuesday Lunch Group" that advised President Johnson that the increased bombing of North Vietnam would break the ties that bound the United States to the Vietnam Conflict. Studies of the development of the Marshall Plan and the handling of the Cuban missile crisis are presented as examples of effective group decision-making. Groupthink, published in 1982, further details the events that affected the Nixon advisory group which ultimately designed and executed the cover-up of the Watergate break-in. (23:viii; 25:iv)

One common characteristic of all of these groups was their vulnerability to groupthink. Janis defines groupthink as "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group. Their desire...for unanimity overrides their motivation to realistically appraise alternative courses of action." (23:9)

> The occurrence of groupthink is dependent on situational factors and structural features of the group. The primary condition necessary for groupthink is a highly cohesive group. Secondary conditions conducive to groupthink are the insulation of the group from outsiders (often for security reasons) and the presence of an active leader promoting his or her own preferred solution. (39:432)

In addition to high levels of cohesiveness in a group, Janis claims that when the leader of such a group promotes his or her own preferred solution, "the greater are the chances of a

consensus based on groupthink, even when the leader does not want the members to be yes-men...."(25:197)

Groupthink has eight main symptoms and one or more of these is usually present when a group makes a faulty decision. The eight main symptoms within their classification types are grouped as follows:

TYPE I: Overestimation of the Group

...the members of the group believe that their group is "special"...that they have the magic touch that makes them invulnerable--whatever they do, whether very risky or very conservative, will succeed. (26:190)

1. <u>An illusion of invulnerability</u>. When shared by most or all of the group members, it creates excessive optimism and encourages risk-taking. At times of threat the fear of failure is salient, and members are likely to take a "why worry" attitude.
2. <u>Belief in the inherent morality of the group</u>. As a result of this belief, the group members are prone to ignore the ethical and moral consequences of their decisions. Members feel that any means they choose to solve their problem is just. This shared assumption helps the members avoid any feelings of shame or guilt that might violate their personal ethical codes.

TYPE II: Close Mindedness

...shared rationalizations are frequently used to dismiss warning signs of the dangers...they take the form of stereotyped views of the opponents as too weak or too stupid to be a strong threat. (26:191)

3. <u>Collective rationalization</u>. This is done in order to discount warnings that might lead the members of the group to reconsider their assumptions before they make a decision.
4. <u>Negative stereotypes of out-groups</u>. Any competing or out-groups are viewed as too stupid or too evil to

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warrant genuine attempts to negotiate with these groups. Stereotypes that picture these out-groups as evil are used to enhance the moral righteousness as well as pride in the mission of the group; stereotypes that picture out-groups as weak are employed to alleviate all fears of being defeated.

TYPE III: Pressures Toward Uniformity

...self-imposed censorship within the group to ward off challenges to the assumption and beliefs supporting the first two symptoms. (26:191)

5. Direct pressures on dissenting members to conform. Any member who expresses arguments against the group's consensus is made aware that such dissent is contrary to what is expected of all group members.
6. Self-censorship. Group members censor themselves from deviations in the group's consensus, reflecting each member's inclination to minimize to himself the importance of his doubts and counterarguments.
7. Illusion of unaniminity. Unaniminity is seen as an illusion because group members are under the false assumption that silence implies consent. This reliance on consensual validation tends to replace individual critical thinking and reality-testing, unless there are clear-cut disagreements among the members.
8. Self-appointed mindguards. These are members who protect the group from any contrary information that might alter a member's belief about the effectiveness and morality of the group's decisions. This often takes the form of urging the dissident member to remain silent if he cannot match his own beliefs with those of the rest of the group. (23:174-175; 38:14-16)

Similarly, most of the symptoms of groupthink will be accompanied by symptoms of defective decision-making. They include:

1. failure to examine any alternative courses of action.

2. an incomplete survey of objectives.

3. a failure to examine the risks of possible choices.

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4.  a failure to reappraise initially rejected alternatives.

5.  poor information search; the group does not seek out additional information that might yield a revision of its decision.

6.  a selective bias in processing information.

7.  failure to work out contingency plans in case the original solution fails. (23:175; 38:16)

Janis' groupthink hypothesis is predicated on the idea that groupthink can only occur in highly cohesive groups. Additional antecedent conditions that make groupthink more likely to occur include insulation of the group, a lack of impartial leadership, and the absence of norms requiring methodical procedures for dealing with the decision-making process. (23:176) The working idea is that groupthink will probably not occur, even in highly cohesive groups, unless one or more of the antecedent conditions exist.

Conversely, two effective decision-making groups exhibit unique indicators that are seen as being correctives to groupthink. These groups include the Executive Committee of the National Security Council (NSC) during the Cuban Missile Crisis, and the Kennan Policy Planning Staff who devised the Marshal Plan to reconstruct Europe after World War II. Janis describes the correctives to groupthink that were employed by the NSC and Kennan's group. These corrective actions are valid today.

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They include:

1. The designation of each member as a critical evaluator.

2. The assurance of the leader that impartiality is desired instead of initially stating preferences and expectations.

3. The establishment of an independent policy-planning and valuation working group with separate leaders.

4. The establishment of two or more decision-making groups with separate leaders.

5. The solicitation of insights from outside of the group to guard against complacency.

6. The invitation of qualified experts outside the group to challenge any sense of complacency regarding risky decisions.

7. The assignment of at least one devil's advocate within the group.

8. The establishment of realistic contingency plans to guard against illusions of invulnerability and complacency.

9. The scheduling of one additional meeting upon reaching a consensus to allow each member to play the role of devil's advocate. (23:262-271) (See Appendix A)

Researchers have noted that some of the symptoms of groupthink--such as belief in the inherent morality of the group, evidence of self-censorship, and the illusion of unaniminity--often operate at a covert level and are, therefore, difficult to detect. (10:890) An understanding of

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Janis' hypothesis of groupthink is essential to comprehend the dilemma presented by Jerry B. Harvey in "The Abilene Paradox".

## THE ABILENE PARADOX

In 1974, Jerry B. Harvey published "The Abilene Paradox" (17:63-80), which is defined as a phenomenon that occurs when organizations take actions in contradiction to the data they have for dealing with problems, thus compounding rather than solving their problems or failing to achieve the very goals or purposes for which they exist. A major corollary of the paradox is that "the inability to manage agreement is a major source of organizational dysfunction." (17:66) Three examples of the paradox are presented, and five psychological concepts are used to explain the paradox's logic: Action Anxiety, Negative Fantasies, Real Risk, Separation Anxiety, and the Psychological Reversal of Risk and Certainty. The use of direct confrontation is recommended as a means to cope with the paradox. The inability to manage agreement is viewed as a major source of organizational dysfunction. The reality-confrontation necessary to cope with the effects of the paradox is viewed as an imperative to successful organizational decision-making. (17:66)

The Abilene Paradox is presented in the form of a story about Dr. Harvey's family outing to Abilene.

The July afternoon in Coleman, Texas (population 5,607) was particularly hot--104 degrees as measured by the Walgreen's Rexal Ex-Lax temperature gauge. In

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addition, the wind was blowing fine-grained West Texas topsoil through the house. But the afternoon was still tolerable--even potentially enjoyable. There was a fan going on the back porch; there was cold lemonade; and finally, there was entertainment. Dominoes. Perfect for the conditions. The game required little more physical exertion than an occasional mumbled comment, "Shuffle 'em," and an unhurried movement of the arm to place the spots in the appropriate perspective on the table. All in all, it had the makings of an agreeable Sunday afternoon in Coleman--that is it was until my father-in-law suddenly said, "Let's get in the car and go to Abilene and have dinner at the cafeteria."

I thought, "What, go to Abilene? Fifty-three miles? In this dust storm and heat? And in an unairconditioned 1958 Buick?"

But my wife chimed in with, "Sounds like a great idea. I'd like to go. How about you?" Since my own preferences were obviously out of step with the rest I replied, "Sounds good to me," and added, "I just hope your mother wants to go."

"Of course I want to go," said my mother-in-law. "I haven't been to Abilene in a long time."

So into the car and off to Abilene we went. My predictions were fulfilled. The heat was brutal. We were coated with a fine layer of dust that was cemented with perspiration by the time we arrived. The food at the cafeteria provided first-rate testimonial material for antacid commercials.

Some four hours and 106 miles later we returned to Coleman, hot and exhausted. We sat in front of the fan for a long time in silence. Then, both to be sociable and to break the silence, I said, "It was a great trip, wasn't it?"

No one spoke.

Finally my mother-in-law said, with some irritation, "Well, to tell the truth, I really didn't enjoy it much and would rather have stayed here. I just went along because the three of you were so enthusiastic about going. I wouldn't have gone if you all hadn't pressured me into it."

I couldn't believe it. "What do you mean 'you all'?" I said "Don't put me in the 'you all' group. I was delighted to be doing what we were doing. I didn't want to go. I only went to satisfy the rest of you. You're the culprits."

My wife looked shocked. "Don't call me a culprit. You and Daddy and Mama were the ones who wanted to go. I just went along to be sociable and to keep you happy. I would have had to be crazy to want to go out in heat like that."

Her father entered the conversation abruptly. "Hell!" he said.

He proceeded to expand on what was already absolutely clear. "Listen, I never wanted to go to Abilene. I just thought you might be bored. You visit so seldom I wanted to be sure you enjoyed it. I would have preferred to play another game of dominoes and eat the leftovers in the icebox."

After the outburst of recrimination we all sat back in silence. Here we were, four reasonably sensible people who, of our own volition, had just taken a 106-mile trip across a godforsaken desert in a furnace-like temperature through a cloud-like dust storm to eat unpalatable food at a hole-in-the-wall cafeteria in Abilene, where none of us had really wanted to go. In fact, to be more accurate, we'd done just the opposite of what we wanted to do. The whole situation simply didn't make sense. (17:63-65)

## Symptoms of the Paradox

"The inability to manage agreement, not the inability to manage conflict, is the essential symptom that defines organizations caught in the web of the Abilene Paradox." (17:66) Six subsystems are identified as indicators of groups that exhibit the inability to manage agreement:

1. Organization members agree privately as to the nature of the situation or problem facing the organization. For example, members of the Abilene group agreed that they were enjoying themselves sitting in front of the fan, sipping lemonade, and playing dominoes.

2. Organization members agree as individuals to the steps that would be required to cope with the situation or problem they face. For members of the Abilene group, "more of the same" was a solution that would have adequately satisfied their individual and collective desires.

3. Organization members fail to accurately communicate their desires and/or beliefs to one another. In fact they do just the opposite and thereby lead one another into misperceiving the collective reality. Each member of the Abilene group, for example, communicated inaccurate data to other members of the organization. The data, in effect, said, "Yeah, it's a great idea. Let's go to Abilene," when

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in reality, members of the organization individually
and collectively preferred to stay in Coleman.

4. With such invalid and inaccurate information,
organization members make collective decisions that
lead them to take actions contrary to what they want to
do, and thereby arrive at results that are
counterproductive to the organization's intent and
purposes. Thus, the group went to Abilene when
it preferred to do something else.

5. As a result of taking actions that are
counterproductive, organization members experience
frustration, anger, irritation, and dissatisfaction
with their organization. Consequently, they form
subgroups with trusted acquaintances and blame other
subgroups for the organization's dilemma. Frequently,
they also blame authority figures and one another.

6. If organization members do not deal with the
generic issue--the inability to manage agreement--the
cycle repeats itself with greater intensity. (17:66-67)

## Analyzing the Paradox

Paradoxes are interpreted as being what they are because

they are "based on a different logic or rationale from what

we understand or expect." (17:69) An analysis of that logic

can disrupt the paradoxical characteristics of certain

actions and provide alternative means of managing similar

scenarios. A part of the dilemma that plagued the Abilene

travelers was the lack of a good road map or model to

provide "rationality to the paradox." (17:70) Harvey's road

map provides the following landmarks to assist organizations

in managing agreement: (1) Action Anxiety; (2) Negative

Fantasies; (3) Real Risk; (4) Separation Anxiety; and the

Psychological Reversal of Risk and Certainty. (17:70)

1. Action Anxiety says that the reason organization

members take actions in contradiction to their understanding

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of the organization's problems lies in the intense anxiety that is created as they think about acting in accordance with what they believe needs to be done. They opt to endure professional or economic degradation rather than act in a manner consistent with what they know needs to be done. (17:70)

2. Negative Fantasies identify what greater evil awaits if one were to fail to follow along with a certain group action. Negative fantasies reinforce action anxiety and provide individuals with excuses that release them from responsibility for having to act to solve organizational problems. (17:71)

3. Real Risk is a fact of life and one's unwillingness to accept it as one of life's givens may force him to "opt to take the organization to Abilene rather than run the risk, no matter how small, of ending up somewhere worse."(17:72)

4. Fear of Separation is manifested in the Abilene Paradox as the fear of the known. Separation, alienation, and loneliness are known fears that are conjured up as a punishment for not going along. "Ostracism is one of the most powerful punishments that can be devised." (17:72)

5. The Psychological Reversal of Risk and Certainty is a paradox within a paradox. One frequently fails to take action in an organizational setting because one fears that the actions one takes may result in separation from others, e.g., being labeled disloyal or a non-team player. One's

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unwillingness to take the risk of doing what ought to be done and thereby virtually ensuring a speedy trip to Abilene and consequently the separation and aloneness so feared...transforms what is a probability statement into what, for all practical purposes, becomes a certainty. (17:72)

### A Possible Abilene Bypass

"Existential risk is inherent in living, so it is impossible to provide a map that meets the no-risk criterion, but it may be possible to describe the route in terms that make the landmarks understandable and that will clarify the risks involved." (17:73)

1. An understanding of the relationship between the victim and victimizer must be understood. Behavior which is characterized by "blaming and fault-finding is one of the basic symptoms of organizations that have found their way to Abilene...."(17:73) "Once a business or government fails to manage its agreement and arrives in Abilene, all its members are victims." (17:73) Arguments and accusations at best become merely symptoms of the paradox and the assignment of victims and victimizers, at worst, drains energy from problem-solving efforts to get out of Abilene.

2. Collusion infers that "human problems of the organization are reciprocal in nature." (17:73) That is, you cannot have an autocratic boss unless subordinates are willing to collude with his autocracy. Conversely, you cannot

have "don't rock the boat" subordinates unless the boss is willing to collude with their "don't rock the boat" attitudes. "Each person in a self-defeating, Abilene-bound organization colludes with others, including peers, superiors, and subordinates, sometimes consciously and sometimes subconsciously, to create the dilemma in which the organization finds itself." (17:73)

3. Responsibility for initiating the problem-solving action rests with the members of the organization itself. The power to destroy the influence of the paradox comes from confronting and speaking to the underlying reality of the situation, and not from one's position within the organization. Any member who chooses to risk confronting the reality that the group is having a problem has the power to release the group from the influence of the paradox. (17:74)

4. The concept of reality and its relationship to knowledge precipitates the notion of confrontation as the process of facing issues directly. The dynamics of the paradox indicate that members know more about issues confronting the organization than they do not know. "Confrontation becomes the process of facing issues squarely, openly and directly, in an effort to discover whether the nature of the underlying collective reality is agreement or conflict." (17:74) Change within the organization "may be facilitated as much by confronting the organization with what

it knows and agrees upon as by confronting it with what it doesn't know or disagrees about."(17:75)

### Real Conflict and Phony Conflict

"Real conflict occurs when people have real differences. Phony conflict, on the other hand, occurs when people agree on the actions they want to take, and then do the opposite. Resultant anger, frustration, and blaming behavior generally termed 'conflict' are not based on real differences. They stem from the protective reactions that occur when a decision that no one believed in or was committed to in the first place goes sour." (17:75) Real conflict exists in organizations, i.e., people of good will and good judgement do disagree on key issues. Phoney conflict, i.e., the blaming behavior which occurs after agreement has been mismanaged, can lead a good group to Abilene.

### Group Tyranny and Conformity

Group tyranny and the resultant individual conformity generally refers to the coercive effect of group pressures on the individual. This phenomenon is referred to as groupthink. An analysis of the dynamics of the Abilene Paradox explores the possibility that individuals perceive that they are experiencing the coercive forces of the organization to conform, when actually they are responding to the dynamics of mismanaged agreement. (17:75)

# CHAPTER III

## CASE STUDY OF THE "CHALLENGER" MISHAP

### DIAGNOSING THE PARADOX

To distinguish between an organization that is involved in a problem of conflict-management and agreement-management, a preliminary Organization Diagnostic Survey has been developed. (17:76) Generally, "if the answer to the first question falls into the 'Characteristic' category and most of the other answers fall into the category 'not characteristic,' one may be relatively sure the organization is in a real conflict situation and some sort of conflict management intervention is in order." (17:76) (See Appendix B)

#### Coping with the Paradox

Once the scenario has been diagnosed to be the mismanagement of agreement as described by "The Abilene Paradox", the most effective form of confrontation is in the group setting. Working within the context of a group is important because the dynamics of the Abilene Paradox involve collusion among group members. An attempt to unravel the dilemma by working with individuals and small subgroups would involve further collusion with the dynamics which led to the paradox in the first place. (17:77)

The first step in solving the dilemma is for whomever elects to be the "confronter" to own up to his position and to be open to the feedback he gets. The process of owning up

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"lets the others know that he is concerned lest the organization make a decision contrary to the desires of any of its members." (17:78)

The process of confrontation usually has results that can be divided into two categories: technical and existential. The technical level of results may very well be absurdly simple and quick. The solution may seem impossible as "most of us have been trained to believe that the solution to conflict requires a long, arduous process." (17:78) Debates about technology, personalities and/or administrative approaches may very well be the basis for creativity in organizational problem solving. The existential results find that psychological success and failure apparently are divorced from what is traditionally accepted in organizations as criteria for success and failure. The willingness to accept risks of being fired for being another "boat rocker" in the organization is deemed to be worth it. (17:78-79)

## THE SPACE SHUTTLE "CHALLENGER" ACCIDENT

The flight of "Challenger" began at 1138 on 28 January 1986 and ended 78 seconds later. While traveling at Mach 1.92 and at an altitude of 46,000 feet, "Challenger" was totally enveloped in an explosive burn. All seven of the crew members perished in the mishap. (62:19,21)

The decision to launch "Challenger" was flawed. Those who made that decision disregarded the history of mechanical problems concerning O-rings and structural joints of the

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spacecraft, were unaware of the initial written recommendation of the contractor advising against the launch at temperatures below 53 degrees Fahrenheit; and ignored the continuing opposition of the engineers to launch after management reversed its position. Management did not have a clear understanding of the builder's concern that it was not safe to launch because of ice on the pad. If the decision-makers had incorporated all of the facts into the decision-making process, it is highly unlikely that they would have decided to proceed with the launch. (62:82)

The Report to the President by the Presidential Commission on the Space Shuttle Challenger Accident examined the chain of decisions that culminated in approval of the launch. The Commission concluded that the decision-making process was flawed. Researchers revealed failures in communication that resulted in a decision to launch based on incomplete and sometimes misleading information, a conflict between engineering data and management judgments, and a National Aeronautics and Space Administration (NASA) management structure that permitted internal flight safety problems to bypass key managers. (62:82)

The Shuttle Flight Readiness Review is a carefully planned, step-by-step activity designed to certify the readiness of all components of the Space Shuttle assembly. The process is focused on the Level I Flight Readiness Review, held approximately two weeks before a launch.
The process begins at Level IV with the contractors formally certifying--in writing--the flight readiness of the elements for which they are responsible. Certification is made to the appropriate Level III NASA project managers at Johnson and Marshall Space Flight Centers. Additionally, at

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Marshall Space Flight Center, the review is followed by a presentation directly to the Center Director. At Kennedy Space Center the Level III review, chaired by the Center Director, verifies readiness of the launch support elements.

The next step in the process is the Certification of Flight Readiness to the Level II Program Manager at Johnson Space Center. In this review, each Space Shuttle program element endorses that it has satisfactorily completed the manufacture, assembly, test and checkout of the pertinent element, including the contractors' certification that design and performance are up to standard. The Flight Readiness Review process culminates in the Level I review.

In the initial notice of the review, the Level I directive establishes a Mission Management Team for the particular mission. The team assumes responsibility for each Shuttle's readiness for a period commencing 48 hours before launch and continuing through post-landing crew egress and the safing of the Orbiter. On call throughout the entire period, the Mission Management Team supports the Associate Administrator for Space Flight and the Program Manager.

A structured Mission Management Team meeting called "L-1" is held 24 hours prior to each scheduled launch. Its agenda includes closeout of any open work, a closeout of any Flight Readiness Review action items, a discussion of new or continuing anomalies, and an updated briefing on anticipated weather conditions at the launch site and at the abort landing sites in different parts of the world. It is standard practice of Level I and II officials to encourage the reporting of new problems or concerns that might develop in the interval between the Flight Readiness Review and the L-1 meeting, and between the L-1 and launch. (See Appendix C)

In a procedural sense, the process described was followed in the case of the last "Challenger" mission. However, in the launch preparation for the flight, relevant concerns of Level III NASA personnel and element contractors were not, in the following crucial areas, adequately communicated to the NASA Level I and II management responsible for the launch.

Two critical examples are:

The objections to launch voiced by Morton Thiokol engineers about the detrimental effect of cold temperatures on the performance of Solid Rocket Motor O-rings and;

The degree of concern of Morton Thiokol and Marshall Space Center about the erosion of the O-rings in prior Shuttle flights. (62:82-84)

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The critical O-rings, which ultimately precipitated the catastrophic failure of the solid rocket booster in "Challenger", had been designated a "Criticality 1" feature of the Solid Rocket Booster design since December 1982. "Criticality 1" is a term denoting a failure point, without backup, that could cause a loss of life or vehicle if the component fails. The faulty O-rings were installed in "Challenger" (and all shuttles since July 1985) with launch constraints imposed and regularly waived by the Solid Rocket Booster Project Manager. Neither the launch constraint, the reason for it, nor the six consecutive waivers prior to "Challenger" were known to Level I, Level II, or the Deputy Director of Launch and Landing Operations at Kennedy Space Center. (62:84)

Other independent paths of deficiency reporting existed to identify the Solid Rocket Booster discrepancies. A task force of Morton Thiokol and Marshall Space Flight Center engineers' test results documented rising concern and frustration, but Level II was not in the line of reporting for that group. Another path, the examination of previous flight discrepancies by the Flight Readiness Review, also failed to report to Level I or II any test or flight discrepancies with O-rings. No mention of an O-ring discrepancy was made in any of the "several inches of paper comprising the entire chain of readiness reviews." (62:85) The Commission surmised that neither Morton Thiokol

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management nor the Marshall Space Flight Center Level III
project managers believed that the O-ring discrepancy was
critical. Therefore, the criticality of the discrepancy was
not conveyed in the Flight Readiness Review. (See Appendix
D).

The original launch, which was scheduled for 27 January
1986, was cancelled by the Mission Management Team due to
high cross-winds at the launch site. The launch was
rescheduled for 0928 28 January. Later that same day a
weather prediction called for temperatures to fall into the
low twenties overnight. The question of what effects the
cold temperatures would have on water drains, eye wash and
shower water, fire suppression system, and over pressure
water trays was discussed, but no concerns were expressed by
the Mission Management Team about O-rings in Solid Rocket
Boosters. (62:85)

Late on the afternoon of 27 January, engineers for Morton
Thiokol expressed concern for the effects of the predicted
low temperatures on the O-rings and the joint seal. (62:85)
The ultimate decision to launch was made under the duress of
a conference telephone conversation which involved senior
vice presidents of Morton Thiokol, the Manager of the
Shuttle Projects Office at Kennedy Space Center, and the
Deputy Director of Science and Engineering of the Marshall
Space Flight Center. Morton Thiokol Vice President for Space
Booster Programs recommended that the launch be delayed

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until the temperature of the O-rings reached 53 degrees, the lowest temperature of any previous flight. The Deputy Director of Science and Engineering at the Marshall Space Flight Center was "appalled" by Morton Thiokol's recommendation, and challenged the conclusion that the O-rings would not function properly within a specified temperature range of 40 to 90 degrees Fahrenheit. (62:107) The Morton Thiokol group asked for and received time to confer. After thirty minutes of discussion, the original recommendation to delay the launch was rescinded and Morton Thiokol recommended that the launch proceed as rescheduled. The Director at Marshall Space Flight Center asked for and *received a written statement from Morton Thiokol represen-* tatives recommending the launch. (62:104-110)

Additional arguments for the delay of the launch were expressed by the Manager of the Space Booster Project for Morton Thiokol to the Kennedy Space Center. His primary concerns were: inability to rationalize launching below qualifying temperatures, booster recovery ships were heading toward shore due to high seas, and icing conditions were increasing on the launch pad. The Manager was told that the matters cited were not his concern but that his opinions would be passed on in an advisory capacity.

On the morning of 28 January the Deputy Manager for Shuttle Projects advised the Deputy Director of Marshall Space Flight Center of Morton Thiokol's original recommen-

dation to delay the launch and subsequent written recommendation to proceed. Between 0700 and 0900 an inspection of the launch pad for ice accumulation was conducted on the Solid Rocket Booster, the External Tank and Orbiter, using an infrared pyrometer. Temperatures of from 8 to 25 degrees Fahrenheit were recorded, but the inspection party was not concerned, since there existed no Launch Commit Criteria based on surface temperatures. Although patches of sheet ice were discovered on the skirt of the left Solid Rocket Booster, no report was filed. The final Mission Management Team Meeting was held at approximately 0900. Ice conditions at the launch pad were discussed, but no mention was made of the effects of temperature on the O-rings of the Solid Rocket Booster. "Challenger" was launched at 1138.

"The inability to manage agreement, not the inability to manage conflict, is the essential symptom that defines organizations caught in the web of the Abilene Paradox." (17:66) The participants in the decision-making process that rendered the determination on the criticality of the discrepancies of the O-rings of the Solid Rocket Booster were clearly caught in the web of the Abilene Paradox. Although all of the parties involved agreed that the environmental conditions were such that a potential catastrophe might result if the launch were to proceed as scheduled, they were unable to manage that agreement.

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# CHAPTER IV

## ANALYSIS

"Organizations frequently take actions in contradiction to the data they have for dealing with problems and, as a result, compound their problems rather than solve them." (17:69) The inability to cope with agreement, not the inability to cope with conflict, stands as the central issue in organizational dysfunction. (17:66) Harvey's Organizational Diagnostic Survey will be applied to the group that ultimately recommended approval to launch "Challenger". An analysis of the results reveals that each of the participants joined in a very costly trip to Abilene.

The crux of the matter was that continued delays in the launch, for whatever reason, would preclude using Casablanca as a transatlantic abort site and, because weather at other sites was unfavorable, the launch would have to be delayed another whole day. The "press on" attitude that had overcome NASA management, thus allowing them to accept conditions that would have warranted cancellation of any other mission, continued to grow. (36:208-209)

The decision-making group involved consisted of senior vice presidents from Morton Thiokol and government representatives from the National Aeronautics and Space Administration (NASA), Marshall Space Flight Center, and Kennedy Space Center. The Report to the President by the Presidential Commission on the Space Shuttle Challenger

Accident provides a detailed account of the dialogue which accompanied the chain of events prior to the launch authorization. (See Appendix A)

A synopsis of those events in response to the Survey demonstrates the effect that mismanaged agreement had on the participants:

1. The question of whether or not conflict existed within the organization is best answered yes and no. In the hours immediately preceding the launch, there was internal conflict among the Morton Thiokol engineers regarding the very nature of the effect of low temperatures on the O-rings. The engineers later agreed on the minimum temperature at which the launch could safely be conducted. Conflict over the possible effects of the low temperatures on the performance of the O-rings developed between the engineers of Morton Thiokol and the government representatives of NASA and Kennedy Space Center. Under pressure of government representatives to reconsider the recommendation to further delay the launch, the engineers conferred among themselves. They ultimately reversed their position and recommended the launch of "Challenger" to accommodate NASA, a major customer. (62:104) At that point, the engineers and government representatives were in agreement that the launch could be conducted with an adequate margin of safety. The conflict that originally plagued them was replaced by agreement. The

lack of management of that agreement then set the stage for disaster.

2. That organization members felt frustrated, impotent, and unhappy was evident. Examples of frustration and confusion on the part of three very senior participants is indicative of the atmosphere that permeates the findings of the Commission.

The head of the Marshall Space Flight Center for twelve years, William R. Lucas, was aware that Morton Thiokol engineers had voiced concern about the effect of low temperatures on the resilience of the O-rings. He remained silent because "he was not part of the countdown decision-making process and he believed the issue had been resolved." (30:B14) As late as June 1986, six months after the disaster, Dr. Lucas continued to disagree with the findings of the Commission that determined that the decision to launch "Challenger" was flawed. (30:B14)

Alan J. McDonald, Director, Solid Rocket Motor Project for Morton Thiokol, recommended cancelling the launch due to the O-ring problem at low temperatures, the fact that the booster recovery ships were heading in to shore due to high winds and the icing conditions on the launch pad. He was told that those things were not his concern and that his thoughts would be passed on in an advisory capacity. (62:109)

As late as 0900 the Mission Management Team meeting the representatives for the Orbiter prime contractor, Rockwell

International, expressed concern about the effects of ice on the Orbiter during launch. (62:114) Two things were apparent from the Rockwell testimony to the Commission. First, Rockwell did not feel it had ample time to research and resolve the issue of ice on the launch pad. Second, even though there was considerable discussion about ice, Rockwell's position was not clearly communicated to NASA officials in the decision chain during the hours preceding the launch. (62:116)

3. The placing of blame for the dilemma was characteristic of NASA's dealings with Morton Thiokol. The meteorological conditions existed as previously described, but NASA was persistent in its demands that the conditions be rationalized to the point that the launch could be authorized with a comfortable margin of protection for the decision-makers. Instead of requiring that those in favor of the launch prove that it was safe to do so, the participants who advised against the launch were required to prove that it was not safe to launch. (36:210)

Morton Thiokol executive Joe C. Kilminster, Vice President of the Space Booster Programs, was required to telefax a detailed statement of the company's final position, after having reversed the original position on the recommendation to delay launch. The stage was being set to place blame on other organizations for anything that might go wrong.

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4. The engineers of Morton Thiokol were compelled to research the effect of the cold temperatures on the O-rings on their own initiative. No impetus came from NASA, although the subject of temperatures was discussed at various Mission Management Team meetings. This in effect was the equivalent of small subgroups meeting somewhat informally to discuss the problems of the organization. (62:104-105)

5. The same people who meet informally and derive positions that reveal an honest estimation of the situation will also "'soften their positions,'" state them in ambiguous language, or even reverse them to suit the apparent positions taken by others." (17:77) Morton Thiokol originally recommended to NASA that the launch be delayed due to extremely low ambient temperatures and an accumulation of ice on the launch pad. This recommendation was discussed during the course of a lengthy telephone conversation which included most of the important participants in the decision-making process. Although the decision was well-researched and presented, NASA was "appalled", and requested that Morton Thiokol reconsider the recommendation. Under that duress, and in an effort to accommodate the "customer", the decision was reversed. The advice of Rockwell International regarding the advisability of continuing with the launch under the conditions was ambiguous. "Rockwell could not 10ⁿ percent assure that it is safe to fly, which (was) changed to Rockwell cannot assure that it is safe to fly..." (36:228)

The Commission found it difficult to determine that there was a "no-launch" recommendation.

There was never any question that a flight safety issue remained unanswered or that the Marshall managers should bring the question of Thiokol's original recommendation against launch to the attention of higher authority. Although there was ample reason to determine that the launch should be delayed for various reasons, the participants in the decision-making group elected to proceed with the launch. Enough of the questions on Harvey's Survey are characteristic of a group under the influence of the Abilene Paradox that one must conclude that the organization was well on the way to Abilene.

A key element of the dilemma which faced the "Challenger" decision-making group was that, as a Abilene-bound organization, they lacked a map--a theory or model--which would provide rationality to the paradox. Harvey discusses the factors that are included in a good map: 1. Action Anxiety; 2. Negative Fantasies; 3. Real Risk; 4. Separation Anxiety; and 5. the Psychological Reversal of Risk and Certainty. (17:69-73)

Action Anxiety stands as a notable landmark in the launch decision. The staff conferences, lengthy telephone conversations, recommendations, and reversals of positions may be interpreted as indicators of group Action Anxiety. The members of the group apparently knew that vital questions

remained unanswered, but they still chose to pursue a course of action with an uncertain outcome. Why did the action anxiety occur? (17:70-71)

Action anxiety is reinforced by the negative fantasies that groups conjure up about what will happen to them if they act according to what they know ought to be done. (17:71) The decision to launch or to delay the launch was primarily founded in whether the government (a major consumer) would accept a further delay based on a variable, such as the extremely low temperature, when the O-rings were supposed to function well below the existing temperature. "The nation's reliance on the Shuttle as its principal space launch capability created a relentless pressure on NASA to increase the flight rate." (62:201) The basis for NASA's decisions appeared to rest in the self-imposed time table which dictated that the Space Shuttle program be maintained on schedule, no matter what. One must look deeper than negative fantasies alone to fully understand why organizations fail to cope with the management of agreement. The questions should be answered: "What is the source of the negative fantasies? Why do they occur?" (17:71)

Real Risk, which is a fact of life, is also a condition of existence. President Kennedy once stated that "Life is unfair," i.e., "we do not know, nor can we predict or control with certainty, either the events that impinge upon us or the outcomes of actions we undertake in response to those

events." (17:71) The risk of ostracism, being branded as a non-team player, or being fired will always exist when one is in a position of having to confront a group with the possibility that a course of action might not work. Real Risk is an existential condition. All actions have consequences that may be worse that the evils of the present, i.e., things could be worse than they already are. The inability of the NASA group to accept this concept may have allowed them "to opt to take their organization to Abilene rather than run the risk, no matter how small, of ending up somewhere worse." (17:72) The Commission describes NASA's "silent safety program" to emphasize NASA's acceptance of the risk of mechanical failure or personnel shortcomings as realities of life which were to be taken for granted.

Throughout the testimony which was presented to the Commission, it was evident that nobody sought the approval or disapproval of the reliability engineers, and nobody expressed the satisfactions or dissatisfaction of the quality assurance staff. No one thought to invite a safety representative or quality assurance engineer to the 27 January 1986 teleconference between Marshall Space Flight Center and Morton Thiokol. Similarly, there was no representative of safety on the Mission Management Team that made key decisions during the countdown on 28 January. The NASA Lunar safety program, which was composed of interdependent safety, reliability, and quality assurance

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functions, served most successfully to discover potential
safety problems. The success of that program appeared to
reside in the fact that the early failures of the space
exploration program loomed heavy on the decision-makers.
Multiple successful missions created an atmosphere of
invulnerability and complacency. The safety program which
had served so well in previous programs had become
ineffective. The checks and balances which were essential to
maintain a good flight safety record were ignored.

An analysis of communication and organizational failures
that contributed to the flawed decisions on 28 January
included lack of problem reporting requirements, inadequate
trend analysis, misrepresentation of criticality and lack of
involvement in critical discussions. It was determined that
a properly staffed, supported, and robust safety organization
might well have avoided these faults and thus eliminated the
communications failures. (62:152) The Commission found the
organizational structures of the Kennedy Space Center and the
Marshall Space Flight Center placed the safety, reliability
and quality assurance offices under the supervision of the
very organizations and activities whose efforts they were to
monitor. (62:161) One cannot possibly hope to know what
risks were involved unless the environment was conducive to
honest inputs from knowledgeable participants. The
organizational structure of the decision-making body was such
that formal inputs regarding the safe and orderly conduct of

the operation would never be received. NASA's inability to accept formal confrontation in the form of safety, reliability, and quality assurance critiques would also create an environment which would resist criticism from within.

The core of the Paradox lies in the fear of taking risks that might result in separation, alienation, and loneliness that would accompany the ostracism or punishment for not agreeing with the group. That fear, which expresses itself in subtle ways, ultimately is the cause of the self-defeating, collective deception that leads to self-destructive decisions within organizations. (62:72)

The psychological reversal of risk and certainty might have played a key role in the willingness of the engineers of Morton Thiokol to reverse their position on the matter of the effects of the low temperature on the O-rings. The initial fear of separation, whether it be fear of being labeled "disloyal" or a "non-team player", prevailed over their perception of the results of the catastrophic failure of the O-rings. The engineers' reversal of "real existential risk" and their "fantasied risk" transformed that risk from a probability to a certainty when the mishap occurred.

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CHAPTER V


RECAPITULATION


MISMANAGED AGREEMENT is the focal point of "The  "Abilene

Paradox."

> The Abilene Paradox can be stated succinctly as
> follows:    Organizations frequently take actions  in
> contradiction   to  the data they have for  dealing  with
> problems  and,  as   a result,  compound their  problems
> rather than solve  them. (17:69)


The  basic problem in most contemporary organizations  is

the  inability to deal with agreement,  not the inability  to

cope  with conflict.   Organizations frequently take  actions

which  are contrary to the desires of any of its members  and

therefore  defeat  the  very purpose  they  are  designed  to

achieve.

The question of why organizations or groups  consistently

lose   control  of their ability to cope  with  agreement  and

embark on the road to Abilene are discussed in Harvey's work.

Action  anxiety states that all people in  the  organization,

when  confronted with a potential conflict,  know a  sensible

action  they  would like to take and can state  it.   When  it

comes time to take action they become anxious,  withdraw  and

become  frightened  and give up.  Why is  no  action  taken?

Negative  fantasies  regarding  the  disaster  that  will  be

encountered are conjured up if sensible behavior is followed.

The    purpose  of  negative  fantasies  is  to  relieve   the

individual of responsibility for doing anything about solving the particular problem at hand.

Real existential risks exist as a fact of life. Life has real risks which are unavoidable. The one thing that all people share that gets them to Abilene is their fear of separation, alienation, and loneliness. Harvey views connection with others as an instinctive requirement for survival. We fear any action which threatens us with separation. "The fear of taking risks that may result in separation from others is at the core of the paradox." (17:72) Hence the desire to please those in positions of authority and power is fostered.

Organizational symptoms, when viewed from outside of the organization, can indicate when an organization is preparing for a trip to Abilene. Those symptoms are: anger, frustration, rage, pain, feelings of impotence and sterility. Individuals agree in private, unknown to one another, as to the nature of the problem and its solution. Backward decision-making then takes place, i.e., in public session, these same individuals lie and mislead one another regarding their true feelings and beliefs. They blame each other instead of debating the substance of the problem. (17:66)

Characteristics that can lead a group to Abilene include: Real Conflict--which exists in all organizations; and Phony Conflict--which occurs when people agree on the actions they want to take, and then do the opposite. The resulting anger,

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frustration, and blaming behavior, generally termed "conflict", are not based on real differences. Rather, they stem from the protective reactions that occur when a decision that no one believed in or was committed to in the first place goes sour. As a paradox within a paradox, such conflict is symptomatic of agreement. (17:75)

A POSSIBLE ABILENE BYPASS is available in the form of a description of the route to Abilene that provides understandable landmarks along the way and that will clarify the risks involved. Terms applicable to this problem need to be redefined. Victim, victimizer, collusion, responsibility, conflict, conformity, courage, confrontation, reality, and knowledge comprise the list:

Victim and victimizer. Blaming and fault-finding behavior is one of the basic symptoms of organizations that have found their way to Abilene, and the target of blame generally does not include the one who criticizes. Stated in different terms, executives begin to assign one another to roles of victims and victimizers. Ironic as it may seem, however, this assignment of roles is both irrelevant and dysfunctional, because once a business or a government fails to manage its agreement and arrives in Abilene, all its members are victims. Thus, arguments and accusations that identify victims and victimizers at best become symptoms of the paradox, and, at worst, drain energy from the problem-solving efforts required to redirect the organization along the route it really wants to take.

Collusion. A basic implication of the Abilene Paradox is that human problems of organizations are reciprocal in nature. You cannot have an autocratic boss unless subordinates are willing to collude with his autocracy, and you cannot have obsequious subordinates unless the boss is willing to collude with their obsequiousness. Thus, each person in a self-defeating, Abilene-bound organization colludes with others, including peers, superiors, and subordinates, sometimes consciously and sometimes subconsciously, to create the dilemma in which the organization finds itself. To adopt

a cliche of modern organization, "It takes a real team effort to go to Abilene." In that sense each person, in his own collusive manner, shares responsibility for the trip, so searching for a locus of blame outside oneself serves no useful purpose for either the organization or the individual. It neither helps the organization handle its dilemma of unrecognized agreement, nor does it provide psychological relief for the individual, because focusing on conflict when agreement is the issue is devoid of reality. In fact, it does just the opposite, for it causes the organization to focus on managing conflict, when it should be focusing on managing agreement.

Responsibility. Problem-solving action rests on each member of the group. Who is responsible for getting us out of Abilene? To that question is frequently appended a rhetorical question with "should" overtones, such as, Isn't it the boss (or the ranking government official) who is responsible for doing something about the situation?

The answer to that question is no.

The key to understanding the functionality of the no answer is the knowledge that, when the dynamics of the paradox are in operation, the authority figure--and others--are in unknowing agreement with one another concerning the organization's problems and the steps necessary to solve them. Consequently, the power to destroy the paradox's pernicious influence comes from confronting and speaking to the underlying reality of the situation, and not from one's hierarchical position within the organization. Therefore, any organization member who chooses to risk confronting that reality possesses the necessary leverage to release the organization from the paradox's grip.

Reality, and knowledge confrontation. Accepting the paradox as a model describing certain kinds of organizational dilemmas also requires rethinking the nature of reality and knowledge, as they are generally described in organizations. In brief, the underlying dynamics of the paradox clearly indicate that organization members generally know more about issues confronting the organization than they do not know.

Given this concept of reality and its relationship to knowledge, confrontation becomes the process of facing issues squarely, openly, and directly in an effort to discover whether the nature of the underlying collective reality is agreement or conflict. Accepting such a definition of confrontation has an important implication for change agents interested in making organizations more effective. That is, organization change and effectiveness may be facilitated as much by confronting the organization with what it knows and agrees upon, as by

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confronting it with what it does not know or disagrees about. (17:73-75)

GROUPTHINK provides a foundation for the understanding of the phenomenon of the Abilene Paradox. The analysis of the "Challenger" mishap demonstrates the symbiotic effects that one phenomenon can have on the other. The illusion of invulnerability and the belief in the inherent morality of the group was formed by the multiple successful space exploration missions that preceded the "Challenger" mission. Collective rationalization and negative stereotypes of outside sources of information permitted them to discount and ignore various indicators of potential catastrophic failure of the O-rings. Additional pressures toward uniformity resulted in duress on suspected dissenters to reverse recommendations. Self-censorship within the decision-making body provided the scenario which excluded all efforts of confronting members of the group, thus an illusion of unaniminity within NASA was created. NASA's position as the sole decision-making agent, without the checks and balances provided by a functional safety program, provided the self-appointed mindguards necessary to complete the description of a decision-making group under the influence of the Abilene Paradox.

CHAPTER VI

CONCLUSIONS AND SUMMARY

The influence of theoretical truths on practical life
is always exerted more through critical analysis than
through doctrine. Critical analysis being the
application of theoretical truths to actual events, it
not only reduces the gap between the two but also
accustoms the mind to these truths through their repeated
application. We must establish a criterion for critical
analysis. We distinguish between the critical approach
and the plain narrative of a historical event, which
merely arranges facts one after another, and at most
touches on their immediate causal links. Three different
intellectual activities may be contained in the critical
approach.

First, the discovery and interpretation of equivocal
facts. This is historical research proper, and has
nothing in common with theory.

Second, the tracing of effects back to their causes.
This is critical analysis proper. It is essential for
theory; for whatever in theory is to be defined,
supported, or simply described by reference to experience
can only be dealt with in this manner.

Third, the investigation and evaluation of means
employed. This last is criticism proper, involving
praise and censure. Here theory serves history, or
rather the lessons to be drawn from history. (63:156)

CONCLUSION

Analysis of the findings and transcripts of the Report to

the President by the Presidential Commission on the Space

Shuttle Challenger Accident yields evidence of several

symptoms of, and fewer correctives to, groupthink. The

interpretation of the sequence of events and actions taken by

the "Challenger" group provides evidence that the symbiotic

relationship between groupthink and the Abilene Paradox had

taken effect. Janis asserts that "whenever a policy-making

group displays most of the symptoms of groupthink, we can

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expect to find that the group also displays symptoms of defective decision-making." (23:175)

The Abilene Paradox is most liable to evolve in highly structured organizations. Many organizations, especially those in highly technical research and development, must address the management of conflict due to excessive communication among factions. The military represents a situation where obedience is paramount and dissent is often viewed as disloyal. (51:3-4) The "Challenger" group can be likened in many ways to military decision-makers as they are unique in one very important respect, e.g., the finality of the decisions that must be rendered as the momentum of crucial events unfold. Top-level managers in all organizations are concerned with tactical or strategic decisions, but to the military commander, these decisions involve the use, or threatened use, of force and are thus unique to his occupation. This is especially true for the military, which is the primary peacetime deterrent. As such, it must be ready to respond at little more than a moment's notice to a crisis situation anywhere in the world, prepared at any time to use force if required to restore order. (3:14)

The "Challenger" group was also involved in a vitally important, and potentially catastrophic decision-making process. It was one which involved not only the integrity of the national space exploration program, but also a ship, captain, and crew which depended on the wisdom of the

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appointed authorities and officers to protect their vital interests. The facts reveal that those appointed to conduct the launch of "Challenger" failed in that undertaking. But in a larger sense, they failed to identify and resolve the conditions which allowed the situation to evolve in the first place. More important now is the fact that the same scenario could evolve again with similarly catastrophic results.

The cause of the "Challenger" mishap was the failure of the joint of the right Solid Rocket Motor. That failure began with decisions made in the design of the joint and in the failure by both Morton Thiokol and NASA's Solid Rocket Motor project office to understand and respond to facts obtained during testing. The Commission determined that both Morton Thiokol and NASA failed to adequately respond to known defects in safety of flight components. As these discrepancies were experienced routinely during the shuttle flight history, they came to be accepted as an unavoidable and acceptable flight risk. (62:148)

The need for a functional safety program was identified by the Commission. The Commission recommended that NASA establish an Office of Safety, Reliability and Quality Assurance. The Safety office should be headed by an Associate Administrator, who should report directly to the NASA Administrator. It should have direct authority for safety, reliability, and quality assurance throughout the agency. The office should be assigned the work force to

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ensure adequate oversight of its functions and should be independent of other NASA functional and program responsibilities. The responsibilities of the Safety office should include: (1) the safety, reliability and quality assurance functions as they relate to all NASA activities and programs; and (2) direction of reporting and documentation of problems, problem resolution and trends associated with flight safety. (62:199)

The Office of the Associate Administrator for Safety, Reliability Maintainability and Quality Assurance was created. On 6 November 1986 Mr. George A. Rodney, the associate administrator, chartered an ad hoc committee to conduct a study of the safety risk assessment of the Space Transportation System (STS) program. That study was completed in May 1987 and the Final Report of the STS Safety Risk Assessment AD Hoc Committee was presented to the administrator. The report presents a critical analysis of the conditions under which the program was operating subsequent to the mishap. The criterion that was used for critical analysis established there was a need to reexamine the course on which the program was embarked. The report cited comments by workers that conditions were "business as usual" and "Their words say safety, but their actions say, don't worry about it." (59:13-14)

The report was presented and received in a spirit of constructive criticism and the recommendations are being

implemented by a new and vigorous community of forward-looking leaders. (1;37) The Safety staff and budget has been increased, open communication of problems is promoted, a system for tracking and assessing "close calls" has been established, and astronauts are now in safety planning. Other measures to improve the overall operation include an "open door policy" of James R. Thompson, director of Marshall Space Flight Center, under which anyone can walk in and get fifteen minutes of the director's time. Furthermore, employees may now voice any concerns anonymously, by phone or in writing , through an independent contractor, if they feel NASA's internal reporting system is failing. Thus far the anonymous reporting system has netted various reports of workshop lighting...not significant flight hardware-type problems. The program sees no "blockbuster" problems which would force any major new changes in the space shuttle's configuration or launch schedule. (30:10)

The primary concerns of the Safety office have been the redesigned safety of flight items which include major components of the shuttle. One particular component has already failed one test firing, causing the postponement of the next shuttle flight until at least August 1988. NASA's Safety Officer stated that the problems may prompt the agency to require three additional test firings of the boosters, instead of the two now considered mandatory. (30:10)

Central to the issue of identifying the failure of the decision-making process is that the investigation and examination of the means employed by the Ad Hoc Committee failed to identify the element of organizational behavior, i.e., the dilemma of the Abilene Paradox and the influence of the Paradox on the group as a whole. Lacking identification, proper labeling, and training, the decision-making functions of the organization are probably going to reenter the pattern which led the group(s) to Abilene in the first place. An overview of the Committee review process concluded by stating "additional Committee reviews of draft iterations of the report resulted in a total consensus and signature approval by all of the Committee members." (59:6) One might suspect that an environment which valued unaniminity as a measure of effectiveness would also not sense the deleterious effects of groupthink and the Abilene Paradox.

Another significant recommendation that the Commission made was that NASA and the primary shuttle contractors should review all items within a defined safety of flight criticality. The review should identify those items that must be improved prior to flight to ensure mission success and flight safety. An Audit Panel, appointed by the National Research Council, should verify the adequacy of the effort and report directly to the Administrator of NASA. (62:199) The Audit Panel found shortcomings in the system, as did the Ad Hoc Committee. NASA critics charge that too little

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attention is being paid to safety; others maintain that the
agency has become so cautious that the next shuttle flight
could be postponed indefinitely. NASA correctly states that
their intention is to always put safety first, but that space
flight will never be risk free. (30:10)

NASA Administrator Dr. James C. Fletcher called for a
study of the entire NASA organization. Retired Air Force
General Samuel C. Phillips, head of the Apollo program from
1964 to 1970, was invited to conduct that study, which was
completed in December 1986. The NASA Management Study Group
(NMSG) failed to address the decision-making capabilities of
NASA. The principal recommendations of the NMSG can be
summarized as follows:

1. Establish strong headquarters program direction for
each major NASA program, clear assignment of
responsibilities to the NASA centers involved.

2. Improve the discipline and responsiveness to problems
of the program management system.

3. Place shuttle and space station programs under a
single Associate Administrator when the Administrator is
satisfied that recovery of the shuttle will not thereby
be compromised.

4. Increase management emphasis on space flight
operations.

5. Place special management emphasis on establishing
NASA world-class leadership in advanced technology in
selected areas of both space and aeronautical technology.

6.  Establish a formal planning process within NASA to enunciate long-range goals and lay out program, institutional, and financial plans for meeting them.

7.  Strengthen agency-wide leadership in developing and managing people, facilities, equipment, and other institutional resources.

8.  Improve management of NASA's external relations.

9.  Strengthen the Office of the Administrator and ease the workload of the Administrator and Deputy Administrator. (60:90; 61:3-4)

The beginnings of a new set of circumstances could very well be in the making. NASA's Langley Research Center reports that an 11-ton satellite, the size of a bus, launched from the space shuttle "Challenger" in 1984, was to have remained in orbit for about a year, collecting data on the effects of long-term exposure to space. The means of collecting and storing data was such that it cannot be transmitted to earth for analysis. The data represents the long-term exposure to conditions in space in support of a permanent space station. The satellite now holds four years' data that will be lost forever if the satellite is not retrieved. The satellite has no self-contained means of adjusting its own orbit.

The retrieval of the satellite was delayed at the scheduled time due to other pressing commitments for the space shuttle. "The explosion of "Challenger" in 1986, which grounded all space shuttles, deprived NASA of all capabilities to retrieve the satellite." (50:1) Failure to

provide a space shuttle to retrieve the satellite will result in the loss of all of the data collected and pose the problem of reentry of the 11-ton satellite within the 1990-1991 time frame. (50:1) Duress from the national media to continue with the launch procedures was perceived at Kennedy Space Center at the time of the "Challenger" launch. (37) The potential that the same duress might resurface is a very real threat.

## LIMITATIONS OF THE STUDY

One major limitation of this study was heavy reliance on the Report to the President by the Presidential Commission on the Space Shuttle Challenger Accident transcripts to determine if the phenomena of groupthink and the Abilene Paradox were present in the decision-making process of the "Challenger" group. A two-pronged approach would be best in determining the presence or absence of the phenomena: transcript analysis and observer accounts. Janis used these two methods effectively in his revised book Groupthink in examining the Nixon group in the Watergate cover-up. (18:198-241)

Of the two methods, transcript analysis would be a more valid means of determining the presence or absence of the Abilene Paradox. Observers' accounts may fade over time and may suffer from the selective bias of the observer's memory. One difficulty of relying totally on transcripts is that the symptoms of the Abilene Paradox occur at a covert level and

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may only be validated via observers' accounts. Thus, it appears that in future studies investigating the phenomena, one important variable would be time. In order to get a more complete analysis of a decision-making group, examination of the group must be made while major participants are alive and the memory is fresh.

Another drawback of the Abilene Paradox is that in this study it did not help ascertain exactly why the decision-making of the "Challenger" group was flawed. The problem that arises when one tries to assign groupthink on the basis of the symptoms of the Abilene Paradox is that it becomes a circular argument. (53:14)

SUMMARY

The following conclusions may be drawn from the results of this study with respect to the decision-making of the "Challenger" group in their handling of the events prior to the mishap: (1) as a decision-making group, the "Challenger" group displayed several symptoms of groupthink as defined by the Abilene Paradox and (2) The decision-making process of the "Challenger" group demonstrated no correctives to the dilemma, i.e., nobody assumed the role of confronter or devil's advocate.

The lack of a roadmap with identifiable landmarks for decision-makers serves to ensure that a trip to Abilene is in the making. The best policing systems are ones that consist of self-policing by all levels within an organization.

External pressure (media image), fears of being thought a
non-team player, lack of an objective devil's advocate, and
lack of an overriding stated mission or the failure to
communicate that mission to all personnel all contribute to
the planning of a trip to Abilene.

Although some corrective actions have been instituted at
the recommendation of the Commission and the Ad Hoc
Committee, the potential of a repeat of the tragedy is very
real and will remain so until a thorough investigation of the
phenomena discussed in this study is applied to the
decision-making functions of the space program. The
subjective probability that another "Challenger" scenario
will develop is great enough to warrant additional study on
the effects of groupthink and the Abilene Paradox.

Appendix A

## CORRECTIVE ACTIONS FOR GROUPTHINK

1.  Each member of the group is assigned the role of critical evaluator. Members give a high priority to voicing their objections and criticisms of the leader's judgments are encouraged.

2.  The leader is careful not to let his or her biases surface when presenting the group with its task. The leader should be impartial instead of initially stating preferences and expectations. To foster an air of open inquiry, the leader must remove all unbiased statements about the scope of the problem and not advocate specific proposals.

3.  The decision-making group has an independent policy-planning and evaluation group working on the same policy question with a different leader. This prevents insulation of the executive from challenging information and independent judgments by well-qualified outsiders.

4.  Decision-making groups divide into two or more sub-groups. The decision-making group meets separately under different chairpersons and then reconvenes to resolve differences. This is done in order to reduce the chance that the entire group will develop a concurrance-seeking norm and increase the chance that illusory assumptions will be critically examined before a consensus is reached.

5.  Each member of the group discusses the group's deliberations with trusted associates. After, the members report reactions of these associates. The purpose of this is to guard against complacency in the group and provide insights from outside the group.

6.  Qualified experts outside the group are invited to group meetings and are encouraged to challenge the views of core members of the group. To challenge any false sense of complacency about risky decisions, trustworthy associates are selected that have the ability to quickly spot problems and communicate these problems to the group.

7.    At least one member is assigned the role of  devil's
advocate.    When    groups    are    evaluating    policy
alternatives,  one or two members are assigned a role   in
which  they challenge and take the opposite side  of   the
prevailing group opinion.


8.    When   policy  issues  deal  with   relations   with
competing    organizations,    groups    should    devote    a
reasonable  amount  of  time to  evaluate  the  competing
organization's    responses    to    their    policy.    To
counteract  any shared illusions of invulnerability  that
group  members may possess,  and to make sure that  group
members   do   not ignore warning  signals  that  interfere
with  complacency,  the leader may have to exert  special
efforts  to  induce  himself and his  colleagues  to  pay
sufficient    attention    to    potential    risks    to    make
realistic contingency plans.

9.    Once  a  consensus  is  reached,  a  decision-making
group    should    hold    another    meeting    where    group
members  can express doubts and rethink the issue   before
making  a final decision.    At this meeting each   member
plays  the  devil's  advocate and  plays  up  the  risks.
Each    member presents to the group any  objections  that
he   or   she does not feel have been  adequately  covered.
(23:262-271; 38:17-19)

APPENDIX B


ORGANIZATION DIAGNOSTIC SURVEY


Instructions: For each of the following statements please indicate whether it is or is not characteristic of your organization.


1. There is conflict in the organization.

2. Organization members feel frustrated, impotent, and unhappy when trying to deal with it. Many are looking for ways to escape. They may avoid meetings at which the conflict is discussed, they may be looking for other jobs, or they may spend as much time away from the office as possible by taking unneeded trips or vacation or sick leave.

3. Organization members place much of the blame for the dilemma on the boss or other groups. In the "back room" conversations among friends, the boss is termed incompetent, ineffective, "out of touch," or a candidate for early retirement. To his face, nothing is said, or at best, only oblique references are made concerning his role in the organization's problems. If the boss isn't blamed, some other group, division, or unit is seen as the cause of the trouble: "We would do fine if it were not for the damn fools in Division X."

4. Small subgroups of trusted friends and associates meet informally over coffee or lunch to discuss organizational problems. There is a lot of agreement among the members of these subgroups as to the cause of the troubles and the solutions that would be effective in solving them. Such conversations are frequently punctuated with statements beginning with, "We should do..."

5. In meetings where those same people meet with members from other subgroups to discuss the problem, they "soften their positions", state them in ambiguous language, or even reverse them to suit the apparent positions taken by others.

6.    After   such  meetings,  members   complain   to   trusted
associates   that  they  really  didn't  say  what  they   wanted
to   say,   but  also  provide a list of  convincing   reasons
why   the   comments,    suggestions,    and   reactions   they
wanted   to   make  would have  been   impossible.    Trusted
associates   commiserate   and say the same   was   true   for
them.

7.    Attempts   to solve the problem do not seem   to   work.
In   fact,   such attempts seem to add to   the   problem   or
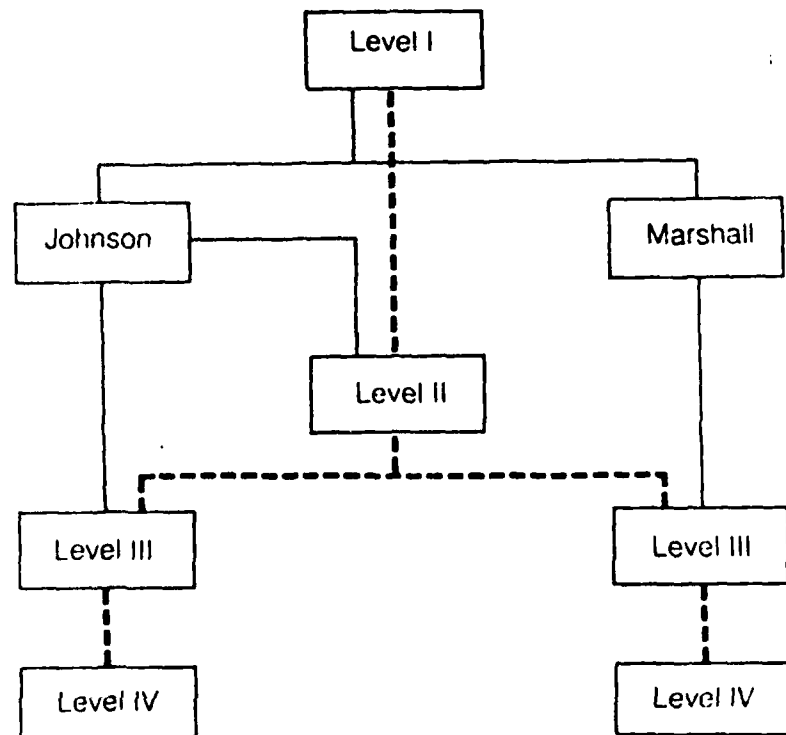make it worse.

8.    Outside   the organization individuals   seem   to   get
along   better,   be happier, and operate more   effectively
than they do within it.   (17:77)

APPENDIX C

SHUTTLE PROGRAM MANAGEMENT STRUCTURE

## Shuttle Program Management Structure



_____ Institutional Chain

.......... Program Chain

**Level I:** The associate administrator for Space Flight Oversees budgets for Johnson, Marshall and Kennedy. Responsible for policy, budgetary and top-level technical matters for Shuttle program.

**Level II:** Manager, National Space Transportation Program. Responsible for Shuttle program baseline and requirements. Provides technical oversight on behalf of Level I.

**Level III:** Program managers for Orbiter, Solid Rocket Booster, External Tank and Space Shuttle Main Engine. Responsible for development, testing and delivery of hardware to launch site.

**Level IV:** Contractors for Shuttle elements. Responsible for design and production of hardware

**Readiness Reviews**

```
                              ┌──────────────┐
                              │ Mission      │
                              │ Management   │
                              │ Team         │
                              └──────▲───────┘
                                     │
Level 1                       ┌──────┴───────┐
                              │ Flight       │
                              │ Readiness    │
                              │ Review       │
                              └──────▲───────┘
                                     │
Level 2                       ┌──────┴───────┐
                     ┌────────│ Pre-Flight   │────────┐
                     │        │ Readiness    │        │
                     │        │ Review       │        │
                     │        └──────▲───────┘        │
                     │               │                │
Level 3              │               │                │
        ┌────────────┴──┐   ┌────────┴────────┐  ┌───┴──────────┐
        │ Marshall Space│   │ Kennedy Space   │  │ Johnson Space│
        │ Flight Center │   │ Center Launch   │  │ Center       │
        │ Flight        │   │ Readiness Review│  │              │
        │ Readiness     │   └────────┬────────┘  └──────┬───────┘
        │ Review        │            │                  │
        └──┬────┬────┬──┘            │            ┌──────┴──────┐
Level 4    │    │    │               │            │             │
  ┌────────┴┐ ┌─┴────┐ ┌───────┐ ┌──┴──────┐ ┌──┴────┐  ┌──────┴────┐
  │ Space   │ │Solid │ │External│ │ Shuttle │ │Orbiter│  │ System    │
  │ Shuttle │ │Rocket│ │ Tank   │ │ Process-│ │       │  │Integration│
  │ Main    │ │Booster│ │       │ │ ing     │ │       │  │           │
  │ Engine  │ │      │ │        │ │Contractor│ │      │  │           │
  └─────────┘ └──────┘ └────────┘ └─────────┘ └───────┘  └───────────┘
  Contractor  Contractor Contractor   S P C   Contractor  Contractor
```

Readiness reviews for both the launch and the flight of a Shuttle mission are conducted at ascending levels that begin with contractors.

APPENDIX D


CHRONOLOGY OF EVENTS RELATED TO TEMPERATURE CONCERNS
PRIOR TO LAUNCH OF "CHALLENGER"

## Chronology of Events Related to Temperature Concerns Prior to
## Launch of Challenger (STS 51-L)

| Time | Key Participants | Event |
|------|-----------------|-------|
| 12 36 PM (EST) January 27, 1986 | *NASA Project Managers and Contractor Support Personnel (including Morton Thiokol)* | ■ *Launch Scrub.* Decision is made to scrub due to high crosswinds at launch site. |
| Approximately 1 00 PM (EST) | *Same as above.* | ■ *Post-Scrub Discussion.* All appropriate personnel are polled as to feasibility to launch again with 24-hour cycle and it results in no SRB constraints for launch at 9:38 AM, 28 January 1986. |
| | | ■ Request is made for all participants to report any constraints. |
| Approximately 1 00 PM (EST) | *Kennedy Space Center* (1) Boyd C. Brinton, Manager, Space Booster Project, MTI; (2) Lawrence O. Wear, Manager, SRM Project Office. Marshall. | ■ *Conversation* Wear asks Brinton if Thiokol had any concerns about predicted low temperatures and about what Thiokol had said about cold temperature effects following January 1985 flight 51-C. |
| | *Morton Thiokol, Utah* (1) Arnold R. Thompson, Supervisor, Rocket Motor Cases; (2) Robert Ebeling, Manager, Ignition System and Final Assembly, SRM Project | ■ Brinton telephones Thompson and other MTI personnel to ask them to determine if there were concerns based on predicted weather conditions. Ebeling and other engineers are notified and asked for evaluation |

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| Time | Key Participants | Event |
|------|-----------------|-------|
| Approximately 2:00 PM (EST) | *NASA Levels I and II Management With Appropriate Program Managers and Contract Personnel* <br> (1) Jesse W. Moore, Associate Administrator, Space Flight, NASA HQ, and Director, JSC; <br> (2) Arnold D. Aldrich, Manager, Space Transportation Systems Program, JSC; <br> (3) Lawrence B. Mulloy, Manager, SRB Project, Marshall Space Flight Center (MSFC); <br> (4) Dr. William Lucas, Director, MSFC. | ■ *Mission Management Team Meeting* Discussion is centered around the temperature at the launch facility and weather conditions predicted for launch at 9:38 AM on 28 January 1986. |
| Approximately 2:30 PM (EST) | *At Thiokol, Utah* <br> (1) R. Boisjoly, Seal Task Force, Morton Thiokol, Utah; <br> (2) Robert Ebeling, Manager, Ignition System and Final Assembly, SRM Project. | ■ Boisjoly learns of cold temperatures at Cape at meeting convened by Ebeling |
| Approximately 4:00 PM (EST) | *At Kennedy Space Center* <br> (1) Allan J. McDonald, Director, SRM Project, Morton Thiokol; <br> (2) Carver Kennedy, Director of Vehicle Assembly Building Operations, and Vice President of Space Operations at KSC, for Morton Thiokol. <br> *At Thiokol, Utah* <br> Robert Ebeling, Department Manager, Ignition System and Final Assembly, SRM Project. | ■ *Telephone Conversation.* McDonald receives call at Carver Kennedy's residence from Ebeling expressing concern about performance of SRB field joints at low temperatures. <br> ■ McDonald indicates he will call back latest temperature predictions up to launch time. <br> ■ Carver Kennedy calls Launch Operations Center and received latest temperature information. <br> ■ McDonald transmits data to Utah and indicates will set up telecon and asks engineering to prepare. |
| Approximately 5:15 PM (EST) | *At Kennedy Space Center* <br> (1) Allan J. McDonald, Director, SRM Project, Morton Thiokol, Inc.; <br> (2) Cecil Houston, MSFC Resident Manager, at KSC. | ■ *Telephone Conversation.* McDonald calls Cecil Houston informing him that Morton Thiokol engineering had concerns regarding O-ring temperatures. <br> ■ Cecil Houston indicates he will set up teleconference with Marshall Space Flight Center and Morton Thiokol. |

| Time | Key Participants | Event |
|------|------------------|-------|
| Approximately 5:25 PM (EST) | *At Kennedy Space Center* Cecil Houston, MSFC Resident Manager, at KSC. *At Marshall Space Flight Center* Judson A. Lovingood, Deputy Manager, Shuttle Projects Office, MSFC. | ■ *Telephone Conversation.* Cecil Houston calls Lovingood, informing him of the concerns of temperature on the O-rings and asks him to establish a telecon with: (1) Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC (at Kennedy); (2) Lawrence B. Mulloy, Manager, SRB Project, MSFC (at Kennedy); (3) George Hardy, Deputy Director, Science and Engineering (at Marshall); (4) Thiokol Wasatch Division personnel. |
| Approximately 5:30 PM (EST) | *At Kennedy Space Center* Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC *At Marshall Space Flight Center* Judson A. Lovingood, Deputy Manager, Shuttle Projects Office, MSFC. | ■ *Telephone Conversation.* Lovingood calls Reinartz to inform him of planned 5:45 PM (EST) teleconference. ■ Lovingood proposes that Kingsbury (Director of Science and Engineering, MSFC), participate in teleconference. |
| Approximately 5:45 PM (EST) | *At Kennedy Space Center* Stanley R. Reinartz, Manager, Shuttle Projects Office (MSFC). *At Marshall Space Flight Center* Judson A. Lovingood, Deputy Manager, Shuttle Projects Office, MSFC *Plus other personnel at Kennedy, Marshall, and Thiokol, Utah.* | ■ *First Teleconference.* Concerns regarding temperature effects on the O-rings are discussed. ■ MTI is of the opinion launch should be delayed until Noon or afternoon. ■ It is decided that another telecon at 8:15 PM will be set up to transmit the data to all of the parties and to have more personnel involved. ■ Lovingood recommends to Reinartz to include Lucas, Director, MSFC and Kingsbury in 8:45 PM conference and to plan to go to Level II if MTI recommends not launching. |
| Approximately 6:30 PM (EST) | *At Marshall Space Flight Center* Judson A. Lovingood, Deputy Manager, Shuttle Projects Office, MSFC. *At Kennedy Space Center* Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC. | ■ *Telephone Conversation.* Lovingood calls Reinartz and tells him that if Thiokol persists, they should not launch. ■ Lovingood also suggests advising Aldrich, Manager, National Transportation System (Level II), of teleconference to prepare him for Level I meeting to inform of possible recommendation to delay. |

| Time | Key Participants | Event |
|---|---|---|
| Approximately 7:00 PM (EST) | *At Kennedy Space Center* (1) Lawrence B. Mulloy, Manager, SRB Project, MSFC; (2) Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC; (3) Dr. William Lucas, Director, MSFC; (4) Jim Kingsbury, Director of Science and Engineering, MSFC. | ■ *Conversation.* Reinartz and Mulloy visit Lucas and Kingsbury in their motel rooms to inform them of Thiokol concern and planned teleconference. |
| Approximately 8:45 PM (EST) | *At Morton Thiokol, Utah* (1) Jerald Mason, Senior Vice President, Wasatch Operations; (2) Calvin Wiggins, Vice President and General Manager, Space Division, Wasatch; (3) Joe C. Kilminster, Vice President, Space Booster Programs, Wasatch; (4) Robert K. Lund, Vice President, Engineering; (5) Roger Boisjoly, Member Seal Task Force; (6) Arnold R. Thompson, Supervisor, Rocket Motor Cases. *At Kennedy Space Center* (1) Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC; (2) Lawrence B. Mulloy, Manager, SRB Project, MSFC; (3) Allan J. McDonald, Director, SRM Project, MTI. *At Marshall Space Flight Center* (1) George B. Hardy, Deputy Director, Science and Engineering; (2) Judson A. Lovingood, Deputy Manager, Shuttle Project Office; (3) Ben Powers, Engineering Structures and Propulsion. *Plus other personnel (see table page 111).* | ■ *Second Teleconference.* Charts present a history of the O-ring erosion and blow-by for the primary seal in the field joints, including results of subscale tests, previous flights and static tests of Solid Rocket Motors. ■ The data shows that the timing function of the O-rings will be slower due to lower temperatures and that the worst blow-by occurred on SRM 15 (STS 51-C) in January 1985 with O-ring temperatures of 53 degrees Fahrenheit. ■ Recommendation by Thiokol (Lund) is not to fly STS 51-L (SRM-25) until the temperature of the O-ring reached 53 degrees Fahrenheit, which was the lowest temperature of any previous flight. ■ Mulloy asks for recommendation from Kilminster. ■ Kilminster states that based upon the engineering recommendation, he can *not* recommend launch. ■ Hardy is reported by both McDonald and Boisjoly to have said he is "appalled" by Thiokol's recommendation. ■ Reinartz comments that he is under the impression that SRM is qualified from 40 degrees Fahrenheit to 90 degrees Fahrenheit. ■ NASA personnel challenge conclusions and recommendations. ■ Kilminster asks for five minutes off-net to caucus. |

| Time | Key Participants | Event |
|---|---|---|
| Approximately 10:30 PM (EST) | *Thiokol Personnel*<br>(1) Jerald Mason, Senior Vice President, Wasatch Operations;<br>(2) Joe C. Kilminster, Vice President, Space Booster Program;<br>(3) Calvin Wiggins, Vice President and General Manager, Space Division;<br>(4) Robert K. Lund, Vice President, Engineering;<br>(5) Arnold R. Thompson, Supervisor, Rocket Motor Cases;<br>(6) Roger Boisjoly, Member, Seal Task Force;<br>(7) Brian Russell, Special Projects, SRM Program Office;<br>(8) Robert Ebeling, Manager, Ignition System and Final Assembly, SRM Project.<br>*Plus other personnel* | ■ *Thiokol Caucus.* Caucus continues for about 30 minutes at Thiokol, Wasatch, Utah.<br>■ Major issues are (1) temperature effects on O-ring, and (2) erosion of the O-ring.<br>■ Thompson and Biosjoly voice objections to launch and indication is that Lund also is reluctant to launch.<br>■ A final management review is conducted with only Mason, Lund, Kilminster, and Wiggins.<br>■ Lund is asked to put on management hat by Mason.<br>■ Final agreement is: (1) there is a substantial margin to erode the primary O-ring by a factor of three times the previous worst case, and (2) even if the primary O-ring does not seal, the secondary is in position and will. |
| Approximately 10:30 PM to 11:00 PM (EST) | *At Kennedy Space Center*<br>(1) Allan J. McDonald, Manager, Space Booster Project, Morton Thiokol, Inc. (MTI);<br>(2) Lawrence B. Mulloy, Manager, SRB Projects, MSFC;<br>(3) Stanley R. Reinartz, Manager, Shuttle Projects, MSFC;<br>(4) Jack Buchanan, Manager, KSC Operations, for MTI;<br>(5) Cecil Houston, MSFC Resident manager, at KSC. | ■ *Conversation at Kennedy.* McDonald continues to argue for delay.<br>■ McDonald challenges Reinartz's rationale that SRM is qualified at 40 degrees F. to 90 degrees F., and Mulloy's explanation that Propellant Mean Bulk Temperatures are within specifications. |
| Approximately 11:00 PM (EST) | *Same participants as 8:45 PM Teleconference.* | ■ *Second Teleconference (Cont'd).* Thiokol indicates it had reassessed; temperature effects are concern, but data is inconclusive.<br>■ Kilminster reads the rationale for recommending launch.<br>■ Thiokol recommends launch.<br>■ Hardy requests that Thiokol put in writing their recommendation and send it by fax to both Kennedy and Marshall. |

| *Time* | *Key Participants* | *Event* |
|---|---|---|
| Approximately 11:15 to 11:30 PM (EST) | *At Kennedy Space Center* (1) Allan J. McDonald, Manager, Space Booster Project, MTI; (2) Lawrence Mulloy, Manager, SRB Projects Office, MSFC; (3) Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC; (4) Jack Buchanan, Manager, KSC Operations, for MTI; (5) Cecil Houston, Manager, MSFC Resident Office at KSC. | ■ *Conversation at Kennedy.* McDonald argues again for delay asking how NASA could rationalize launching below qualification temperature. ■ McDonald indicates if anything happened, he would not want to have to explain to Board of Inquiry. ■ McDonald indicates he would cancel launch since (1) O-ring problem at low temperatures; (2) booster recovery ships heading into wind toward shore due to high seas, and (3) icing conditions on launch pad. ■ McDonald is told it is not his concern and that his above concerns will be passed on in advisory capacity. |
| Approximately 11:45 PM (EST) | | ■ *Telefax.* Kilminster faxes Thiokol's recommendation to launch at 9:45 MST, 27 January 1986 (11:45 EST). ■ Fax is signed by Kilminster. ■ McDonald retrieves fax at KSC. |
| Approximately 11:30 PM to 12:00 AM (EST) | *At Kennedy Space Center* (1) Lawrence B. Mulloy, Manager, SRB Projects Office, MSFC; (2) Stanley R. Reinartz, Manager, Shuttle Projects, MSFC; (3) Arnold D. Aldrich, Manager, National Space Transportation System Program Office, JSC. | ■ *Teleconference.* Discussion centers around the recovery ships' activities and brief discussion of the ice issue on the launch complex area. ■ Reinartz and Mulloy place call to Aldrich. ■ McDonald delivers fax to Jack Buchanan's office at Kennedy Space Center and overhears part of conversation. ■ Aldrich is apparently not informed of the O-ring concerns. |
| Approximately 12:01 AM (EST) January 28 | | ■ Kennedy Space Center meeting breaks up. |
| Approximately 1:30 to 3:00 AM (EST) | *At Kennedy Space Center* (1) Charles Stevenson, Supervisor of Ice Crew; KSC (2) B.K. Davis, Ice Team Member, MSFC | ■ *Ice Crew Inspection of Launch Pad B* Ice crew finds large quantity of ice on Fixed Service Structure, mobile launch platform, and pad apron; and reports conditions. |
| Approximately 5:00 AM (EST) | *At Kennedy Space Center* (1) Lawrence B. Mulloy, Manager, SRB Project, MSFC; (2) Dr. William Lucas, Director, (MSFC); (3) Jim Kingsbury, Director of Science and Engineering, MSFC. | ■ *Conversation.* Mulloy tells Lucas of Thiokol's concerns over temperature effects on O-rings and final resolution. ■ Lucas is shown copy of Thiokol telefax. |

| Time | Key Participants | Event |
|------|------------------|-------|
| Approximately 7:00-9:00 AM (EST) | *At Kennedy Space Center* (1) Charles Stevenson, Supervisor of Ice Crew, KSC; (2) B. K. Davis, Ice Team Member, MSFC. | ■ *Ice Crew Inspection of Launch Pad B.* Ice crew inspects Launch Pad B and Challenger for ice formation. ■ Davis measures temperatures on SRBs, External Tank, Orbiter, and launch pad with infrared pyrometer. ■ Left-hand SRB appears to be about 25 degrees F. and right-hand SRB appears to be about 8 degrees F. near the aft region. ■ Ice crew is not concerned since there is no Launch Commit Criteria on surface temperatures and does not report. ■ Crew reports patches of sheet ice on lower segment and skirt of left Solid Rocket Booster |
| Approximately 8:00 AM (EST) | *At Marshall Space Flight Center* (1) Judson A. Lovingood, Deputy Manager, Shuttle Projects Office, MSFC; (2) Jack Lee, Deputy Director, MSFC. | ■ *Conversation.* Lovingood informs Lee of previous night's discussions. ■ He indicates that Thiokol had at first recommended not launching, and then after Wasatch conference recommended launching. ■ He also informs Lee that Thiokol is providing in writing their recommendation for launch. |
| Approximately 9:00 AM (EST) | *NASA Levels I and Level II Management With Appropriate Project Managers and Contract Personnel.* | ■ *Mission Management Team Meeting.* Ice conditions at launch complex are discussed. There is no apparent discussion of temperature effects on O-ring seal. |
| Approximately 10:30 AM (EST) | *At Kennedy Space Center* (1) Charles Stevenson, Supervisor of Ice Crew; (2) B.K. Davis, Ice Team Member | ■ *Ice Crew Inspection of Launch Pad B* Ice crew inspects Launch Pad B for third time. ■ Crew removes ice from water troughs, returns to Launch Control Center at T-20 minutes, reports conditions to Mission Management Team, including fact that ice is still on left Solid Rocket Booster. |
| 11:38 AM (EST) | | ■ *Launch.* Challenger (STS 51-L) is launched. |

## Final Teleconference Participants

| NASA Marshall Space Flight Center | Morton Thiokol Wasatch Division |
|---|---|
| 1. George B. Hardy, Deputy Director, Science and Engineering, MSFC | 1. Jerald Mason, Senior Vice President, Wasatch Operations, MTI |
| 2. Judson A. Lovingood, Deputy Manager, Shuttle Projects Office, MSFC | 2. Calvin Wiggins, Vice President and General Manager, Space Division, MTI |
| 3. Leslie F. Adams, Deputy Manager, SRB Project, MSFC | 3. Joe C. Kilminster, Vice President, Space Booster Programs, MTI |
| 4. Lawrence O. Wear, Manager, SRM Project Office, MSFC | 4. Robert K. Lund, Vice President, Engineering, MTI |
| 5. John Q. Miller, Technical Assistant, SRM Project, MSFC | 5. Larry H. Sayer, Director, Engineering and Design, MTI |
| 6. J. Wayne Littles, Associate Director for Engineering, MSFC | 6. William Macbeth, Manager, Case Projects, Space Booster Project Engineering, Wasatch Division, MTI |
| 7. Robert J. Schwinghamer, Director, Material and Processes Laboratory, MSFC | 7. Donald M. Ketner, Supervisor, Gas Dynamics Section and Head Seal Task Force, MTI |
| 8. Wilbur A. Riehl, Chief, Nonmetallic Materials Division, MSFC | 8. Roger Boisjoly, Member, Seal Task Force, MTI |
| 9. John P. McCarty, Deputy Director, Structures and Propulsion Laboratory, MSFC | 9. Arnold R. Thompson, Supervisor, Rocket Motor Cases, MTI |
| 10. Ben Powers, Engineering Structures and Propulsion Laboratory, MSFC | 10. Jack R. Kapp, Manager, Applied Mechanics Department, MTI |
| 11. James Smith, Chief Engineer, SRB Program, MSFC | 11. Jerry Burn, Associate Engineer, Applied Mechanics, MTI |
| 12. Keith E. Coates, Chief Engineer, Special Projects Office, MSFC | 12. Joel Maw, Associate Scientist, Heat Transfer Section, MTI |
| 13. John Schell, Retired Engineer, Materials Laboratory, MSFC | 13. Brian Russell, Manager, Special Projects, SRM Project, MTI |

**Present at KSC**

14. Cecil Houston, MSFC Resident Manager, at KSC
15. Stanley R. Reinartz, Manager, Shuttle Projects Office, MSFC
16. Lawrence B. Mulloy, Manager, SRB Project, MSFC

14. Robert Ebeling, Manager, Ignition System and Final Assembly, SRB Project, MTI

**Present at MSFC**

15. Boyd C. Brinton, Manager, Space Booster Project, MTI
16. Kyle Speas, Ballistics Engineer, MTI

**Present at KSC**

17. Allan J. McDonald, Director, SRM Project, MTI
18. Jack Buchanan, Manager, KSC Operations, MTI

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