Accountability in the Public Sector: Lessons from the Challenger Tragedy

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■ *The Rogers Commission investigation of the space shuttle Challenger accident was too narrow in its focus; an institutional analysis is needed to supplement the concentration on technical and managerial causes of the tragedy. Using an institutional perspective, we contend that the accident was, in part, a manifestation of NASA's efforts to manage the diverse expectations it faces in the American political system.*

Four types of accountability (legal, political, bureaucratic, and professional) are commonly used by public agencies to manage expectations of them. Yet, the presence of multiple accountability systems is not without costs. This case study shows that many of NASA's technical and managerial problems resulted from efforts to respond to legitimate institutional demands. Specifically, we contend that the pursuit of political and bureaucratic accountability distracted NASA from its strength: professional standards and mechanisms of accountability. Furthermore, agency reforms now being implemented and considered compound trends away from the professional accountability approaches used by NASA during the 1960s. Such reforms are just as likely to exacerbate the dilemmas facing NASA as they are to improve the agency's performance.

On January 28, 1986, the space shuttle Challenger exploded in mid-flight and seven crew members lost their lives. The widely known details of that tragic event need not be retraced here. Opinion is growing, however, that the official explanations offered by the Presidential Commission on the Space Shuttle Challenger Accident (the Rogers Commission) fail to provide full answers to why the disaster occurred. We offer an alternative explanation which addresses institutional factors contributing to the shuttle accident.

I. Seeking an Institutional Perspective

Two common threads ran through public discussions of the Challenger incident. First was the urge to pinpoint the technical problems contributing directly to the booster rocket explosion on the shuttle. Second was the desire to uncover human and managerial errors that might have caused National Aeronautics and Space Administration (NASA) officials to overlook or ignore those technical flaws. By the time the Rogers Commission issued its findings on June 9, 1986, those technical and managerial issues dominated its conclusions.

On the first point, the verdict of the Commission was unequivocal:

> The consensus of the commission . . . is that the loss of the space shuttle Challenger was caused by a failure in the joint between the lower segments of the right solid rocket motor. The specific failure was the destruction of the seals that are intended to prevent hot gases from leaking through the joint during the propellant burn of the rocket motor. The evidence assembled . . . indicates that no other element of the space shuttle system contributed to this failure.[1]

The Commission was equally explicit about managerial problems at NASA being a "contributing cause" of the accident:

> The decision to launch the Challenger was flawed. Those who made the decision were unaware of the recent history of problems concerning the O rings [seals] and the joint and were unaware of the initial written recommendation of the contractor advising against the launch at temperatures below 53 degrees Fahrenheit and the continuing opposition of engineers at [Morton] Thiokol after the management had reversed its position. . . . If the decision-makers had known all the facts, it is highly unlikely that they would have decided to launch [the shuttle] on January 28, 1986.[2]

The Commission's report was notable for its conclusive tone regarding these specific findings. More interesting, however, is the untravelled investigative path which asks if the problems at NASA and in the space shuttle program were institutional as well as technical or managerial. The institutional perspective is familiar to students of organizational theory who, following the lead of Talcott Parsons and James D. Thompson, note three levels of organizational responsibility and control: technical, managerial, and institutional.[3]

At the *technical level,* organizations focus on the effective performance of specialized and detailed functions. At the *managerial level,* an organization provides for mediation among its technical components and between its technical functionaries and those "customers" and "suppliers" in the organization's "task

environment." At the *institutional level,* the organization deals with the need for being part of the "wider social system which is the source of the 'meaning,' legitimation, or higher-level support which makes implementation of the organization's goals possible."[4]

Applying this framework to the study of specific program or project failures such as the Challenger, one can argue that critical problems can arise at any or all three levels. Thus, an investigation of such events would be incomplete without considering the possible implications of activity at each level. The fact that NASA and other public agencies must constantly contend with the institutional forces that surround them (i.e., the "wider social system" of which they are part) is worthy of attention because agency efforts to deal with those forces may contribute to shaping the outcomes of agency action.

Investigators might ignore the role of institutional factors for several reasons. Attention to such factors might raise questions that are too basic and too dangerous for the organization or its supporters. Thus, a commission composed of individuals committed to the enterprise under investigation[5] and to the political system in general[6] is unlikely to open up the Pandora's Box of institutional factors. In contrast, institutional factors might be overlooked because analysts lack a conceptual framework that facilitates such considerations. Assuming the latter explanation, we offer a framework useful for highlighting the institutional factors that might have contributed to the Challenger disaster.

II. An "Accountability" Perspective

While often regarded as a unique public organization,[7] NASA has institutional characteristics similar in very important respects to other public sector agencies. As such, NASA has to deal with the diversity of legitimate and occasionally conflicting expectations emanating from the democratic political system of which it is a part (its institutional context). In the following pages we present a framework of public accountability as a means for examining NASA's management of its institutional pressures and its implications.

Managing Expectations

Accountability is a fundamental but underdeveloped concept in American public administration. Scholars and practitioners freely use the term to refer to answerability for one's actions or behavior. Administrators and agencies are accountable to the extent that they are required to answer for their actions. Beyond this basic notion of answerability, there has been little refinement of the term. Most of the discussion in the literature centers on the "best" strategy for achieving accountability, with the Friedrich-Finer exchange of the 1940s being the most cited example.[8]

From an alternative perspective, accountability plays a greater role in the processes of public administration than indicated by the idea of answerability. In its simplest form, answerability implies that accountability involves limited, direct, and mostly formalistic responses to demands generated by specific institutions or groups in the public agency's task environment. More broadly conceived, *public administration accountability involves the means by which public agencies and their workers manage the diverse expectations generated within and outside the organization.*[9]

Viewed as a strategy for managing expectations, public administration accountability takes a variety of forms. The focus here is on four alternative systems of public accountability, each based on variations involving two critical factors: (1) whether the ability to define and control expectations is held by some specified entity inside or outside the agency; and (2) the degree of control that entity is given over defining those agency's expectations. The interplay of these two dimensions generates the four types of accountability systems illustrated in Figure 1.

Regarding the first dimension, the management of agency expectations through accountability mechanisms calls for the establishment of some authoritative source of control. Internal sources of control rely on the authority inherent in either formal hierarchical relationships or informal social relationships within the agency. External sources of control reflect a similar distinction, for their authority can be derived from either formalized arrangements set forth in laws or legal contracts or the informal exercise of power by interests located outside the agency.

A second ingredient in any accountability system is the degree of control over agency choices and operations exercised by those sources of control. A high degree of control reflects the controller's ability to determine both the range and depth of actions which a public agency and its members can take. A low degree of control, in contrast, provides for considerable discretion on the part of agency operatives.

Bureaucratic accountability systems (cell 1) are widely used mechanisms for managing public agency expectations.[10] Under this approach, the expectations of public administrators are managed through focusing attention on the priorities of those at the top of the bureaucratic hierarchy. At the same time, supervisory control is applied intensively to a wide range of agency activities. The functioning of a bureaucratic accountability system involves two simple ingredients: an organized and legitimate relationship between a superior and a subordinate in which the need to follow "orders" is unquestioned; and close supervision or a surrogate system of standard operating procedures or clearly stated rules and regulations.[11]

Legal accountability[12] (cell 2) is similar to the bureaucratic form in that it involves the frequent application of control to a wide range of public administration activities. In contrast to bureaucratic accountability, however, legal accountability is based on relationships between a controlling party outside the agency and members of the organization. That outside party is not just anyone; it is the individual or group in a position to impose legal sanctions or assert formal contractual

FIGURE 1
Types of Accountability Systems

		Source of Agency Control	
		Internal	External
Degree of Control Over Agency Actions	High	1. Bureaucratic	2. Legal
	Low	3. Professional	4. Political

obligations. Typically, these outsiders make the laws and other policy mandates which the public administrator is obligated to enforce or implement. In policy-making terms, the outsider is the "lawmaker" while the public administrator has the role of "executor."

The legal accountability relationship between controller and the controlled also differs from that found between supervisor and subordinate in bureaucratic accountability forms. In the bureaucratic system, the relationship is hierarchical and based on the ability of supervisors to reward or punish subordinates. In legal accountability, however, the relationship is between two relatively autonomous parties and involves a formal or implied fiduciary (principal/agent) agreement between the public agency and its legal overseer.[13] For example, Congress passes laws and monitors a federal agency's implementation of those laws; a federal district court orders a school board to desegregate its classrooms and oversees the implementation of that order; the local city commission contracts with a private firm to operate the city refuse dump. In each case the implementors are legally or contractually obliged to carry out their duties, and the enforcement of such obligations are very different from those found in situations where bureaucratic accountability systems are applied.[14]

Professional accountability[15] (cell 3) occurs with greater frequency as governments deal increasingly with technically difficult and complex problems. Under those circumstances, public officials must rely on skilled and expert employees to provide appropriate solutions. Those employees expect to be held fully accountable for their actions and insist that agency leaders trust them to do the best job possible. If they fail to meet job performance expectations, it is assumed they can be reprimanded or fired. Otherwise they expect to be given sufficient discretion to get the job done. Thus, professional accountability is characterized by placement of control over organizational activities in the hands of the employee with the expertise or special skills to get the job done. The key to the professional accountability system, therefore, is deference to expertise within the agency. While outside professional associations may indirectly influence the decision making of the in-house expert (through education and professional standards), the source of authority is essentially internal to the agency.

Typically the professional accountability organization will look like any other public agency with a manager in charge of a set of workers, but the relationships among them are much different. Under a bureaucratic accountability system, the key relationship would be that of close supervision. In contrast, under professional accountability the central relationship is similar to that found between a layperson and an expert, with the agency manager taking the role of the layperson and the workers making the important decisions that require their expertise.[16]

Political accountability (cell 4) is central to the democratic pressures imposed on American public administrators. If "deference" characterizes professional accountability, "responsiveness" characterizes political accountability systems (cell 4).[17] The key relationship under these systems resembles that between a representative (in this case, the public administrator) and his or her constituents (those to whom he or she is accountable). Under political accountability, the primary question becomes, "Whom does the public administrator represent?" The potential constituencies include the general public, elected officials, agency heads, agency clientele, other special interest groups, and future generations. Regardless of which definition of constituency is adopted, the administrator is expected to be responsive to their policy priorities and programmatic needs.

While political accountability systems might seem to promote favoritism and even corruption in the administration of government programs, they also serve as the basis for a more open and representative government. The urge for political accountability, for example, is reflected in open meetings laws, freedom of information

acts, and "government in the sunshine" statutes passed by many state and local governments.

Table 1 summarizes the principal features of the four general types of accountability systems. Under the bureaucratic system, expectations are managed through a hierarchical arrangement based on supervisory relationships; the legal accountability system manages agency expectations through a contractual relationship; the professional system relies on deference to expertise; while the political accountability system promotes responsiveness to constituents as the central means of managing the multiple expectations.

Preferences for Accountability Systems

Given these alternative means for managing expectations, what determines the preference for one accountability approach over others in any particular situation? The appropriateness of a specific accountability system to an agency is linked to three factors: the nature of the agency's tasks (technical level accountability); the management strategy adopted by those heading the agency (management level accountability); and the institutional context of agency operations (institutional level accountability).[18] Ideally, a public sector organization should establish accountability mechanisms which "fit" at all three levels simultaneously.

In the American political system, all four accountability types offer potentially legitimate means for managing *institutional level* expectations.[19] Under current institutional norms, no single type of accountability system is inherently more acceptable or legitimate than another. *In theory,* each of the four accountability systems can insure agency responsibility at the institutional level. Thus, in theory an agency might manage its expectations using the accountability system most appropriate in light of relevant institutional considerations. The same potential flexibility may not exist at the technical or managerial levels where the appropriateness of accountability mechanisms is more closely tied to specific tasks or the strategic orientations or idiosyncrasies of individual managers.

In reality, most U.S. public agencies tend to adopt two or more types of accountability systems at any time depending on the nature of existing environmental (institutional) conditions as well as their technical tasks and management orientations. We argue, however, that institutional pressures generated by the American political system are often the salient factor and frequently take precedence over technical and managerial considerations.[20] If this is the case, the challenge of managing expectations changes as institutional conditions change. If the environmental changes are drastic enough, they may trigger a different type of accountability system, one which attempts to reflect those new institutional conditions.

III. Accountability under Different Challenges: The Case of NASA

NASA was an organizational initiative born in the midst of a national crisis and nurtured in the relatively protective shelter of an institutional consensus that lasted until at least 1970. That nurturing consensus focused attention on President Kennedy's mandate to land an American on the moon by the end of the 1960s. In addition, it fostered the belief that achieving that

TABLE 1
Relationships Within Accountability Systems

Type of Accountability System	Analogous Relationship (Controller/Administrator)	Basis of Relationship
1. Bureaucratic	Superior/subordinate	Supervision
2. Legal	Lawmaker/law executor Principal/agent	Fiduciary
3. Professional	Layperson/expert	Deference to expertise
4. Political	Constituent/representative	Responsiveness to constituents

objective required complete deference to those experts who could get the job done. In short, it was a consensus which supported a professional accountability system.

Over time, the pressures to develop a politically responsive agency strategy became dominant. Even before the successful lunar landing of Apollo 11, changing institutional conditions were creating an organizational setting that encouraged more reliance on bureaucratic and political accountability mechanisms. This reliance on bureaucratic and political accountability systems produced circumstances which made the agency ill-equipped to contend with the problems that eventually led to the Challenger disaster. Furthermore, institutional reactions to the Challenger tragedy itself may be creating new pressures that are moving the agency toward a greater reliance on legal and bureaucratic accountability methods for managing expectations.

The Professionalization of the Space Program

NASA's earliest programs had three important characteristics: they involved clearly defined outcome objectives, highly technical methodologies for achieving those goals, and almost unqualified political (and therefore budgetary) support.[21] The task of overcoming the technical barriers to space exploration was central to the agency's mission, and NASA was able to invest its expenditures primarily in research and development projects associated with its missions.[22]

Those early conditions had a significant impact on the development and management of NASA. The agency's structure and recruiting practices reflected an institutional willingness to respect the technical nature of NASA's programmatic tasks. NASA's form of organization emphasized deference to expertise and minimized the number of political appointments at the top of the administrative structure (in this case, two political appointees with extensive professional expertise in public management).[23] NASA's initial staff consisted almost entirely of individuals with the relevant substantive knowledge, primarily aeronautical engineers.

These circumstances afforded NASA the opportunity to become among the most innovative organizations (public or private) in recent American history and a classic example of an agency operating under a professional accountability system. The locus of control over agency activities was internal; NASA's relationship to outside sources (including Congress, the President, and the general public) was that of expert to layperson. Internally, NASA developed a matrix structure in which managers and technicians were assigned to project teams based on the expertise they could offer to the particular task at hand. Technical experts in NASA were expected to make decisions based upon their expertise. Thus, within the agency the degree of control exercised over NASA technical personnel was relatively low. Much of this deference to NASA's technical experts was based on trust in their judgment as well as their expertise. The early managers at NASA "were highly technical people, who knew the spacecraft from the ground up, and they were all very conservative." If "an order to launch came down from on high, they wouldn't do it without first giving everybody the bottom line."[24]

The professional accountability system was evident in the three centers under the Office of Manned Space Flight (OMSF): the Marshall Space Flight Center (Alabama), the Manned Spacecraft Center (Texas; later renamed the Johnson Space Center), and Kennedy Space Center (Florida). During the early 1960s, OMSF and its subunits acted with considerable autonomy. NASA's top management in Washington did occasionally pull in the organizational reins. In several cases (1961, 1963, and 1965), reorganizations were intended to redirect several key units toward new program goals as NASA moved from Project Mercury toward Project Apollo. Each of these changes led to a short-term centralization of control which was intentionally relaxed once programmatic arrangements were in place. In 1967, however, a major long-term effort was made to reduce the autonomy of the manned space flight centers in light of the agency's first major budget constraints and the launch pad fire that killed three astronauts.[25]

The Politicization and Bureaucratization of Accountability

Although many of the technical tasks facing NASA did not change significantly over the past 30 years, institutional pressures on the agency have undergone considerable change. In the late 1960s, NASA faced a leveling off of both its political and financial support. Beginning in the early 1970s there was more concern about the managerial challenges inherent in making NASA into an operational agency—a concern arising from pressures to make the shuttle system a fully operational program.[26] The result of these pressures was a reconfiguration of the accountability systems used by some of the agency's key units. Ironically, the very success of NASA's early programs generated those changes.

NASA's apparent victory in the "space race" coincided with an end to the nurturing consensus that permitted the agency to rely almost exclusively on professional accountability for managing expectations. With America's attention turned increasingly toward Vietnam and economic issues, the space program no longer took priority. A new consensus had to be constructed around some new programmatic mission, and in the late 1960s the idea of a space shuttle began to take form. According to its proponents, the shuttle would represent "a whole new way of space flight," one that would transform NASA from an agency committed to accomplishing specific and discrete program goals within given time constraints (e.g., Apollo) to an agency obligated to the continuous operation of a commercial-like enterprise.[27]

The effort to gain presidential endorsement for the space shuttle program made NASA more aware of and responsive to key actors in the political system. Building the necessary consensus was not easy in the highly volatile and competitive institutional context of the early 1970s. James Fletcher, NASA's Administrator from

1971 to 1977 (and the individual President Reagan brought back to head the agency after the Challenger disaster), needed to sell the space shuttle effort to Congress and the American public as well as the White House. Most of the opposition to the shuttle came from the Office of Management and Budget which was supported by negative assessments of the program by a presidential scientific advisory committee and the RAND Corporation.[28]

NASA has to deal with the diversity of legitimate and occasionally conflicting expectations emanating from the democratic political system of which it is a part.

During this period NASA entered into political coalitions with groups that it had previously ignored or fought in the policy-making arena, as well as with its traditional supporters in government and among its contractors. The shuttle program, for example, was designed to attract the support of those who might take advantage of its capacity to launch satellites and conduct unique scientific and technological experiments in space. Aided by the military, the scientific community, and parts of the business community, NASA was able to get President Nixon's backing for the program in 1972 despite OMB's opposition. Political accountability was no longer secondary or peripheral to NASA.[29] It became a critical ingredient in guaranteeing its maintenance as a viable agency. In more recent years, that urge for public and political support was implicit in NASA's widely publicized efforts to include members of Congress and non-agency civilians on its shuttle flights. These programs represented NASA's efforts to cultivate or maintain general support for its activities.

Another important (and related) set of institutional constraints emerged in the form of major budget cutbacks and (in the late 1970s) greater pressures for privatization. From the height of its support in the late 1960s to the mid-1970s, NASA's budget was cut in half (in constant dollars). Recent estimates indicate that NASA went through a staff cut of 40 percent from the big-budget days of Apollo and that NASA's safety and quality control staff alone were cut by 71 percent between 1970 and 1986.[30] Operating with fewer resources, the agency had to economize; it became just like most other agencies in Washington. NASA experienced a new-found interest in efficiency and thus became more willing to use bureaucratic means for dealing with its financial problems.

NASA officials intended to accommodate these new institutional pressures by reducing the organizational costs that characterized NASA in the "old days" when external support and availability of resources were not major concerns. NASA has "had to pinch pennies to protect the shuttle, accepting lower-cost technologies and making what seem to have been extravagant claims for its economic potential."[31] Agency decentralization and field center specializations continued, and decentralization brought with it increasing reliance on bureaucratic accountability mechanisms. The shift allowed for economies due to a careful division of labor and compartmentalization of authority based on position. While professional accountability systems survived *within* some of the field centers, for the agency as a whole professional accountability patterns characteristic of the early NASA nearly disappeared. With decentralization in NASA came an isolation and competition among field centers.[32]

NASA's use of contractors was, to a certain extent, a manifestation of its efforts to manage changing institutional expectations. In addition to any technical and financial benefits they provided NASA, contractors had always proved very helpful politically in establishing support for the agency's programs and annual funding requests. During the 1970s the link between contract decision and political support became increasingly critical to NASA.[33]

Bureaucratically, contracting out established the ultimate superordinate/subordinate relationship between NASA's top managers and those carrying out the specific parts of the shuttle program. A contract establishes clear responsibilities and gives top management considerable leverage to apply pressures for better performance. It also allows top management to avoid the problems and costs associated with directly maintaining professional accountability mechanisms. Thus, contracting out not only enhanced the bureaucratization process at NASA; it also reduced reliance on deference to expertise characteristic of professional accountability systems.

Changing institutional conditions altered the locus of control over NASA's activities as well as the degree of control over agency activities. The result was a shift in the types of accountability systems relevant to NASA's operations. In place of the dominant professional accountability systems of the pre-Apollo 11 era, NASA created an elaborate mixture of accountability mechanisms that stressed the political and bureaucratic. It was under these conditions that decisions regarding the general schedule of space shuttle flights and specific launch times were being made when the Challenger lifted from its Kennedy Space Center pad on January 28, 1986.

The Case of the Challenger

Evidence gathered by the Rogers Commission Report and through the mass media illustrate the various forms of accountability in operation in NASA before the launch of the Challenger. The principal question is whether (and to what extent) the Challenger accident resulted from the efforts by NASA's leadership to manage changing institutional expectations through political and bureaucratic forms of accountability. Did NASA's emphasis on these accountability mechanisms eventually take precedence over the professional system of accountability that characterized NASA in the early 1960s? Were the problems that eventually led to the Challenger accident linked at all to the poor fit between

agency tasks and agency accountability mechanisms? In our view, the answer to both questions is "yes."

Political pressures. The contention that NASA was feeling considerable political pressure to launch the Challenger on January 28 was widely rumored just after the Challenger accident, particularly stories about direct pressure emanating from the White House. The Rogers Commission emphatically denied the truth of those rumors.[34] Nonetheless, similar pressures existed and came from a variety of sources outside of NASA, including the White House.

On the official policy level, President Reagan announced in July 1982 that the first priority of the shuttle program was "to make the system fully operational." Given the costs involved in supporting the program, additional pressures emanated from an increasingly budget-conscious Congress.[35] Other pressures on NASA were due to widespread reporting of shuttle delays in the mass media. One top agency official argued that the press, in giving major coverage to numerous shuttle delays over the previous year, had "pressured" the agency to jeopardize flight safety. "I don't think it caused us to do anything foolish," he said. "But that's where the pressure is. It's not from anywhere else."[36]

These external pressures were easily translated into internal decisions that set an overly ambitious launch schedule.[37] In short, NASA set that schedule for the purposes of reducing the program's cost factors and appeasing various attentive publics, including the White House, Congress, the media, and the agency's military and private sector "customers" who were important actors in NASA's supportive political coalition.

These political pressures may not have been specifically addressed to the Challenger launch, but there is little doubt they were felt throughout the agency. The increasing emphasis on political accountability was bound to cause attitudinal as well as operational problems. "The pressure on NASA to achieve planned flight rates was so pervasive," concluded a congressional report, "that it undoubtedly adversely affected attitudes regarding safety."[38] An agency official noted that NASA's organization culture changed "when NASA felt itself under pressure to demonstrate that the shuttles were operational vehicles in a 'routine' transportation system."[39] Part of that "routinization" took the form of "streamlining" the reporting requirements for safety concerns. Less documentation and fewer reporting requirements replaced previous directives that all safety problems and responses were to be reported to higher levels in NASA's hierarchy. The "old requirements," it was argued, "were not productive for the operational phase of the Shuttle program."[40]

The same political accountability pressures had an impact on NASA's key shuttle program contractor, Morton Thiokol. The assent of Morton Thiokol management (and the silence of their engineers) to the Challenger launch recommendation was influenced in part by NASA's importance as a primary customer—a customer who was in the process of reviewing its contracts with the firm. The company's management did not want to jeopardize their relationships with NASA. As a result, rather than emphasizing deference to the experts who worked for them, Morton Thiokol deferred to the demands of NASA's top managers who, in turn, were under a self-imposed, politically derived launch schedule.

Public administration accountability involves the means by which public agencies and their workers manage the diverse expectations generated within and outside the organization.

Bureaucratic Pressures. Indications of preference for bureaucratic rather than professional forms of accountability in NASA are evident in the agency's shuttle program operations. By the early 1980s, NASA's managers were having difficulty coordinating their projects.[41] They came to rely increasingly on hierarchical reporting relationships, a clear manifestation of bureaucratic accountability. This had two effects. First, it increased the potential for "bureaupathological" behavior which the professional accountability system attempted to minimize.[42] Second, it reduced the cross-cutting communications channels which once characterized the less hierarchical and flexible matrix structure at NASA.

The failure of NASA's management system is a fundamental theme of the Rogers Commission. Supervisors were criticized for not passing on up the hierarchy their subordinates' recommendations. Managers were criticized for judgments that were contrary to those suggested by the available data. The Commission reported that its investigation revealed "failures in communication that resulted in a decision to launch [the Challenger] based on incomplete and sometimes misleading information, a conflict between engineering data and management judgments, and a NASA management structure that permitted internal flight safety problems to bypass key Shuttle managers."[43] But what the Rogers Commission perceived as a failure of the agency's management system was, in fact, an inherent characteristic of the bureaucratic accountability system adopted by NASA in order to meet the institutional expectations of the post-Apollo 11 era.

Under NASA's shuttle program, responsibility for specific aspects of the overall program was allocated to supervisors at lower levels in the reporting hierarchy, and the burden for giving the go ahead to launch decision makers shifted from the engineers and experts toward those supervisory personnel. As scheduling and other pressures increased, so did the reluctance of those supervisors to be the individual who threw a monkey wrench into the shuttle program machinery. Thus it is not surprising that lower-level managers tried to cope on their own instead of communicating their problems upward.[44]

The relevance of this problem to the Challenger disaster was illustrated time and time again in the testimony given before the Rogers Commission. NASA officials noted that individuals higher up in the agency had

not been informed about the Rockwell engineers' reservations about ice on the launch pad nor the concerns of Morton Thiokol's personnel about weather conditions and the O-rings.[45] In another instance, when asked why he had not communicated the Thiokol engineers' concerns about the O-ring seals to the Program Manager of the National Space Transportation System, the manager of the Solid Rocket Booster Project (based at the Marshall center) answered that he believed it was an issue that had been resolved at his level in the organization.[46] As one reporter observed, "no one at Marshall saw any reason to bother the managers at the top of NASA's chain of command—the normal procedure in the face of disturbing new evidence." This bureaupathological behavior reflects an attitude among employees at Marshall who feel they are competing with Johnson and the other centers. "Nothing [sic] was ever allowed to leave Marshall that would suggest that Marshall was not doing its job. . . ."[47]

Under the bureaucratic system, expectations are managed through a hierarchical arrangement based on supervisory relationships; the legal accountability system manages agency expectations through a contractual relationship; the professional system relies on deference to expertise; while the political accountability system promotes responsiveness to constituents as the central means of managing the multiple expectations.

The impact of the bureaucratic accountability system is also evident in testimony about discussions between NASA representatives and Thiokol engineers on the night before the Challenger launch. During an "off-line" caucus between Morton Thiokol management and their engineers (while NASA prelaunch review officials were "on hold"), a member of management asked one of his colleagues

to take off his engineering hat and put on his management hat. From that point on, management formulated the points to base their decision on. There was never one comment in favor . . . of launching by any engineer or other nonmanagement person in the room before or after the caucus. . . . [The engineers were] never asked nor polled, and it was clearly a management decision from that point. . . . This was a meeting where the determination was to launch, and it was up to [the Thiokol engineers] to prove beyond a shadow of a doubt [to Thiokol management and NASA] that it was not safe to do so. This is in total reverse to what the position usually is in a preflight conversation or a flight readiness review. It is usually exactly opposite that.[48] (emphasis added)

A final example of the bureaucratic accountability system's relevance to the failure of the Challenger focuses on an incident occurring in 1984. Problems with the O-rings were noticed and noted by Morton Thiokol engineers in February that year after the tenth Shuttle mission had been completed, and a report on the problem was ordered by the Office of the Associate Administrator for Space Flight before the launch of the eleventh flight in late March. A decision was made to launch the shuttle, but not before it was determined by the Associate Administrator, James Abrahamson, and NASA's Deputy Administrator, Hans Mark, that the O-ring problem had to be solved. A meeting to discuss the problem with relevant officials from the different NASA centers was called for May 30. It was a meeting that would have drawn attention to the technical factor that would later cause the shuttle tragedy; it was a meeting that never took place. By May 30, Abrahamson had left the agency to work on President Reagan's Strategic Defense Initiative, and Deputy Administrator Mark cancelled the meeting to visit Austin, Texas, where he was being considered for the position of University Chancellor. Abrahamson's successor, Jesse A. Moore, was never informed of the problem, and Mark's successor was not appointed for a full year. Thus, the O-ring problem was never communicated to the relevant experts for action. In Mark's words, it was "a classic example of having something fall between the 'cracks.' "[19] In our terms, it was another instance of bureaucratic accountability applied in inappropriate circumstances.

IV. A Post-Commission Era: The New Institutional Pressures

Given the technical and managerial focus of the Rogers Commission Report and other investigations of the Challenger accident, it is not surprising that calls for changes in the space program tend to favor two objectives: punishing those in NASA who were to blame for the tragedy and instituting reforms that would guarantee that a similar event would not occur in the future. In both form and content, these efforts represented increased institutional pressures for NASA, pressures likely to lead the agency to develop new legal accountability mechanisms as well as increase its reliance on bureaucratic accountability mechanisms.

The search for scapegoats and legal responsibility for the Challenger accident are unsavory but perhaps unavoidable by-products of the Rogers Commission's focus on technical and managerial problems. If a technical problem existed, why was it not discovered in time; and if it was discovered in time, why was it not taken seriously by those in charge?[50] These are the questions which have led to personnel actions within NASA (and Thiokol) ranging from reassignments and resignations to early retirements. Beyond these actions, the families of most Challenger crew members either filed lawsuits or accepted legal settlements from the government and its subcontractors.[51]

On less personal levels, suggestions for reforms in the space agency have proliferated. On the surface many of these seem to signal a return to professional accountability. Some recommendations call for improving the role and voice of certain classes of individuals within NASA with special or unique insight into the risks associated with space exploration. There is, for exam-

ple, a proposal for placing ex-astronauts in management positions at NASA.[52] At first glance, this looks like an attempt to reinvigorate the role of experts and professionals in the agency, but bringing former astronauts into NASA does not guarantee improvement in technical expertise and actually looks more like a thinly veiled attempt to use highly visible symbols of the space program to enhance the agency's damaged credibility.

Another proposal that at first seems to involve a return to professional accountability calls for establishment of explicit guidelines and criteria for use in making launch decisions. Supposedly these criteria would represent the accumulated wisdom of many experts in the field, but they can just as easily be regarded as another step away from deference to professional engineering judgments and toward imposing accountability that carries with it threats of legal liability if such checklists are not properly followed.

Legal accountability mechanisms are also manifested in the emphases in many other proposed reforms on establishing independent or external oversight bodies capable of vetoing decisions by agency personnel regarding safety issues. For example, the Rogers Commission called for the creation of an independent Solid Rocket Motor design oversight committee to review the rocket design and make recommendations to the Administrator or NASA.[53] Similarly, the Commission called for creation of a separate Office of Safety, Reliability and Quality Assurance outside the normal lines of the agency hierarchy to report directly to the NASA Administrator.[54] In both instances, actors outside the normal lines of the agency hierarchy would oversee key decision-making points within NASA dealing with the design and launch of future manned space flights.[55] While these bodies are not intended to exercise direct control over the day-to-day operations of NASA's space shuttle program, such bodies would have jurisdiction over a wide range of agency actions.

It is also evident that congressional oversight of NASA activities is likely to focus a great deal more on details of technical and managerial matters than in the past.[56] In the past, Congress' role regarding NASA was that of patron rather than overseer. For the most part, congressional concerns about NASA were limited to the general priorities of the agency and its potential as a source of pork-barrel projects. In the near future, at least, members of relevant congressional committees and their staffs will become more involved in the details of NASA's operations.[57]

Other suggested reforms (some already being implemented) attempt internal changes in NASA that would complement this movement toward changing accountability. For example, recommendations for reorganizing the shuttle management structure include redefining the program manager's responsibilities to enhance that official's decision-making role. In addition, units within NASA are being reorganized to improve intraorganizational communications. Operationally, suggested reforms include a call for refinement of decision criteria used in equipment maintenance, landing safety, and launch abort procedures. These changes reinforce or legitimize the influence of bureaucratic structures within NASA by formalizing organizational relationships and operational procedures. In form and function, they attempt to move the bureaucratic structures of NASA closer to a centralized system more easily held legally accountable for the agency's future actions.

It was inevitable that the Challenger disaster would generate strong institutional pressures for NASA, and those pressures are creating new demands and expectations for the agency. Ironically, the direction of those pressures has been toward enhanced bureaucratic structures and growing reliance on legal accountability mechanisms which stress NASA's formal responsibilities for the safety of its astronauts. Since President Reagan ordered NASA to terminate its commercial operations temporarily, a major source of political pressure and support has been removed. Thus, we might expect a decline of political accountability in the space agency's operations. Nevertheless, political factors have not disappeared. At present, NASA lacks a clear sense of direction and faces programmatic competition from the military and commercial sectors. At the end of 1986, Dr. Fletcher's view was reported as follows: "the policy-making process is not so straightforward because there are 'so many players.' "[58] In addition, there is little likelihood that Challenger-related reforms will reflect the need for NASA to reestablish the priority of professional accountability systems which held sway in the agency during pre-Apollo 11 heydays.

V. Conclusion

The primary contention of this paper is that the Rogers Commission was shortsighted in focusing exclusively on the failure of NASA's technological or management systems. The problem was not necessarily in the *failure* of those systems, but rather in the *inappropriateness* of the political and bureaucratic accountability mechanisms which characterized NASA's management approach in recent years. The agency's emphasis on political and bureaucratic accountability was a relevant response to changing institutional expectations in NASA's environment, but they were inappropriate for the technical tasks at hand. To the extent that these accountability mechanisms were ill-suited to the technical nature of NASA's agency task, they comprised a major factor in the Challenger tragedy.

In more prescriptive terms, if the professional accountability system had been given at least equal weight in the decision-making process, the decision to launch would probably not have been made on that cold January morning. Had NASA relied exclusively on a professional system of accountability in making the decision to launch the Challenger space shuttle, perhaps deference would have been given to the technical expertise of the engineers. Their recommendation against launch might never have been challenged by the Project Manager for the Solid Rocket Booster.[59] Instead, the Thiokol engineers' initial recommendation

against launch was ignored by their hierarchical superiors. Decision makers relied upon supervisors to make the decision rather than deferring to professional experts.

Will the post-accident push for greater emphases on the legal and bureaucratic accountability systems improve NASA's ability to successfully pursue its mission? If this assessment of the role of institutional factors in the success and failure of NASA's programs is correct, then the proposals for reform increase the chances of other failures. This conclusion is consistent with the thesis that adding safety mechanisms to already complex systems in fact may increase the chances that something can go wrong.[60] As NASA gets drawn further away from what it can do best—namely, mobilizing the expert resources needed to solve the technical challenges of space exploration—its chances for organizational success are diluted. Ideally, NASA needs to return to what it does best, using the form of accountability that best suits its organizational mission, i.e., a professional accountability based on deference to expertise.[61] The reality of NASA's institutional context, however, makes achievement of this ideal highly improbable. NASA no longer enjoys a nurturing institutional context; instead it faces increased environmental pressures calling for the adoption of political, bureaucratic, and legal accountability mechanisms. Such is the dilemma facing NASA and the challenge confronting all American public administrators.

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Notes

The authors gratefully acknowledge the helpful comments of Dwight Kiel, John Nalbandian, Laurence J. O'Toole, Jr., and anonymous referees.

1. *Report of the Presidential Commission on the Space Shuttle Challenger Accident* (Washington: June 6, 1986), p. 40; hereafter cited as *Rogers Commission Report.*
2. *Rogers Commission Report,* p. 82.
3. See James D. Thompson, *Organizations in Action: Social Science Bases of Administrative Theory* (New York: McGraw-Hill Book Co., 1967), pp. 10-11.
4. Thompson, *Organizations in Action,* p. 11.
5. Besides current astronaut Sally Ride and former astronaut Neil Armstrong, the commission membership included: Eugene Covert, an MIT professor and frequent consultant to NASA who received the agency's "Public Service Award" in 1980; Robert W. Rummel, an aerospace engineer and private consultant who was also a recipient of a NASA public service award; and Major General Donald J. Kutyna, director of the U.S. Air Force's Space Systems program and former manager of the Defense Department's space shuttle program.
6. For example, Commission Chair Rogers was Attorney General for President Eisenhower and Secretary of State for Richard Nixon. David C. Acheson, a well-known Washington lawyer, had previously served as a U.S. Attorney, counsel for the Atomic Energy Commission, and Senior Vice President of COMSAT. Other members of the Commission were: two physicists, Richard P. Feynman and Albert D. Wheelan (Executive Vice President, Hughes Aircraft); astronomer, Arthur B. C. Walker, Jr.; test pilot, Charles E. Yeager; aeronautical engineer, Joseph F. Sutter; and Robert B. Hotz, former editor of *Aviation Week and Space Technology Magazine.*
7. See Paul R. Schulman, *Large-Scale Policy Making* (New York: Elsevier North Holland, Inc., 1980), pp. 22-41; James E. Webb, *Space Age Management* (New York: McGraw-Hill Book Co., 1968); Leonard R. Sayles and Margaret K. Chandler, *Managing Large Systems* (New York: Harper and Row, 1971); and Peter F. Drucker, *Management: Tasks, Responsibilities, and Practices* (New York: Harper and Row, 1974), chapter 47.
8. See discussion in Herbert A. Simon, Donald W. Smithburg, and Victor A. Thompson, *Public Administration* (New York: Alfred A. Knopf, Inc., 1950), especially chapters 24 and 25. Also, Carl Joachim Friedrich, "Public Policy and the Nature of Administrative Responsibility," in C. J. Friedrich and Edward S. Mason, eds., *Public Policy, 1940* (Cambridge: Harvard University Press, 1940), pp. 3-24; and Herman Finer, "Administrative Responsibility and Democratic Government," *Public Administration Review,* vol. 1 (Summer 1941), pp. 335-350.
9. This view of accountability is developed more fully in Barbara Romzek and Mel Dubnick, "Accountability and the Management of Expectations: The Challenger Tragedy and the Costs of Democracy," presented at the annual meeting of the American Political Science Association, the Washington Hilton, August 28-31, 1986.
10. See Max Weber, *Economy and Society; An Outline of Interpretive Sociology,* edited by Guenther Roth and Claus Wittich (Berkeley: University of California Press, 1987), chapter XI.
11. See Alvin Gouldner, *Patterns of Industrial Bureaucracy* (New York: The Free Press, 1954), pp. 159-162.
12. Philosophically and ideologically, the basis of legal accountability is found in the "rule of law" concept; see Friedrich A. Hayek, *The Road to Serfdom* (Chicago: University of Chicago Press, 1944), chapter VI; also see Theodore J. Lowi's call for "juridical democracy" in *The End of Liberalism: The Second Republic of the United States,* 2d ed. (New York: W.W. Norton and Co., 1979), chapter 11.
13. For a comprehensive application of the theory of agency, see Barry M. Mitnick, *The Political Economy of Regulation: Creating, Designing, and Removing Regulatory Forms* (New York: Columbia University Press, 1980).
14. While bureaucratic accountability relies on methods available to members, such as close supervision and rules and regulations, legal accountability is limited to the tools available to outsiders,

such as monitoring, investigating, auditing, and other forms of "oversight" and evaluation.

15. See Carl Joachim Friedrich, "Public Policy and the Nature of Administrative Responsibility."
16. For an example of a professional accountability system, see the story of the Manhattan Project offered in Peter Wyden, *Day One: Before Hiroshima and After* (New York: Warner Books, 1985), Book One.
17. See Emmette S. Redford, *Democracy in the Administrative State* (New York: Oxford University Press, 1969); also see works by Paul Appleby and Herman Finer.
18. See James Thompson, *Organizations in Action.*
19. See Robert C. Fried, *Performance in American Bureaucracy* (Boston: Little, Brown and Co., 1976).
20. It is possible (at least theoretically) for different accountability mechanisms to operate within one agency at different levels of the organization. For example, a professional accountability mechanism may be in operation at the technical level of an organization while a legal accountability mechanism may be used to manage external expectations at the institutional or boundary-spanning level. See Thompson, *Organizations in Action.* For an application of this notion in a related area, see Donald Klingner and John Nalbandian, "Values and Conflict in Public Personnel Administration," *Public Administration Quarterly* (forthcoming).
21. See Hans Mark and Arnold Levine, *The Management of Research Institutions: A Look at Government Laboratories* (Washington: National Aeronautics and Space Administration, 1984), pp. 117-118. On the political support for NASA in those early years, see Don K. Price, *The Scientific Estate* (Cambridge, MA: The Belknap Press, 1965), pp. 222-223. On the effects of its budgetary support through 1966, see Paul R. Schulman, *Large-Scale Policy Making* (New York: Elsevier North Holland, Inc., 1980), pp. 87-88.
22. Through the Apollo program, NASA spent over 80 percent of its funding on research and development (R&D) efforts. See Philip N. Whittaker, "Joint Decisions in Aerospace," in Matthew Tuite, Roger Chisolm, and Michael Radnor, eds., *Interorganizational Decision Making* (Chicago: Aldine Publishing Co., 1972), p. 272.
23. On the early history of NASA by an "insider," see John D. Young, "Organizing the Nation's Civilian Space Capabilities: Selected Reflections," in Theodore W. Taylor, ed., *Federal Public Policy: Personal Accounts of Ten Senior Civil Service Executives* (Mt. Airy, MD: Lomond Publications, Inc., 1984), pp. 45-80. Some analysts have defined that "nurturing consensus" as little more than a "political vacuum" in which the agency got to define its own programmatic objectives. See John Logsdon, *The Decision to Go to the Moon,* cited in Lambright, *Governing Science and Technology* (New York: Oxford University Press, 1976), pp. 41-42.
24. Henry S. F. Cooper, Jr., "Letter from the Space Center," in *The New Yorker* (November 10, 1986), p. 93.
25. Mark and Levine, *The Management of Research Institutions,* pp. 60, 200-202.
26. Schulman, *Large-Scale Policy Making,* pp. 62-74. Also Cooper, "Letter from the Space Center," p. 99.
27. Schulman, *Large-Scale Policy Making,* pp. 74-76; also Mark and Levine, *The Management of Research Institutions,* pp. 117-118.
28. Lambright, *Governing Science and Technology,* p. 43. Also see Wayne Biddle, "NASA: What's Needed To Put It On Its Feet?" *Discover,* vol. 8 (January 1987), pp. 36, 40.
29. It is incorrect to think that NASA was apolitical even during its early years. Tom Wolfe describes a heated argument between John Glenn and NASA Administrator James Webb when Glenn bitterly complained of the number of trips he had to take at the request of members of Congress or the White House. See Wolfe's, *The Right Stuff* (New York: Bantam Books, 1979), p. 331. See also Mark and Levine, *The Management of Research Institutions,* p. 82, for a discussion of the importance of generating "new business" for the agency. The politics surrounding the shuttle are reflected in investigations of the role Fletcher played in awarding contracts for the shuttle project in 1973; see William J. Broad, "NASA Chief Might Not Take Part in Decisions on Booster Contracts," *The New York Times* (December 7, 1986), pp. 1, 14.
30. W. Henry Lambright, *Governing Science and Technology,* pp. 21-22; and U.S. Congress, House, Committee on Science and Technology, *Investigation of the Challenger Accident,* Report, 99th Congress, 2d Session (Washington: U.S. Government Printing Office, 1986), pp. 176-177.
31. John Noble Wilford, "NASA May Be a Victim of Defects in Its Own Bureaucracy," *The New York Times* (February 16, 1986), p. 18E.
32. See Cooper, "Letter from the Space Center," especially pp. 85-96.
33. See Mark and Levine, *The Management of Research Institutions,* pp. 122-123, on NASA contracting. NASA's use of "pork barrel" politics dates to the agency's earliest years; see Amitai Etzioni, *The Moon Doggle* (Garden City, NY: Doubleday and Co., 1964), and Price, *The Scientific Estate,* pp. 21-23. The continuation of political considerations in NASA's contracting practices during the 1970s is demonstrated by the circumstances surrounding the competition for the shuttle's booster rocket contract which was eventually awarded to Thiokol in 1973; see Broad, "NASA Chief May Not Take Part in Decisions on Booster Contracts."
34. *Rogers Commission Report,* p. 176.
35. *Rogers Commission Report,* pp. 176, 201. Also Cooper, "Letter from the Space Center," pp. 99-100, and U.S. Congress, House, *Investigation of the Challenger Accident,* pp. 119-120.
36. William J. Broad, "NASA Aide Assails Panel Investigating Explosion of Shuttle," *The New York Times* (March 16, 1986), p. 23.
37. U.S. Congress, House, *Investigation of the Challenger Accident,* p. 120.
38. U.S. Congress, House, *Investigation of the Challenger Accident,* p. 122. Richard P. Feynman, a member of the Rogers Commission, speculated about agency attitudes regarding safety. He believed the agency might have downplayed the riskiness of the shuttle launching to "assure" Congress of the agency's "perfection and success in order to ensure the supply of funds." See David E. Sanger, "Looking Over NASA's Shoulder," *The New York Times* (September 28, 1986), p. 26E.
39. John Noble Wilford, "NASA Chief Vows to Fix Problems," *The New York Times* (June 10, 1986), p. 22.
40. *Rogers Commission Report,* pp. 153-154.
41. Laurie McGinley and Bryan Burrough, "Backbiting in NASA Worsens the Damage from Shuttle Disaster," *The Wall Street Journal* (April 2, 1986), p. 1.
42. See Victor A. Thompson, *Modern Organization,* 2d ed. (University: University of Alabama Press, 1977), chapter 8.
43. *Rogers Commission Report,* p. 82.
44. On the factors which make it difficult for employees to pass bad news to upper levels of the organization, see Chris Argyris and Donald A. Schon, *Organizational Learning: A Theory of Action Perspective* (Reading, MA: Addison-Wesley Publishing Co., 1978).
45. *Rogers Commission Report,* p. 82.
46. Testimony of Lawrence Mulloy, *Rogers Commission Report,* p. 98.
47. Cooper, "Letter from the Space Center," pp. 89, 96.
48. Testimony of Roger Boisjoly, *Rogers Commission Report,* p. 93. Also see testimony of R. K. Lund, *Rogers Commission Report,*

p. 94.

49. David E. Sanger, "Top NASA Aides Knew of Shuttle Flaw in '84," *The New York Times* (December 21, 1986), pp. 1, 22.
50. See William J. Broad, "NASA Had Solution to Key Flaw in Rocket When Shuttle Exploded," *The New York Times* (September 22, 1986), p. 1; and David E. Sanger, "NASA Pressing Shuttle Change Amid Concerns: Fear of Short-Circuiting Safety Search Raised," *The New York Times* (September 23, 1986), p. 1.
51. In July 1986, the family of shuttle pilot Michael Smith filed a "wrongful death" suit against NASA and some of its top managers. Later settlements with other families were announced. See William J. Broad, "4 Families Settle Shuttle Claims," *The New York Times* (December 30, 1986), p. 1.
52. *Rogers Commission Report,* pp. 199-201.
53. *Rogers Commission Report,* p. 198.
54. *Rogers Commission Report,* p. 199.
55. *Rogers Commission Report,* pp. 198-199.
56. Members of Congress criticized the Commission for not going deeply enough into the question of which individuals bore direct responsibility for the accident. See Philip M. Boffey, "Shuttle Panel is Faulted for Not Naming Names," *The New York Times* (June 11, 1986), p. 16.
57. Philip M. Boffey, "NASA Challenged on Modification That Rockets Met Requirements," *The New York Times* (June 12, 1986), p. 18.
58. John Noble Wilford, "Threat to Nation's Lead in Space is Seen in Lack of Guiding Policy," *The New York Times* (December 30, 1986), p. 18.
59. *Rogers Commission Report,* p. 96.
60. See Charles Perrow, *Normal Accidents: Living With High Risk Technologies* (New York: Basic Books, Inc., 1984).
61. Our suggestion that a professional system of accountability is the most appropriate to NASA should not be construed as an endorsement of professional accountability under all circumstances. Rather, our point is to indicate that the type of accountability system needs to suit the agency task.