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Airport Security, High Reliability, and the Problem of Rationality

The events of September 11, 2001, have raised troubling questions regarding the reliability and security of American commercial air travel. This article applies the concepts and logic of high-reliability organizations to airport security operations. Contemporary decision theory is built on the logic of limited or buffered rationability and is based on the study of error-tolerant organizations. The concept of high-reliability organizations is based on the study of nearly error-free operations. For commercial air travel to be highly secure, there must be very high levels of technical competence and sustained performance; regular training; structure redundancy; collegial, decentralized authority patterns; processes that reward error discovery and correction; adequate and reliable funding; high mission valence; reliable and timely information; and protection from external interference in operations. These concepts are used to inform early-stage issues being faced by both local airports and the newly established Transportation Security Administration.

On September 11, 2001, the nation and much of the world was transfixed by televised coverage of four commercial passenger airplane hijackings carried out by four small groups of suicidal terrorists who piloted the commandeered planes into the twin towers of the World Trade Center in New York City, the Pentagon in northern Virginia—just three miles from the White House and the U.S. Capitol building—and, were it not for a struggle with resistant passengers, into another important building. The events of that day resulted in the loss of approximately 3,100 lives and untold billions of dollars in damage to buildings and other physical infrastructure, and launched a global war against terrorism. The events of that day also raised troubling questions regarding the reliability and security of American commercial air travel.

The organization and management of commercial air travel in the United States is a complex, fragmented array of horizontal, vertical, and lateral linkages between multiple jurisdictions at all levels of government; a wide range of types of corporations and unions; and a wide range of types of contractors—a system rather than a hierarchy or an organization (Moynihan and Roberts 2002, 141). The terrorist attacks of September 11th bring the security of the air travel system into focus: wide-angle foci on the whole air travel system, and narrow-angle foci on its system components. This article is a narrow-angle application of the logic of high reliability to airport operations—particularly passenger and baggage security—and a consideration of the policy and management implications of that application.

Commercial air passenger security is part of a unique class of institutional characteristics and decision-theoretic challenges that are collectively described as *high-reliability organizations* (HROs). The imperatives of organizational reliability vary from error-tolerant organizations that are doing so-called impossible jobs, such as trying to reduce prison recidivism or drug traffic, to error-adverse organizations, such air traffic control or nuclear power generation (Hargrove and Glidewell 1990). Much of what we

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know about public organizations and their management is based on the study of error-tolerant organizations, with their difficult-to-measure social purposes, ambiguous political messages, limited resources, trials and errors, and, therefore, tolerance for failure (March and Olsen 1995). Based on the study of error-tolerant organizations, theories of buffered or limited rationality, muddling through, mixed scanning, incremental decision making, contingency, efficiency, and sense making have dominated our literature. These theories describe organizational and system order and administrative behavior within that order, which seeks effectiveness while both anticipating and accepting at least some level of organizational failure. But standard organizational theory fails to deal with the very special organizational problem of reconciling the high costs of maintaining procedures that guarantee security in the face of fundamental uncertainty as to whether and when a threat might occur and the particular nature of that threat (Whitford 2001). Error or failure in the commercial air travel system is publicly unacceptable, as the events of September 11, 2001, have indicated. And high levels of delay in the air travel system are also unacceptable, as the air travel responses after September 11th indicate. To sort out the puzzle of combined expectations of error-free and relatively delay-free air travel in the context of efficient security screening processes, one must first turn to standard theories of controlling for error and then to the concept of high-reliability organizations.

Comparing the Classic Public Administration and the Structured Redundancy Schools

In the aftermath of September 11th, Congress passed and President Bush signed the Aviation Security Act, which established the Transportation Security Administration (TSA) and gave it responsibility for all passenger and baggage screening, previously the responsibility of each commercial air carrier. As is now well known, airlines contracted out passenger and baggage screening to firms that paid very low wages, required minimal qualification, and, as a consequence, experience high personnel turnover. It is now estimated that the TSA will hire and train—following rather strict security checks—about 50,000 passenger and baggage security persons, and it will direct and oversee the purchase and installation of improved and rather expensive baggage screening equipment. Finally, in conjunction with local airport security directors, the TSA will develop strengthened procedures and protocols for controlling access to all "land-side" ramps, storage areas, parked airplanes, parking lots, doors, and the like. The Federal Aviation Administration retains control of all "air-side" aspects of air travel, including moving airplanes around the airport, landing, takeoff and flight (see Ashford, Stanton, and Moore 1996, 254–80, for a full description of land-and air-side operations in airport security; see also Jenkins 2002). Many other important aspects of the Aviation Security Act and other congressional and executive branch initiatives followed September 11, 2001, but they are not central to the issues being considered here.

To put the passage of the Aviation Security Act and the creation of the TSA in theoretical perspective, consider these contrasting perspectives on organizational design and decision rationality. It would be correct to assume that the act's purpose and the TSA's mission are to control passenger and baggage access to airports and air travel, so as to prohibit terrorists or other dangerous persons and dangerous objects from getting on or near commercial airlines. What are the probabilities that the act and the TSA will be able to effectively exercise this control and prevent error—error being defined as a dangerous person getting on or a dangerous object being put on an airliner?

The first and dominant perspective on the rationality of control is understood to be classic or traditional public administration. In traditional public administration, duplication and overlap are to be avoided; costs are to be minimized for a given level of services, or services are to be maximized for a given level of dollars; and tasks and responsibilities are scalar, organized in a hierarchy of authority (Heimann 1993, 1997). In contemporary terms, the classic model is modified by extensive contracting out and by attempts to measure performance or results. Still, the rational logic is one of control through bureaucratic order, although the maintenance of order and control is now often exported to private firms or nonprofit organizations and implemented by a vast shadow bureaucracy. The theory of "normal accidents" argues the statistical probability of accidents and suggests that control-system components interact in complex ways that can increase the probability of whole-system failure (Perrow 1984; Sagan 1993). In such circumstances—and modern air travel fits these circumstances—centralized and streamlined authority best controls the whole system. The passage of the Aviation Security Act and the creation of the TSA fit fairly comfortably into the classic public administration model of the rationality of control and the perspective of the normal-accident theorists (Ting 2001). Structured redundancy is the second, less established perspective on the rationality of control. Most of the elements of the theory of redundancy are the work of Martin Landau (Landau 1969, 1991; Landau and Stout 1979; Landau and Chisholm 1995). Redundancy theory "accepts the inherent limitations of any organization by treating any and all part—regardless of the extent of perfection—as fallible, as prone to error. It upsets the time-honored but incorrect belief that a chain is no stronger than its weakest link.… Can we design organizations that are stronger, more reliable, more effective, than any of their units? The answer is yes: It can be done by adding sufficient redundancy. And the simplest form of redundancy is duplication" (Landau 1991, 15). Redundancy theory is especially applicable in organizational domains that are associated with high levels of technology. Passenger airplanes, space travel, computers, metropolitan transportation systems, American federalism, market economy, and a range of other domains have been demonstrated to have increased reliability by structured redundancy (Ting 2001; Heimann 1993, 1997; Chisolm 1989; Bendor 1985; Lerner 1986; Sah and Stiglitz 1986; Kee and Shannon 1992). Redundancy theory also borrows from physiology: There are four systems to maintain blood pressure; seven systems to keep body fluids at the proper acid levels; and the brain is so dense, complex, and redundant that it defies description (Landau 1991). The full application of the logic of redundancy asks that the parts of the system be loosely coupled or sufficiently independent of each other, so that a failure in one part is an independent event that can be compensated for by the other parts of the system. Structured-redundancy advocates argue that the sum of the redundant parts should be greater than the parts. Tightly coupled systems—parts organized in a sequence or a series—are not only not redundant, they can be dangerous if the failure of one part ensures the failure of the others.

Tests of these contrasting perspectives on organizational structure and decision rationality for the purposes of controlling for error are usually designed to evaluate whether a particular hypothesis is true or false. In the context of airport security, and particularly decisions to load or not load a passenger or a bag, type I and type II errors can be understood in terms of figure 1. Assume the hypothesis that the passenger should be boarded or the bag should be loaded. If that hypothesis is correct and the passenger is boarded, then there is perfect airport security. But, if the passenger is not boarded or the bag is not loaded, then there is a type I error, sometimes called a false positive. Given the hypothesis, a type I error is expensive in time and money and, if there are many type I errors or false positives in an hour or a day, there will be inefficient air travel. Assuming the same hypothesis—that the passenger should be boarded or the bag should be loaded—if the passenger is a terrorist or the bag is a bomb, there is a type II error. As we learned on September 11, 2001, a type II error of this sort can lead to catastrophe.

Figure 1 Passenger Boarding and Baggage Loading*

		Board and load	Do not board and load
Actual Decision	Board and load	Correct decision Reliable flight	Type II error Accident or hijacking
	Do not board and load	Type I error Wasted resources, inefficient air travel	Correct decision Accident or hijacking avoided

Hypothesis: Passenger should be boarded or baggage should be loaded.

*Type I and II errors are a bimodal statistical test of the null hypothesis. Following Landau and Stout, for heuristic purposes, a type II error is defined here as "accepting as true an hypothesis which is false" (1979, 153).

Advocates of both schools of thought, the classic public administration school and the structured redundancy school, claim their approach is most likely to prevent type II errors (Landau and Stout 1979; Sagan 1993; Perrow 1984). The passage of the Aviation Security Act, the creation of the TSA, and the federalization of the baggage and passenger handling system, appear to incline toward the classic public administration school as the decision-theoretic approach that Congress regards as the most likely to prevent type II errors. In his splendid analysis of the Challenger space flight disaster, however, Heimann (1993) finds both significant advantages and important deficits associated with too great an emphasis on either the classic public administration or the structured redundancy perspective. "I have demonstrated, both in theory and in the case of NASA, that changes in the number and alignment of administrative components alters the probability that an agency would commit either a type I or a type II error. Perhaps most interesting is the fact that NASA changed its institutional configuration to appease both the traditional and the Landau schools of thought in public administration, yet both decisions contributed to the biggest failure in NASA history" (Heimann 1993, 433) In the early stages of the space program, Heimann finds, there was greater demand for type II decision-theoretic reliability (as we describe it here), with an emphasis on redundancy and quality control. Later, to streamline processes, eliminate duplication, and save money, there was a greater demand for type I reliability. Then, after the Challenger disaster, there was a return to type II decision logic. In view of these swings in decision logic, Heimann suggests a "three state world" to provide for a "theoretically richer and more empirically useful framework for evaluating organizational reliability" (433). Heimann's three-state world is similar to the concept of high-reliability organizations, the subject to which we now turn.

Organizational High Reliability

The perspective of highly reliable organization is based on many years of direct observation of error-intolerant systems such as air traffic control, nuclear power generation, nuclear submarine and aircraft carrier operations, production of the components of nuclear weapons, and electricity transmission systems (LaPorte 1988, 1996; Heimann 1993; Jenkins 2002; LaPorte and Consolini 1991: Lohmann and Hopenhayn 1998; Perrow 1984; Roberts 1990; Rochlin 1993, 1996; Rochlin, LaPorte, and Roberts 1987; Rochlin and von Meier 1994; Sagan 1993; Schulman 1993: Ting 2001; Weick and Roberts 1993). High-reliability conceptions shift the issue from the traditional public administration–redundancy debate to how the primary units in complex systems function under strict reliability criteria. By any measure, the safety and reliability of these systems is remarkable. Studies of high-reliability operations attempt to explain how primary units in complex systems achieve nearly error-free results over time. This unique class of organizational systems works in the context of the essential insistence that they be nearly failure free, and, with rare exceptions, they are. These organizational systems are deeply embedded in the public sector, and many are operated by public servants and overseen by regulatory agencies, legislative committees, and elected or appointed executives. Because these high-reliability systems have much in common with the challenges faced by the contemporary air passenger and baggage security system, the theory that has emerged from the study of highly reliable organizations usefully informs the issues at hand. Modeling the internal and external properties of high-reliability organizations aids the application of those properties to the air passenger and baggage system.

The Internal Properties of High-Reliability Organizations

The internal properties of high-reliability organizations (HROs) (*HRint*) begin with two imperatives, adequate financial and human resources (*fr*) and a strong, shared sense of mission *valence* (*mv*) that includes a collective commitment to highly reliable operations in terms of both safety and production.

Several organizational and managerial properties determine the internal reliability of system operations (*o-m*), including extraordinary levels of technical competence (*tc*); sustained high technical performance (*sp*); regular and continuous training (*t*); structural redundancy (*r*): flexible decision-making processes involving operating teams (*ot*); collegial, decentralized authority patters in the face of high-tempo operational demands (*da*); and processes that reward error discovery and reporting and a continual search for system improvement (*er*).[1]

The high-reliability systems observed in the initial array almost always involve either very dangerous materials or highly complex technologies. Because failure in the use or application of these technologies will have catastrophic consequences, high-reliability systems are adequately—if not generously—funded. Commercial air travel in America is almost a perfect example. On any Friday between 3:00 p.m. and 7:00 p.m., about 500,000 people will be traveling at 500 miles per hour in every conceivable direction, all directed by the air traffic control system. Because system failure, however rare, is dramatic and horrible, we invest adequately (though the adequacy of funding is always a debatable point) in the human and technological capital needed to ensure the reliability of air traffic control.

Because we have experienced airplane hijackings and recognize it as a threat to system reliability, commercial airlines were required to invest in passenger and baggage screening (airport screening for drugs is federalized). It has been in the interest of both commercial airline companies and air travelers to control the costs of passenger and baggage screening, controls that were implemented by the airlines through third-party contracting, recognizing that contractors would control costs through low wages and benefits. Furthermore, in the United States, unlike in some other parts of the world, airplane hijacking had all but disappeared, so it was evident that airport security was effective as a deterrent. It seemed, therefore, that the passenger and baggage screening system was both overly expensive and a drag on the efficient movement of passengers. In other words, it appeared the airport security system was making too many type I errors. Even if, over time, passenger and baggage security systems were less than adequately funded, and therefore less than fully reliable, in the event of a hijack, the results probably would not be catastrophic. Prior to September 11, 2001, the possibility of a suicide hijacker causing an airliner to crash might have been believed, but the idea of groups of trained suicide terrorists who would be able to fly airliners into large buildings was simply beyond the range of belief. Therefore, on September 11, 2001, in the space of about two hours, our passenger security system made 19 terrible type II errors. Now that the risks associated with less than fully reliable passenger and baggage security are vividly evident, the adequate funding of passenger and baggage security is just as imperative as adequate funding of the air traffic control system. Although there can be some economies, in the world of high reliability, you get about what you pay for. Therefore, adequate funding is the imperative upon which all other properties of highly reliable operations depend. TSA budget requests are not yet finalized, but it appears there will be a request for an overall staff of 50,000 persons, which would make TSA more than twice as large as the air traffic control system and larger than the FBI, Customs Service, Drug Enforcement Administration, and Border Patrol systems combined. Once the newly built passenger and baggage screening system is in place, and if it performs adequately, errors in the future will be type I. Given the limitations of present technology, however, there will likely be high false positives in the screening process—type I errors. A typical false positive would be the identification of a bag (checked or carry-on) as containing a possible explosive and, upon opening the bag, finding electronic equipment such as a shaver or a hair dryer.

Like many so-called high functioning or high-culture public organizations, such as the FBI, the Bureau of Prisons, and the military, high-reliability organizations exhibit a strong collective sense of mission valence (DiIulio 1994). In the special case of HROs, norms of attention to the equal importance of system performance and safety are particularly evident. Patterns of high career and individual identification with organizational purposes are standard. With low wages, high turnover, and few career prospects, the companies that previously managed passenger screening were unable to build high levels of organizational identity and mission valence. Now that passenger and baggage security has been federalized and the prospects for adequate funding are improved, the TSA has much better prospects for building an organizational culture with high mission valence.

The management of high-reliability systems is characterized by complex technologies and patterned interactions between these technologies and their human operators. The operation of these technologies is ordinarily based on understanding and following established protocols and procedures. It is essential, therefore, that system operators have extraordinary levels of technical competence and demonstrate sustained high technical performance. This requires extensive initial education to establish base-level qualifications and continuous training to stay abreast of changing threats and technological adaptation. Because the technologies of passenger and baggage screening are rapidly multiplying (new screening technologies for explosive powders and liquids and for baggage x-ray, for example), changing, and improving, the required qualifications, experience, and training for system operators will need to increase dramatically. If the TSA sets the qualifications bar high and invests in continuous training for system operators, the prospects for genuine high reliability are good.

But good machinery and competent operators must be matched by a management approach that emphasizes the development of teams operating in collegial, flexible, and decentralized authority patterns. Because high-reliability systems follow strict protocols and carefully developed standardized procedures, it might be assumed that very formal authority hierarchies are called for. While formal hierarchies are evident, they do not operate at all times. System operators who are trained to follow established protocols and procedures do not need authority hierarchies to enforce them. Instead, they need flexible decision environments in which they can work together in teams to implement protocols in the face of expected contingencies. In such settings, the prospects for error reporting and even the reporting of one's own error are improved. A tolerance for error reporting—indeed, a welcoming approach to error reporting—is essential to the search for system improvement, and particularly to the challenge of recognizing when it is time to recommend changing protocols or procedures and identifying conditions under which protocols can be overridden.

Perhaps the greatest organizational and managerial challenges to high-reliability systems are the competing forces of operating demanding technology to avoid failure, on one hand, and maintaining the capacity to meet periods of peak demand whenever they occur, on the other hand. Certainly this is the challenge in the organization and management of air travel security. To unpack this challenge, consider an illustration from the air traffic control system. At times of peak load, air traffic controllers at the end of flight terminal control segments are to maintain at least a three-mile distance between aircraft as they descend to final landing patterns—the protocol or decision rule. If, at peak load, controllers allow for greater separation, traffic backs up at one site and may effect traffic at other sites, and so forth. It is not unusual, however, for experienced controllers, in order to assure that incoming airplanes arrive at three-mile intervals, to push the air traffic control management rules, depending on circumstances such as weather or the size of the airplane. Controllers who are able to bring aircraft in at exactly three-mile intervals are known among other controllers as "artists." Based on experience, they are able, under peak load conditions, to shift the production-risk equation slightly in the direction of production without increasing risk. Because other controllers as well as supervisors recognize that "pushing the rules" does not increase risk but does facilitate production, they protect and even revere these artists.

Air passenger and baggage security is an especially interesting case because, in addition to the difficulties of maintaining close attention to increasingly automated passenger and baggage screening technologies, certain key decision elements are judgmental and as yet lack precise decision rules. Elements of passenger age, gender, race, ethnicity, behavior, and appearance have to do with the level of risk and are likely as informative as data provided by machines. This is further complicated by our democratic commitment to fairness and our concern with possible racial or ethnic profiling. Applying the air traffic control example to air passenger and baggage security systems, it is evident that a balanced consideration of production and risk will require system operators to both know their automated technologies and build a repertoire of judgmental understandings of passengers and their baggage—in short, to become skilled risk-evaluation artists. It is also important to retain loosely coupled redundant processes, such as two personal-identification checkpoints, random searches, video surveillance, and so forth.

Because air travel security system operators are face-to-face with passengers, the tempo of production and the pressures associated with that tempo are somewhat different than high-reliability systems in which operators are distant and once or twice removed from their customers, such as nuclear power plant operations. In addition, very few people understand the mysteries of nuclear power generation. But most of us fly and, therefore, have a rudimentary understanding of the present passenger and baggage screening process. In the immediate aftermath of September 11, 2001, most of us have been patient with the trade-off between production and reliability, and therefore we are willing to get to the airport early, stand in long lines, and go through far more rigorous examinations of ourselves and our luggage. We are in direct contact with the operators of what we believe will become a high-reliability system, and we are able to observe and evaluate them, albeit on the basis of limited knowledge of what they are doing. In addition, air travel (and particularly anomalies in air travel) have been widely covered in the press. So, as is true with religion and politics, we all have experiences with and opinions about the air travel security system.

When air travel tempo is high on, say, a Friday afternoon, how patient will we be with the reliability system when it is evident that system operators are willing to make type I errors, causing the air travel system to be inefficient, because type II errors would be catastrophic? Will the face-to-face characteristics of the passenger and baggage security system and the media attention it gets, particularly as we are removed in time from September 11, 2001, result in reduced attention to risk and increased attention to productivity? The answers to these questions turn, in part, on the funding, mission valence, organization, and management of the air travel security system.

The application of the internal high-reliability model to air travel security does not include a consideration of contracting for services, a very common practice in government and the primary arrangement for passenger and baggage screening before September 11th. Judged on the basis of the internal properties found in high-reliability organizations, the functioning of the pre–September 11th passenger and baggage screening work done by the contract companies would be given very low marks. They could fairly claim, of course, that in the absence of adequate resources, they were unable to build work groups with high mission valence and technical competence. But the subject is more complex than that. Contracting out is common in high-reliability systems, and the results are not unlike the general findings on the subject (Kettl 1988, 1993). Contracting out introduces the problem of split loyalties, particularly in work groups. With contracting, it can be difficult to harmonize the work cultures of direct and contract staff. This was especially evident under conditions of peak load or in the event of an error (LaPorte and Consolini 1991; LaPorte 19??). Finally, the management and oversight of contracts is a continual problem in the federal government. The TSA already has contracted for training services, and it remains to be seen whether all or part of the passenger and baggage security system will be contracted out. Contracting can work well when there are organizations skilled in providing the services needed. But the more technical or unique the needed services, the more precarious the contract (Kettl 1993).

To summarize, the internal reliability of the air passenger and baggage security system will be at least a function of adequate funding, mission valence, and the organization and management qualities of technical competence, sustained technical functioning, training, structured redundancy, collegial decentralized teams working under conditions of flexible decision making, and processes that reward error discovery. We now turn the external properties of highly reliable systems and their application to air travel security.

The External Properties of High-Reliability Organizations

The external properties of HROs (*HRext*) are expressed in terms of the varying characteristics of top-down governance, policy making, and oversight (*G*), which include governmental structure (*gs*); the visibility or salience of the high-reliability system to the governing body or bodies (*v*); the presence of stakeholder groups in the governing body or bodies (*gsh*); the presence of stakeholder groups in the high-reliability organization (*osh*); mechanisms for managing boundaries between the high-reliability system and governance, often in the form protecting the system and its technology from external influences and buffering the effects of contextual turbulence (*p*); and the availability of venues for credible operational information on a timely basis (*oi*) (LaPorte 1996).[2]

Before the passage of the Aviation Security Act, airline contracts with private security firms for managing passenger and baggage security were under relatively strict federal rules and guidelines. Although this model appeared to be fragmented—and it was—in fact, all of the airlines and their contractors were in standard regulatory principal–agent patterns that provided substantial order to the system. Indeed, in their comprehensive review of national security completed just nine months prior to September 11, 2001, the U.S. Commission on National Security/21st Century (the so-called Hart-Rudman Commission) made many recommendations for sweeping changes in the federal government's organization for security, but no recommendation for change in the governance arrangement for domestic air travel (2001). Following our earlier application of the logic of the internal properties associated with high reliability to air passenger and baggage security, it could be argued, in retrospect, that although fragmented governance might have been a problem, the bigger problem was inadequate funding and the absence of mission valence and other managerial and organizational qualities of high-reliability organizations.

With the passage of the Aviation Security Act, the formal governance of the air passenger and baggage security system becomes the responsibility of the TSA, an agency in the Department of Transportation. Under the direction of the secretary of transportation, the TSA has dotted-line responsibilities to other executive agencies such as the Office of Management and Budget and now the Office of Homeland Security. Just as important, however, are contemporary patterns of congressional comanagement and the dotted-line relationships of the TSA to the Senate and House Committees on Transportation and Infrastructure, and, of course, to the appropriations committees and subcommittees (Gilmour and Halley 1994). The complex horizontal, lateral, and vertical network of participants in the air travel security system is still in place, augmented now by the coordinating role of the Office of Homeland Security (Moynihan and Roberts 2002). While the establishment of the TSA concentrates air passenger and baggage responsibility directly in governmental hands and provides a system of finance that is independent of the air carriers, it does not reduce the system's overall fragmentation and complexity. Much of the contemporary debate over whether the Office of Homeland Security should have more than just coordinating responsibilities has to do with perceived disarticulation between the fragmented components of the air security system.

Although the TSA is organized nationally and its policies and programs are comprehensive, implementation will be decentralized at airports across the United States. Therefore, one of the most important external features of high reliability will be the couplings forged between local units of the TSA and the governance and administration of local airports.

Most American airports are owned by cities and operated as departments of aviation in city governments, particularly in smaller and intermediate-sized jurisdictions. Larger airports are owned and operated in several ways. Logan Airport in Boston, for instance, is owned and operated by Massport, an independent authority of the Commonwealth of Massachusetts. Several large city airports are parts of interstate compacts: The best known of these are the airports of the Port Authority of New York and New Jersey, which holds long-term leases on and operates LaGuardia, Kennedy, and Newark airports, as well as smaller airports and heliports; and the Metropolitan Washington Airports Authority (Maryland, Virginia, and Washington, DC), which leases and operates the Washington National (Reagan) and Dulles airports. Of the 30 largest American airports, 20 are owned or operated by authorities and 10 are city departments of aviation, such as those in Kansas City, Salt Lake City, Miami–Dade County, and Chicago.

When it is applied to airports, the logic of autonomous government authorities, often called "government corporations," is to separate airport operations from city political affairs and bureaucratic rules and regulations and have them operate on a businesslike basis. They are governed by a board of directors appointed by elected executives. In each case, the board appoints a full-time executive director, who in turn appoints the senior staff of the authority. The rest of the authority staff are appointed and holds office on the merit basis of civil service. They set gate, landing, and other fees and rents for services, and they are empowered to issue tax-exempt revenue bonds to finance long-term operations. They are expected to operate on a self-supporting basis, and they do.

Departments of aviation have much of the same financial flexibility, but they tend to operate under standard city executive and legislative rules over staff appointments, salaries, and contracts.

The most comprehensive study of government authorities concludes that "On the one hand, they have built some of the nation's most highly acclaimed structures (including the World Trade Center); implemented important public policies with utmost care, and provided jobs and other economic benefits for untold numbers of Americans. On the other hand, some are so secretive and complicated that not even the most astute scholar can figure them out; a number of them have made decisions in a manner that makes them look unaccountable and incompetent; and too many of them seem especially apt to become involved in activities that are at best questionable and at worst illegal and undemocratic" (Mitchell 1999, 127; see also Burns 1994)

Following September 11th, a study of Logan Airport in Boston "found that patronage at Massport is a four headed monster, taking the following forms: the hiring of unqualified individuals, the creation of new positions to accommodate applicants, the awarding of contacts to companies with inside connections, and financial contributions to charities or outside parties that go beyond community goodwill" (Special Advisory Task Force on Massport 2001). The study further found that Logan Airport was "overstaffed, particularly at top levels of administration. There is also duplication of function, excessive layers of middle management and a lack of access to the CEO by the managers of the core functions…" (3).

Massport is, no doubt, the most egregious example of airport mismanagement, and there is little evidence that other large airport authorities or city aviation departments are similar. The larger point is that local airports vary in their governance in important ways, and, because these airports are the hosts of the local units of the TSA, those local units must recognize these variations and adapt locally in ways that will ensure air passenger safety. This form of structural decentralization can work effectively, particularly if the properties of internal high reliability are in place locally.

The governance, organizational, and management structures of local airports are critically important because they manage much of the air-side and land-side interface. Because modern airports look and even act like shopping malls, passengers usually are unaware of the complex patterns of air-side services and activities, including fueling, cleaning, maintenance, catering, deicing, and so forth. The critical air-side issues include fencing and other forms of perimeter control, the identification of persons, the identification of vehicles, the protection of aircraft on aprons, the management of general (noncommercial) aviation, and the management of cargo and package air services. There are elaborate protocols for each of these functions, and even international conventions, treaties, and protocols that most major world airports follow (Ashford, Stanton, and Moore 1996). Other than hijacking, security failures such as drug smuggling and bomb placement are far more likely to happen on the air side than the land side.

To manage the security aspects of air-side activity, all major airports have a director of airport security with a staff reporting to the chief executive officer or the department head. The background and qualifications of these directors vary widely (the security director at Logan Airport, for example, had no background in security), as do the qualifications, training, and professionalism of the airport security staffs. In the wake of September 11th, under general FAA guidelines, airport security staff, along with some elements of law enforcement (in many cases airport security defines itself as law enforcement and is commissioned), have been reviewing the background of air-side workers who hold identification cards allowing them open access. The FAA is also in various stages of reviewing all other critical air-side points of vulnerability. This will lead, it is assumed, to a general tightening of air-side security standards and to improved security operations. It is evident that local airports have essentially the same challenge that the TSA has in terms of developing an internal high-reliability system.

Because the local airport is the host of TSA passenger and baggage security, it is important that the interface between the airport security director and staff and the local TSA group be carefully developed and maintained. Based on present TSA plans, every major airport will have a federal security director who is compensated at the top of the senior executive service range. Thus far, it appears these jobs are being filled by former police chiefs, generals, and admirals. They will have trained forces of sworn officers at passenger and baggage checkpoints and elsewhere on both the land and air sides of local airports. At all of these locations, TSA staff will be in direct contact with local airport security as well as the employees of airlines and airline and airport contract organizations. All of these interface points hold the potential for cooperation or for tension and conflict.

Like many other aspects of governance, high-reliability organizations have an advantage when they have high visibility in their governing body or bodies. Visibility can, however, be a function of system failure. In the closing section of this study, we will consider the unique decision rationality of failure.

As with other aspects of governance, high-reliability organizations are helped by the presence of stakeholders in both their governing bodies and their direct management. This is a form of the application of co-optation to high-reliability organizations (Selznick 1949).

Because of the complex technology involved, the pressures of production—particularly at periods of high demand—and the imperatives of error-free functioning, high-reliability organizations are deeply dependent on solid and dependable venues for reliable and timely information.

Finally, high-reliability organizations depend on effective management of their horizontal boundaries with other organizations. The above description of the boundaries between local airport security operations and the local units of the TSA illustrates the point. The tightness or looseness of interorganizational coupling is important: tight or serial coupling of nonredundant or nonparallel units under which an error in one unit informs the other units but does not simply magnify the error, and loose coupling of redundant units so that failure in one unit will be caught by the redundant unit and acted on (Landau 1991).

A second form of boundary management and an important feature of HROs takes the form of protecting the technology and culture of the organization from vertical influences and contextual turbulence (Thompson 1967). Put in the language of public administration, the policy–administration dichotomy is alive and well in high-reliability organizations. Based on his recent study of innovation at five airports, Scott E. Terry concludes that "political leaders would be best advised to find qualified airport administrators who understand fully the business of air transport and then give those administrators the autonomy to innovate" (2000, 35). Many of the internal properties of high-reliability organizations depend on both protection from external forces and external forces that insist on investing in reliability-enhancing activities. In the visible and high-tempo world of air travel, the TSA will need to find buffers and insulation from external forces if it hopes to build a highly reliable passenger and baggage security system.

To summarize, the external properties of high reliability in passenger and baggage security systems will be at least a function of carefully sorting out the structural characteristics of the TSA at the top, including finding ways to maintain visibility among and salience for key decision makers in the absence of type I errors. The challenge will be to build support among key principals while protecting core TSA functions from undue interference. At the local level, airport by airport, TSA staff must carefully build positive, mutually supportive relationships with local airport security staff and with the full range of airside workers.

The Problem of Rationality

In the modern world of government program evaluation and performance measurement, the rational assumption is that organizational effectiveness will result in greater program investment. Indeed, the Government Performance and Results Act of 1993 mandates a connection between the quality of annual performance and future budget treatment, a mandate that has been honored in the breech. In the case of high-reliability organizations, it is nearly impossible to know how many type II threats there were or how many type II errors there might have been, were it not for effective passenger and baggage security. This is the rationality of preventing bad things from happening while facilitating the efficiency of commercial air travel.

In this form of rationality, it appears there is an inverse relationship between effectiveness and future possible program investments. Errors in high-reliability systems are so visible and catastrophic that they appear to increase rather than decrease the prospects for program funding. In modeling terms, the rate of high-reliability program investment (HRI_t) is a function of capital (K_{t-1}) at one point and an accident (A_{t-1}) at that point, resulting in greater capital at a future point (K_{t-2}) and an accident at that point (A_{t-2}), resulting in even greater capital, and so on.[3] If this is true, then the reverse can also true. As a consequence of September 11th, there has been significant investment in air travel reliability. Right now, if there are errors, they will be type I—errors of production inefficiency and duplication. While memories of September 11th are fresh, there is a collective determination not to make type II errors. Over time, as memories of September 11th fade, if there are no subsequent air accidents associated with errors in passenger or baggage screening, and assuming a crowded and competitive policy and budget-making arena, there will be pressure to reduce funding for passenger and baggage screening. In other words, in the world of high reliability, effectiveness can result in declining investments, a public administration problem that has been described as the crisis and anticrisis dynamic (Kee and Shannon 1992). Because one of the essential properties of high-reliability systems is adequate funding, this can be a serious rationality problem.

This phenomenon can be described as a loss of focus and can be compensated for through the logic of reserve rationality (Whitford 2001). A possible future catastrophic event may be believable, but the probability is low and very unlikely in the distant future. Reserve rationality describes ethical attention on the part of policy makers to long-range threats to future generations as a formal, rational calculus, and it argues that in unique cases of possible future catastrophic events, short-run, rational, cost–benefit calculus is inappropriate. The presence of a respected meritocracy, not unlike the qualities of internal high-reliability organizations, has been found to increase the prospects for reducing focus loss and increasing reserve rationality (Whitford 2001)

Finally, there is a good old-fashioned public administration solution to the problem of possible diminishing investments in successful high-reliability systems—fees for service and earmarking. If a sufficiently high ticket tax or surcharge is established and set aside to support the TSA and related air travel security functions, it can be said that the TSA is self-supporting. With ticket surcharges and earmarking, the prospects for continuing adequate investments in the TSA would be good. If the TSA has to compete with other transportation needs for general-fund support, the prospects for continuing adequate funding would not be good. Thus far, the news is not good. Congress has approved only a $2.50 one-way ticket surcharge, far below the rate needed to accrue the finances needed to offset TSA costs.

Even if funding for passenger and baggage security is adequate, there is still the problem of balancing air travel efficiency and security. Over time, in the absence of type II errors, the focus will be on type I errors, and because no system is entirely efficient, there always will be type I errors. Because so many people have direct contact with the passenger and baggage security system, as we are removed in time from September 11, 2001, it is likely that those people, in the absence of type II errors, will assume the system is safe and will, therefore, demand greater air travel efficiency. Against this probability, it is essential that the TSA become a politically credible, highly professional, trusted high-reliability organization. The lessons learned from the study of highly reliable organizations regarding the careful balance of error avoidance and passenger efficiency should be helpful in this pursuit.

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Notes

1. In this study, we present narrative models, but we see the potential for formal modeling (Heimann 1993). In formal modeling terms, the internal properties of high-reliability systems can be expressed as *HRint = (fr) (mv) o-m (tc, sp, t, r, ot, da, er)*.

   We recognize the very limited treatment here of the assumptions built into this model, as well as the additive or multiplicative challenges in it. We will argue these matters in subsequent research.

2. In formal modeling terms, the external properties of high-reliability systems can be expressed as *HRext = G (gs, v, gsh, osh, p, oi)*.

3. The possible inverse relationship between the effectiveness of systems that are highly reliable and their future funding probabilities could be expressed as $HRIt = f\ (K_{t-1}, A_{t-1}, K_{t-2}, A_{t-2} \ldots)$.

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