Review: The "Cog in the Machine" Manifesto: The Banality and the Inevitability of Evil
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Source: *Business Ethics Quarterly*, Vol. 8, No. 4 (Oct., 1998), pp. 743-756
Published by: Cambridge University Press
Stable URL: http://www.jstor.org/stable/3857551
Accessed: 29-06-2016 03:04 UTC

THE "COG IN THE MACHINE" MANIFESTO: THE BANALITY AND THE INEVITABILITY OF EVIL

Robert E. Allinson

The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA

Diane Vaughan

Chicago and London: The University of Chicago Press, 1996, 575 pp.

> "It [the *Challenger* launch decision] is a story that illustrates how disastrous consequences can emerge from the banality of organizational life."[1]

> "The *Challenger* disaster can justifiably be classed as a normal accident: an organization-technical system failure that was the inevitable product of the two complex systems."[2]

The "cog in the machine" manifesto (my *reductio* of the thesis of the above book) is that the *Challenger* launch decision was a mere blip on the screen of everyday events at NASA, and occurred in the process of routine business as usual—enacted by administrators following willy-nilly the bureaucratic proclivities of their organizational culture. Since the disaster was the result of the determined, mechanistic movement of the parts of the organizational system, once the mechanism was set in motion, the disaster was inevitable, and could not have been prevented. Ironically, Perrow, the inventor of the concept of the inevitable "normal accident," does not think that the *Challenger* was a "normal accident," although others of his adherents, such as Karl Wieck, think that the *Challenger* was a benchmark case of Perrow's inevitable "normal accidents."[3]

In order to expose the fallacies of the cog in the machine manifesto, one may consider an alternative umbrella thesis and four sub-theses. Firstly, the thesis advanced in my *Global Disasters: Inquiries into Management Ethics,* is repeated here, that the causes of the *Challenger* disaster were the lack of an overall 'safety

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first' ethos, and irresponsible choice and poor decision-making practises in the lead up to and including the final risky decision. Secondly, the widespread justification that one always faces inherent risk when one operates in the realm of risky technology (a thesis foreshadowed in her subtitle, *Risky Technology*) is shown to be an illicit and misleading justification when one considers that there was no necessity to choose this risky technology in the first place, and paying heed to warnings of its dangers in use would also have provided a means by which the operation of risky technology could have been avoided. Choice was involved in the adoption and continued use of this risky technology in the face of less risky alternatives. Thirdly, the real culprit is not so much "risky technology," which locates the risk in the technology, but "risky assessment," which locates the risk in the decision to employ technology while not basing that decision on known safe designs and continued use on performance data which are free from strong clues of potential dangers. The "acceptable risk" justification for the *Challenger* launch as argued by Ms. Vaughan and others is both epistemologically and ethically inadequate to the situation of risking the lives of five astronauts and two civilians. Fourthly, the decision to choose an Orbiter without a passenger and crew abort system is proof in and of itself of a lack of a "safety first" management priority. Fifthly, an analysis of the fateful eve of launch teleconference launch decision makes it impossible to construe it as a banal, routine and inevitable organizational mistake.

Firstly, in the most proximate situation to the disaster, had the safety of the crew and passengers been the first priority of the decision makers, the resistance of the two engineers who knew the most about the structure of the O-rings would have been heeded during that fateful eve of launch teleconference. [4] In chapter seven, "Structural Secrecy," with regard to NASA's lack of a safety first priority management system, she writes that "Following preestablished criteria for an operational system and ignoring the developmental nature of the shuttle's 'unruly technology,' [one wonders if NASA officials were attempting to cage a wild beast here] top NASA officials *purposefully* weakened the internal safety system."[5] (emphasis added) Does this support her conclusion that "The cause of disaster was a mistake embedded in the banality of organizational life."[6] Is purposefully weakening a safety system part of the banal process of organizational life? Or, does it not rather reflect a malign neglect of safety?

In her self-described anthropology of NASA's organization, she narrates that early in NASA's history, unlike the "Apollo Program, in which extensive and redundant testing programs were carried out early in equipment development . . . NASA cut spending on safety testing and other development work for the shuttle components."[7] Even later in NASA's history continuously up to and including the time period of the risky decision to launch, she points out that "Top administrators reduced budget allocations for safety personnel, altered safety procedures, and reduced testing requirements. They arranged for payload specialists, Christa McAuliffe and Senator Jake Garn to fly, without asking whether the official tasks and public relations use of these crew additions justified the risking of their lives. They engaged in and publicized mission adventurism while ignoring various external reviews, including the 1984 annual report of the space agency's own Aerospace Safety Advisory Panel, which warned top administrators that this was no operational system." Does this sound like an anthropologist's account of everyday bureaucratic pencil pushing?

She writes further: "Jack Macidull, FAA investigator working for the Presidential Commission, wrote, 'Valid safety awareness was screened by first misdefining, and then not reevaluating the capability of the system based on new data, which led to dangerous operational assumptions and procedures.'"[8] She has provided evidence enough to establish that NASA in no sense could be said to have possessed a safety first priority. If NASA had possessed a safety first priority, they would not have decided to launch the *Challenger*. Thus, it was the absence of a safety first prioritization management that was the main underlying cause of the *Challenger* disaster, and it was therefore not, as she claims, "a normal accident" and an inevitable mistake.[9] The disaster *could and should have been prevented*. How can the disaster have been an inevitable mistake and how can "the launch decision [have been] a story about routine decisions in the workplace,"[10] if the author is also stating that "to their great credit, both investigations [the House Committee and the Presidential Commission] made it clear that the disaster was not merely a technical failure; the NASA organization was implicated. . . . *powerful elites, far removed from the hands-on risk assessment process* . . . made decisions and *took actions that compromised* both the shuttle design and *the environment of technical decision making for work groups* throughout the NASA-contractor system."[11] (emphasis added) Some routine and some workplace.

She cannot have it both ways. The shuttle design cannot have been both compromised and also justified. There cannot be both a systematic, long-term and comprehensive compromise of safety on the one hand and a conclusion that "The *Challenger* disaster was an accident, the result of a mistake."[12] Her conclusion that the *Challenger* disaster was due to a mistake is a misstatement of facts, is contradicted by the evidence she provides, and is systematically misleading.

The word *mistake* conjures up the image of a harmless and trivial error, although incongruous and therefore mind numbing in this context when construed as the cause of fatal consequences, an inevitable mishap as in, "Whoops, you mean that was the launch button, Harry? I thought it was the toaster!" The use of the "mistake" language is inadequate to the decision processes which led to the disaster, and by trivializing and ethically neutering the decision, is ethically offensive to any informed reader. The use of the euphemistic and inappropriate "mistake" language is also cognitively diremptive of meaning by inserting a word normally connoting a harmless act in a context in which great harm has occurred, thus both neutralizing the harm that has occurred, and at the same time masking the accountability of the agents responsible for the decision.

Secondly, it is misleading to claim as she does that the disaster was the result of the combination of a "mistake" and the unavoidable hazards of "risky technology," as evidenced by her last sentence of her preface: "This case directs our attention to the relentless inevitability of mistake in organizations—and the irrevocable harm that can occur when those organizations deal in risky technology." The fact is, there was no necessity in the choice of the Thiokol designed O-ring which, out of four submitted designs, ranked the lowest in respect of engineering design.[13] *There is a difference in the general unknown risk of space travel and the knowable and known risk of operating with a design with known defects.* NASA was not forced to choose the Thiokol design. It decided, when it made its choice, not to choose the least risky design. The Lockheed design was rated first in engineering design. Lockheed was a better known and more experienced producer of aeronautic parts than Thiokol. It was safer, and if one were following a safety first priority, one would certainly not have opted for the riskier design. Thus, it cannot be said that "risky technology" is the demon: the demon is the one who chooses the risky technology over the safer one. Why would one select an unknown and untried small firm over a major and long standing industrial designer of airline engines? *It was not a case of "risky technology"; the preferred choice was to select the most risky design submitted.*

Thirdly, the concept that adequate risk assessments were made and that the resulting decision was simply a mistake is not supported by a deeper analysis of risk assessment than one finds in her book.[14] The late distinguished physicist and Presidential Commission member, Richard Feynman, analyzed the "safety margin of three" to which Ms. Vaughan refers. As he explains, "If a bridge is built to withstand a certain load . . . it may be designed for the materials used to actually stand up under three times the load. . . . But if the expected load comes on to the new bridge and a crack appears in a beam, this is a failure of the design. There was no safety factor at all, even though the bridge did not actually collapse because the crack only went one-third of the way through the beam. The O-rings of the solid rocket boosters were not designed to erode. Erosion was a clue that something was wrong. Erosion was not something from which safety could be inferred."[15] Major General Donald Kutyna, Director of Space Systems and Command Control, USAF, and Presidential Commission member, strongly agreed. For General Kutyna, the O-ring evidence was analogous to evidence that an airliner wing was about to fall off.[16] The phrase "risky technology" mistakes the effect for the cause; it is more appropriate to speak of risky assessment (not "risky judgment" for that could be misread as "faulty judgment," a sophisticated version of the inevitable human error hypothesis discussed in *Global Disasters*), but "risky assessment" which locates the problem in the choice of unreliable assessment strategies.

"Risky assessment" (not "risky technology") was the assessment of choice at NASA. Professor Feynman was shocked to learn that NASA management claimed the risk factor of a launch crash was 1 in 100,000, which translated into a shuttle launch every day for the next 280 years without one equipment-based failure. The figure of 1 in 100,000 was a subjective engineering judgment (read: hyperbolic guess work) without the use of actual performance data. Unless the risk estimates are based on some actual performance data, according to Feynman, "it's all tomfoolery." (He calculated the odds at 1 in 100 when utilizing past performance data as a data base.)

It is important to note that the risk assessors originally started with subjective assessments (hyperbolic hunches) and only later translated the subjective assessments into numbers: "frequent" equalled 1 in 100; "reasonably probable" equalled 1 in 1000; "occasional" equalled 1 in 10,000; and "remote" equalled 1 in 100,000.[17] Using this "system," according to NASA's subjective assessment statistics, NASA considered the *Challenger* disaster to be a remote possibility, while according to Feynman's statistics based on past performance, Feynman considered the prospect of a *Challenger*-like disaster to be a frequent occurrence.

But, to take into account ethical as well as epistemological considerations, one must consider not only the probability of the actual occurrence of an engineering failure; one must consider the consequences that are entailed, and whether such consequences are acceptable. Risk assessment must take the consequences of risk occurrence, in this case the death of five astronauts and two civilians, into account. Ethical risk assessment would also include informing the astronauts and the civilians of the probability of the catastrophe, and permitting them to decide if it were an "acceptable risk" (acceptable to whom?). When risk assessment takes life and death consequences, and death likelihood into account, only those who are morally comatose would have called the risk an "acceptable risk." When she states that "flying with acceptable risks was normative in NASA culture," that does not make it morally acceptable. She chides the renowned physicist Richard Feynman for being astonished at the concept of "acceptable risk." Even if the astronauts and the passengers were informed of (they were not) and accepted such a risk, while their knowledge and acceptance of such a risk would qualify them for moral sightedness, it would remain an epistemologically unsound risk and certainly an operationally superfluous one. (There was no necessity to launch at that particular moment against the engineers' recommendation.) Not informing the astronauts and the passengers of the engineers' Red Flagged warnings was *ethically unacceptable*. Vaughan's unwillingness to discuss this issue and still claim that "Managers were, in fact, quite moral and rule abiding as they calculated risk" and "the launch decision was rational calculation but not amoral" implies that deciding not to inform the risk takers of the Red Flagged warning of a catastrophic failure with the consequent loss of life of all aboard was a moral choice. She states that "locating responsibility for continuing to launch during this period with individual managers who intentionally suppressed information about O-ring problems is incorrect."[18] Then, who was responsible for not informing the astronauts and the civilian passengers of the malfunctioning O-rings and the likely horrifying consequences? It was unconscionable to authorize them to fly without letting them know of the risk they were taking. They died not as the heroes and heroines of Reagan's dramaturgical liturgy, but as innocent victims, unaware of the risk they were taking.

Fourthly, can it be said that a decision to accept a design for an Orbiter that does not provide for an escape possibility for the crew and possible passengers is an example of a decision in which ethics has a high degree of priority? Only the morally obtuse would say that a decision to accept a design without escape possibility reflects an attitude which makes safety considerations the most important criterion for decision making. This would seem to be true whether or not an ejection system for crew and passengers were a practical possibility. If one were to make safety a necessary condition for an ultimate decision, then one might need to delay launching until such systems were to become practical possibilities. Such an attitude prevailed during the Apollo days.[19] Production of shuttles and shuttle launches can be delayed until satisfactory ejection systems are practical possibilities. But, what if it were the case that crew ejection systems were possible, but that designs submitted for crew abort systems were rejected out of cost considerations?[20] If this were the case, then safety certainly could not have been perceived as the top priority, as by definition, cost considerations were being rated as more important than safety considerations. Even if it were to be assumed that the *Challenger* was an inevitable disaster, there was no reason why the five astronauts and Christa Macauliffe and Greg Jarvis had to die.

In her assertions that no escape system was possible, Ms. Vaughan states that Fletcher (head of the agency in the 70s and again after the *Challenger* disaster) announced that there would be a system of escape rockets,[21] (thus implying that such a system was possible): "These escape rockets would make possible crew escape in emergency situations during the dangerous 'first stage of ascent'—the first two minutes of flight during which the SRBs burned [the *Challenger* disaster occurred at the 73rd second] to thrust the shuttle into orbit. [Escape rockets had been used on all previous NASA spacecraft.] . . . After Fletcher's announcement, a decision was made to scrap the two escape rockets on the Orbiter in order to reduce weight."[22] Further down the page she argues that "Nothing could save the crew if a failure occurred while the boosters were thrusting."[23] Her statements about the impossibility of an abort system do not seem to take into account the proposal by McDonnell-Douglas, which actually anticipated the cause of the disaster. "Their abort system provided for a 'burn through wire' that would have sensed 'O-ring' leakage, then triggered booster thrust termination and the Orbiter's abort rocket escape system."[24]

The sole evidence which supports the author's position that nothing could save the crew during thrust (which contradicts the earlier plan of Fletcher's to provide escape rockets as all the previous flights had included), is the testimony of astronaut Crippen before the Presidential Commission, who testified that *he knew* of no abort system.[25] (emphasis added) Ms. Vaughan transmogrifies this single opinion into an unquestionable fact: "Since the escape rockets could not save the crew, their exclusion from the design lightened Orbiter weight with no safety trade-off."[26] One might well ask, since the crew compartment did in fact separate from the Orbiter, why was it impossible to save the crew during thrust?—

"any method of ejecting the crew from the Orbiter would fail because the astronauts [and the two civilians] would be pulled into the flame behind the boosters"[27]—But, what actually occurred was that the crew cabin was spontaneously ejected from the Orbiter, and was not pulled into the flame behind the boosters. *The seven were saved during thrust.* The problem was after thrust, since their deaths were caused by impact with the ocean at high speed, a speed that could have been arrested by a compartment parachute or reverse thrust rockets. Was the decision to permit launching without an escape system part of the tedious routinization of organizational life, or did it add a *frisson* to the humdrum life-and-death decision making that went on at the "workplace"?

Fifthly, an analysis of the fateful eve of launch teleconference makes it impossible to construe it as a banal routine organizational mistake as in, "It [the *Challenger* launch decision] is a story that illustrates how disastrous consequences can emerge from the banality of organizational life." Or, worse yet, "the *Challenger* launch decision is a story about routine decisions in the workplace."[28] Routine? Workplace? Ms. Vaughan may be bureaucratically, technically and legalistically correct in stating that the middle managers were not obligated to report the intense debate over the O-rings and temperature concerns voiced at the teleconference to senior managers. Sometimes, however, one needs to do more than what is bureaucratically, technically or legalistically required. Her justification of the action of the middle managers by arguing that the middle managers did not violate any rules is grotesque. Urgent conditions cry out for rules to be violated. The Dred Scott decision not to harbour runaway slaves was once the law of the land. Yet, those who violated this rule were morally courageous; those who did not were morally blind.

Senior managers have testified under oath that had they known of the resistance of the Thiokol engineers they would have intervened and stopped the launch. (*Thus implying that there could and should have been rule violation in this case!*) The deaths of seven innocent people would have been prevented had the "proper" regulations been circumvented. If the decision of the middle managers were in fact banal, then evil is banal. But, the banality of evil does not make it any the less evil. Considering the level of dissent at the meeting, that the decision of the middle managers not to report to higher-ups conformed to the Delta review reporting protocol, and was therefore justified, is a monstrous justification.[29] Ms. Vaughan's legalistic exoneration of the actions of the middle managers is distorting and morally numbing; it hides the grotesque reality that lives were casually risked by not bringing to senior managers' attention that for the first time in NASA history the engineers had unanimously voted not to launch before managers railroaded the decision through. *This* was following rules. *This* was the cult of the organizational man. This was the eminence of the gray flannel suit.

It must be emphasized that the final decision to fly was forced down the throat of the engineers present at the teleconference launch decision, and was by no means a decision with which they were happy, was not one on which they were allowed to vote, and was one in which nearly a score of engineers who knew about the O-rings voted unanimously against flying. When this decision was reversed by a vote of four managers, such a "forced decision" cannot be construed either as "routine" or as a "mistake."

There was every argument not to fly if safety were a prime concern. The burden of proof was incumbent on those who considered that the lives of the five astronauts and the two civilian passengers should be put at risk. If the status quo were to be changed, and lives were to be risked, then the burden of proof rests on the shoulders of those who argued that it was worth the risk of the lives of the crew and passengers.

There is no way that it can be proved that it is 100 percent unsafe to fly as the engineers were asked to do. Even if the shuttle were operating with mission- and life-threatening, dangerously designed, defective equipment (which it was), there would always be a miniscule .00006 percent chance that it could have flown safely. It is logically impossible to prove that it is 100 percent unsafe to fly—but that is precisely what the engineers were required to do. The relevant question should have been, how safe was it? Those recommending flight should have been able to provide demonstrations of a high degree of safety (what should be the confidence margin, 85 percent?). The burden of proof cannot and should not rest on the shoulders of those who were arguing that it is unsafe to fly, since they could not possibly prove that it was 100 percent unsafe to fly. When the engineers could not prove that it was unsafe to fly (an impossible task), this did not make it safe to fly, nor did it remove the burden from those who wished to launch of proving that it was safe to do so.

In *The Challenger Launch Decision,* the author states that "the burden of proof did shift. It shifted because the contractor position shifted. . . . Since their position shifted from the norm, the burden of proof deviated from the norm."[30] But, this argument is not sound. The burden of proof always rests on the shoulders of those who recommend altering the status quo, in this case launching. In this case, the ones recommending launch were the managers. Thus, the burden of proof rested on their shoulders to prove that it was safe to launch. Since the Thiokol engineers were opposing launch, it was not their burden to prove that the shuttle not be launched.

In addition to the resistance of the engineers, Rockwell also stated that "they could not assure that it was safe to fly." That in itself should have been enough to delay the flight even if the Thiokol engineers had been pressured to alter their original recommendation not to fly. Rockwell's verdict that it was not safe was based on weather concerns since stalactite looking icicles hung from the shuttle such that one Rockwell engineer, John Tribe, was moved to describe it as "something out of Dr. Zhivago. There's sheets of icicles hanging everywhere." (in Southern Florida)

The launch of the *Challenger* when the surface temperature of the right aft rocket booster (where the O-rings were located) was 8 degrees Fahrenheit was not routine. Ms. Vaughan claims that the late Nobel Prize, Einstein Award and

Niels Bohr Gold Medal winning physicist, Professor of Theoretical Physics at the California Institute of Technology, and Presidential Commission member Richard Feynman's celebrated gesture of dropping a piece of an O-ring into a glass of ice water at the televised hearings "greatly simplified the issues on the table on the eve of the launch. Managers and engineers alike knew that when rubber gets cold, it gets hard. The issues discussed during the teleconference were about much more complicated interaction effects: joint dynamics that involved the timing (in *milliseconds*) of ignition pressure, rotation, *resiliency*, and redundancy."[31] (emphasis added) Did she not think that the Nobel laureate physicist knew that? The whole point of the demonstration was that when Dr. Feynman took the O-ring piece out of the ice water, there was no resiliency to it at all for more than a few seconds at a temperature of 32 degrees, far longer than the milliseconds required for the superhot propellant gases to escape and burn the O-rings.[32]

According to the Presidential Commission (on which the distinguished physicist sat), "There is a possibility that there was water in the . . . joints. At the time of launch, it was cold enough that water present in the joint would freeze. Tests show that ice in the joint can inhibit proper secondary seal performance."[33] As for the rest of Ms. Vaughan's book, it is too complex: one can no longer see the forest for the trees. Two characteristics of preferred scientific explanations are simplicity and elegance. Her book contains neither. In the last sentence of her book she writes, "What matters in developing an anthropology of organizations is that we go beyond the obvious and grapple with the complexity, for explanation lies in the details."[34] No, what is necessary is to have the capacity (as one commentator said was the mark of Aristotle's greatness) to be able to see the obvious.

They were discussing wrapping the joints in blankets to protect the O-rings from the below freezing temperatures, the shuttle did after all destroy itself, the inability of the O-rings to seal was what allowed the superhot combustible gases (which were over 5,000 degrees Fahrenheit, a detail never mentioned in Ms. Vaughan's account) to escape and burst into flame. The flame plume was deflected rearward by the aerodynamic slipstream. The aft field joint of the right Solid Rocket Booster faced the External Tank. The External Tank and the right Solid Rocket Booster were connected by several struts, including one near the aft field joint that failed. [Read: the combustion chamber rode on top of the fuel tank.] These deflections directed the flame plume onto the surface of the External Tank and the swirling flame mixed with leaking hydrogen from the External Tank. [No one to my knowledge has investigated why the External Tank was leaking hydrogen; Ms. Vaughan makes no mention of it at all.][35] The External Tank exploded, separating the crew cabin from the Orbiter. The force of the blast probably did not seriously injure any of the crew members. The cabin dropped 65,000 feet in two minutes and forty-five seconds. [A separate crew compartment parachute would have saved all aboard.] The *Challenger*'s cabin and crew slammed into eighty feet of water at 207 miles an hour. No one survived.

It is important to be aware that the O-ring leakage was not simply a malfunctioning part, but a part that was a known design deficient part, and it was this that the Presidential Commission concluded: "The failure [of the seal] was due to a faulty design unacceptably sensitive to a number of factors . . . [including] temperature, the character of materials [read: putty]." [After the Chernobyl disaster, six managers and those who had designed the reactors were sentenced to jail for criminal disregard of safety].[36]

For the foregoing reasons, the "cog in the machine" manifesto cannot stand up to rational scrutiny. Human beings who are in decision-making roles bear the burden of choice. Those who assume the burden of choice (the middle managers) cannot foist that burden off onto others, to ask others to prove that they (the middle managers) should not act; such a divestment of their burden was an abrogation of responsibility. They needed to justify their action since they were the ones who were planning to risk the lives of five astronauts and two innocent civilians. It was their duty and their responsibility; they were not cogs in a machine.

For the author of *The Challenger Launch Decision,* "The teleconference was . . . a situation of perhaps unparalleled uncertainty for those assembled, all participants' behavior was scripted in advance by the triumvirate of cultural imperatives that shaped their previous choices."[37] According to this description, those present had no choice. Their choice was predetermined by previous choices—presumably, granting that they were responsible for previous choices, although this too is not to be taken for granted—so that their choices were determined by the past. Such an analysis relieves all those present from any responsibility for their decisions. It makes all those present into—for all practical intents and purposes—cogs in a bureaucratic machine—unable to move (that is, make a decision) except in conformity with and as a reaction to the movement of all other parts. Such a description is not a description of responsible choice, but of a determined bureaucratic machine, labelled in my earlier *Global Disasters* "the Techno-Organization," a label therein attributed (with eerie prescience) to Ms. Vaughan, who had not yet published *The Challenger Launch Decision.* The decision to launch the *Challenger*, and the disaster that ensued, were, for the author of this latter work, inevitable. "Socially organized and history-dependent, it is unlikely that the decision they reached could have been otherwise, given the multilayered cultures to which they all belonged."[38] That responsible professionals, trained engineers and highly reputed managers could not have acted otherwise than they acted is the cog in the machine manifesto carried to its utmost logical conclusion. Hapless victims of culture, of their own culture no less, they had no choice but to make the decisions that they did. The disaster was as inevitable as if it had been foreordained. The Greek Fates or an omnipotent Divinity have been replaced by the far more plebeian powers of bureaucratic ennui, the inertia of decision making, and the cultural shibboleths of the Techno-organization. Such a fatedness is not as glorious seeming and extraordinary as it may have appeared under the Greek concept of *Moira,* but the pedestrian and banal determinants of organizational culture are, for this author, no less effective. The author cites Hannah Arendt's, *Eichmann in Jerusalem* with approval. One wonders if Hannah Arendt shares the author's view that those caught in an organizational culture (such as Nazism) had no choice but to carry out the dictates of that culture.[39] If that were the case, then no one should have been condemned at Nuremberg.

According to the author, "when individual actions are embedded in an organizational context, evil becomes irrelevant as an explanation because the meaning of one's actions and the locus of responsibility of one's deeds become transformed, as this book will show [a horrifying prospect]. . . . managers . . . considered the costs and benefits of launching. . . . No rules were violated. Following rules, doing their jobs, they made a mistake. With all procedural systems for risk assessment in place, they made a disastrous decision."[40] The procedural systems for risk assessment, as discussed above, were epistemologically and morally unsound. If one makes a "mistake" following rules, then one should not follow rules. If "the locus of responsibility for one's deeds become transformed, as this book will show," then the substitution of banal mistake for rational and moral choice is a chilling and fitting celebration of both the moral numbness and the moronization of America.

Notes

[1]Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA* (Chicago and London: The University of Chicago Press, 1996), p. 365.

[2]Ibid., p. 410.

[3]Charles Perrow, "The Limits of Safety: The Enhancement of a Theory of Accidents," *Journal of Contingencies and Crisis Management,* Vol. 2, No. 4, December 1994, p. 218; Karl E. Weick, "Enacted Sensemaking in Crisis Situations," *Journal of Management Studies,* Vol. 25, No. 4, July 1988, p. 316.

[4]Vaughan, p. 268.

[5]Ibid., p. xiv.

[6]Ibid., p. 23.

[7]Ibid., p. 213.

[8]Ibid., p. 415.

[9]Ibid., pp. 403, 415.

[10]Ibid., p. 389.

[11]Ibid.

[12]Ibid., p. 394.

[13]Ibid., p. 15. Senior Editor Trudy E. Bell and Karl Esch list inadequate original design of the booster joint as the chief cause of the *Challenger* disaster. Cf. Trudy E. Bell and Karl Esch, "The Space Shuttle: A case of subjective engineering," *IEEE Spectrum* [a professional engineering journal], Vol. 26, No. 6, June 1989, p. 44. Sadly, this key source is not employed by Ms. Vaughan.

[14]Vaughan states, "The public did not learn that competent technical experts doing the risk assessments, following rules and using all the usual precautions, made a mistake." Cf.

Vaughan, p. 390; Richard Feynman, *What Do You Care What Other People Think?* (London: Unwin Hyman, Ltd., 1989), p. 165.

[15]Malcolm McConnell, *Challenger: A Major Malfunction* (London: Simon & Schuster, 1987), p. 119.

[16]Ibid., p. 224.

[17]Robert E. Allinson, *Global Disasters: Inquiries into Management Ethics* (New York, Prentice-Hall, 1993), pp. 146–7 and Eliot Marshall, "Feynman issues his own shuttle report, attacking NASA's risk estimates," *Science*, Vol. 232, June 1986, p. 1596. For a discussion of Morton Thiokol's managers attempting to justify high levels of risk by appropriating the expert role of risk measurement and representing it to others as engineering judgment, see Joseph R. Herkert, "Management's hat trick; misuse of Engineering Judgement in the Challenger incident," *Journal of Business Ethics,* Vol. 10, No. 8, August 1991, pp. 617–20. Cf. also General Alton D. Slay, *Post-Challenger Evaluation of Space Shuttle Risk Assessment and Management,* prepared by the Committee on Shuttle Criticality, Review and Hazard Analysis Audit of the Aeronautics and Space Engineering Board (Washington, D. C.: National Academy Press, 1988). All four of these important sources are not consulted by Ms. Vaughan.

[18]Vaughan, pp. 68, 76, 82, 273. Ms. Vaughan does not speak to the ethical issue of whether the astronauts or the civilian passengers were informed of the problems with the O-rings. This has been discussed by Mike W. Martin, Roland Schinzinger, Roger Boisjoly, Malcolm McConnell, the science editor for *Reader's Digest,* myself and others. Martin, a professor of philosophy and honors at Chapman College, and Schinzinger, of the School of Engineering at the University of California, Irvine, write, "But it has also been revealed that the *Challenger* astronauts were not informed of particular problems such as the field joints. They were not asked for their consent to be launched under circumstances which experienced engineers had claimed to be unsafe." Mike W. Martin and Roland Schinzinger, *Ethics in Engineering,* Second Edition (New York: McGraw-Hill Company, 1989), p. 82. McConnell writes, "As far as anyone in the astronaut corps had been informed, there had never been a problem with the SRB field joints." McConnell, p. 6. For an informed inside view which confirms these authors, cf. the evidence presented by Roger Boisjoly in Mark Maier and Roger Boisjoly, *Roger Boisjoly and the Space Shuttle Challenger disaster* (Binghamton: SUNY-Binghamton School of Education and Human Development, Career and Interdisciplinary Studies Division, 1988), Videotape instructional package. Cf. Allinson, p. 155. Ms. Vaughan makes no mention in her book of the opinions of these sources which speak to the important issue that neither the astronauts nor the civilian passengers were informed of the O-ring dangers. Martin and Schinzinger's highly relevant book does not form part of Ms. Vaughan's data base. Strangely, a book that is frequently cited and thus does form part of Ms. Vaughan's data base, Richard S. Lewis's book, *Challenger, The Final Voyage* (New York: Columbia University Press, 1988), makes the point a number of times that the astronauts were not informed of the O-ring problem: "Along with the general public, the astronauts who were flying the shuttle were unaware of the escalating danger of joint seal failure. So were the congressional committees charged with overseeing the shuttle program. NASA never told them that the shuttle had a problem." (p. 76) Lewis also quotes the Presidential Commission report: "Chairman Rogers raised the question of whether any astronaut office representative was aware [of the O-ring problem]." Weitz [a representative] answered: "We were not aware of any concern with the O-rings, let alone the effect of weather on the O-rings." (p. 183)

[18]Allinson, pp. 157–9.

[19]Ibid., p. 158.

[20]Vaughan, p. 423.

[21]Ibid., p. 424.

[22]Ibid.

[23]Ibid., pp. 333, 423.

[24]McConnell, p. 49.

[25]Allinson, p. 162. Some of the confusion as to whether an abort system was possible (including Bell and Esch's opinion which she cites which is based on the actually chosen design, not on any possible design) may have arisen because of ambiguity as to whether one is referring to ejection when solid rocket fuel is utilized or liquid rocket fuel. But, there was no necessity in the choice of solid fuel rockets which von Braun likened to sending the astronauts and civilians up on a roman candle. Ibid., p. 158. (A roman candle, once lit, cannot be put out. Liquid fuel rockets (the Russians will use no other kind) can be shut off. According to NASA, "Crew escape and launch abort studies will be complete on October 1, 1986, with an implementation decision in December 1986." Apparently, this would imply (if the word *implementation* has any meaning at all) that an abort system is practical and feasible and was thought to be so by NASA. Cf. Recommendation 7, *National Aeronautics and Space Administration, Report to the President, Actions to Implement the Recommendations of the Presidential Commission on the Space Shuttle Challenger Accident, Executive Summary* (Washington, D. C.: GPO, 1986), p. 4. [This is yet another crucial source which mysteriously is not referred to by Ms. Vaughan.] Oddly enough, according to a source with which she is familiar, it was *not an issue of possibility* that the *Challenger* was not equipped with an abort system, *but an issue of policy:* "The question of whether such [abort] systems are feasible for the orbiter is not one of engineering, but of policy." Lewis, p. 178. Earlier spacecraft had been equipped with launch escape systems, thus proving by fact that escape systems were not only possible, but were actual. "Unlike Mercury, Gemini and Apollo spacecraft, the orbiter was not equipped with a launch escape system during the solid rocket booster phase, the first stage of flight ascent. Such a system had been considered during development of the shuttle, but had been dropped, except for the temporary installation of aircraft-style ejection seats in Columbia, because failure of the solid rocket boosters after launch was considered highly improbable." Lewis, pp. 3–4. [One might ask here whether the concept of improbability was one which took the O-ring problem into account, *but the central point was not that an escape system was impossible, but that it was thought not to be necessary.*]

[26]Vaughan, p. 425.

[27]Ibid., p. 425. According to Lewis, given that "the probable cause of death was ocean impact . . . a crew module equipped with a parachute descent system would have saved them—and averted the most horrendous result of the accident [*sic*]." Lewis, p. 178.

[28]Vaughan, p. 403.

[29]Ibid., pp. 344–5.

[30]Ibid., p. 343.

[31]Ibid., p. 39.

[32]Feynman, p. 151.

[33]*Report to the President, Report at a Glance, by the Presidential Commission on the Space Shuttle Challenger Accident* (Washington, D. C.: GPO, 1986), Chapter IV. [Unaccountably, this helpful source is also not utilized by Ms. Vaughan.]

[34]Vaughan, p. 463. Ironically, key details are missing in her account; e.g., that the Senior Editor of an engineering journal cites inadequate original design of the boosters as the leading cause of the disaster, that the astronauts and civilian passengers were not informed of the O-ring problems, that there was no necessity to omit an escape system for the crew and passengers (and that such an omission is ethically unpardonable).

[35]Vaughan, p. 10.

[36]*Report to the President,* Chapters III, IV, and Conclusion. Cf. Patricia H. Werhane, "Engineers and management: The challenge of the Challenger incident," *Journal of Business Ethics,* Vol. 10, No. 8, August 1991. [This last article is still one more illuminating and useful source that is not to be found in Ms. Vaughan's bibliography.]

[37]Vaughan, p. 398.

[38]Ibid., p. 399.

[39]Ibid., p. 407.

[40]Ibid., p. 68.