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

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The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA, by Diane Vaughan. Chicago: University of Chicago Press, 1996, 575 pages. Cloth, $24.95.

The Challenger tragedy represents an important case for understanding the social bases of technical failure. The technical reasons for the explosion are now well known: the failure under cold-weather conditions of a pair of o-rings used as seals in the solid rocket booster (SRB). The tragedy had a sociological as well as a technical cause, however. NASA and the SRB contractor, Morton Thiokol, had advance warning of the possibility of o-ring malfunction in cold weather. Yet the decision was made to launch; understanding the tragedy thus requires understanding this decision.

Diane Vaughan has written an exhaustive, theoretically sophisticated, and mostly persuasive account of the Challenger launch decision which questions the

conclusion reached by earlier investigations. The view that the tragedy reflected "amoral calculation" by mid-level managers who suppressed safety concerns makes little sense, she argues, in view of NASA's normal concern for safety and the disastrous consequences of ignoring risk. Understanding the launch decision requires moving beyond individual actors to explore the organizational and environmental context in which it was made. Invoking anthropological ideas about "thick description," she plunges the reader into the culture of NASA and engineering and the history of the ill-fated o-rings.

According to Vaughan, the Challenger launch decision was made by moral individuals who responded to production pressures but consistently abided by the set of rules governing the definition of safety and risk. Engineers and managers were aware of problems with the o-rings, but they evaluated the evidence of o-ring damage using consensual procedures consistent with engineering and industry principles. Incrementally, they came to the conclusion that the o-rings were "safe" because they were redundant (a second o-ring would back up the first). There was some risk, as evidenced by damage to primary and even secondary o-rings, but it was within acceptable limits.

The work group's belief in the acceptability of this risk was supported by larger organizational and environmental contingencies. Engineering culture accommodated technical compromise, and the original "technical" culture of NASA had been modified to include bureaucratic and political concerns, requiring the balancing of all three. Vaughan also shows how "structural secrecy" made it difficult for NASA administrators to "know" that there was a safety problem. Organizational inertia made it difficult to overturn previous conclusions about safety; specialization limited understanding, as did technical jargon and the overabundance of information; regulatory mechanisms were ineffective.

On the eve of the launch, decision makers at NASA were concerned enough about the effects of cold temperatures to ask for a teleconference with Thiokol. Thiokol engineers recommended against launch, arguing that risk increased unacceptably in cold temperatures. However, they did not have unambiguous hard data to back up their recommendation. This prevented an effective formal challenge to the belief in o-ring safety; various obstacles to communication limited the effectiveness of the warnings the engineers were able to send out.

On the whole, Vaughan mounts an effective critique of the amoral calculation hypothesis. She provides abundant evidence indicating that procedures were followed and that there was a pervasive belief in the safety of the o-rings; similarly, she shows that the view that rules were violated is based on a misunderstanding of NASA's procedures. Nevertheless, Vaughan may read more into this than is warranted. She admits in her conclusion that the normalization of deviance may, in other contexts, facilitate misconduct, so why not in the Challenger case? There

is no clear evidence that individuals used the rules to cover their conscious transgressions. But Vaughan's argument that there was no malfeasance too often boils down to a simple insistence that actors followed the rules of decision making, which tends to assume what needs to be proven.

This is particularly important as Vaughan appears to have relatively limited access to events at Morton Thiokol. Since engineers there eventually cautioned against cold-weather launch, and since Thiokol managers excluded the engineers from the launch decision, it is conceivable that concern about the o-rings prior to the Challenger incident was greater than it appeared. Circumstantial evidence to this effect exists, since when NASA asked for a teleconference on the question, the Thiokol engineers responded with an extremely unusual no-launch recommendation, even in the absence of "hard" evidence. If nothing else, Vaughan's account does not allow us to dismiss completely this alternative hypothesis.

The conclusions Vaughan draws from her analysis are also persuasive and reasonable, but could be expanded. She makes a strong case that the focus on middle management malfeasance distracts from the real responsibility of organizational and political elites in shaping the decision-making environment. It also makes technical decisions seem deceptively routine. Most importantly, it draws attention away from the ways in which routine organizational practices can "normalize" deviance.

Vaughan could add that Thiokol's apparent willingness to express its concerns about the o-rings only after NASA asked and NASA's aggressive reaction to the unusual suggestion by a contractor that launch be delayed may suggest that interorganizational hierarchy played a role in structuring this (and perhaps other) technical decisions. Finally, her analysis reveals the limits of engineering culture. Engineers' willingness to balance technical, economic, political, and bureaucratic pressures reduced the chances that concerns about o-ring safety would be voiced in unambiguous ways. And engineering "craft," as Vaughan calls it, which constructs lasting conclusions on the basis of necessarily imperfect knowledge and best estimates, may encourage certainty about matters which should be routinely questioned.

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