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ORIGINAL RESEARCH/SCHOLARSHIP

Leadership, Engineering and Ethical Clashes at Boeing

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Abstract

When there are disasters in our society, whether on an individual, organizational or systemic level, individuals or groups of individuals are often singled out for blame, and commonly it is assumed that the alleged culprits engaged in deliberate misdeeds. But sometimes, at least, these disasters occur not because of deliberate malfeasance, but rather because of complex organizational and systemic circumstances that result in these negative outcomes. Using the Boeing Corporation and its 737 MAX aircraft crashes as an example, this ethical analysis will examine some of the organizational problems that led to changes in management in Boeing and ultimately resulted in the fatal accidents. We will examine ethical blind spots within the company that led to the deadly accidents, and we will study the kinds of circumstances that are particularly acute in organizations such as Boeing, and which contributed to the malfunctions in the 737 MAX and the two resulting crashes. The Boeing 737 MAX example is not a singular case, but rather shares similarities with other engineering disasters such as the Challenger and Columbia explosions, and the ignition switch failures at General Motors each of which seem to have been at least partly the result of organizational shortcomings involving a compromise in commitment to safety. These parallels lead us to conclude that organizational malfeasance poses a serious ethical challenge for engineers and their organizations. We will conclude with some tentative suggestions for avoiding such tragic incidents in the future.

Keywords Ethical · Boeing 737 max · Engineers · Federal aviation administration · Self-assess · Maneuvering characteristics augmentation system (MCAS) · Sensors malfunctioned · Dominant logics · Mental models · Silo mentality · Obedience to authority

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Introduction

When there are disasters in our society, whether on an individual, organizational or systemic level, individuals or groups of individuals are often singled out for blame, and commonly it is assumed that the alleged culprits engaged in deliberate misdeeds. But sometimes, at least, these disasters occur not because of deliberate malfeasance, but rather because of complex organizational and systemic circumstances that result in these negative outcomes. Using the Boeing Corporation and its 737 MAX aircraft crashes as an example, this ethical analysis will examine some of the organizational problems that led to changes in management in Boeing and ultimately resulted in the fatal accidents. We will examine ethical blind spots within the company that led to the deadly accidents, and we will study the kinds of circumstances that are particularly acute in organizations such as Boeing, and which contributed to the malfunctions in the 737 MAX and the two resulting crashes. While the primary subject of this paper is an analysis of the Boeing 737 MAX failure, this disaster is not a singular case, but rather shares similarities with other engineering cases such as the Challenger and Columbia explosions, and the ignition switch failures at General Motors, each of which have been partly the result of organizational shortcomings involving a compromise in commitment to safety. These parallels lead us to conclude that organizational malfeasance poses a serious ethical challenge for many engineers and their organizations. We end the paper with some tentative suggestions for avoiding such tragic incidents in the future.

The Boeing 737 MAX Case

Until a short time ago the name 'Boeing' was stellar. The corporation was lauded for its engineering and scientific innovations, its large workforce (approximately 160,000 employees worldwide) and its business acumen. Based on its 2018 revenue, the company was among the largest aerospace manufacturers and was the fifth largest defense contractor in the world (Gates 2020).

However, investigations from some arenas speculate that Boeing's engineering excellence and management style have been at odds for more than 20 years. At that time Boeing made a fundamental leadership change as priorities shifted from an engineering and scientific ethos to an emphasis on stock performance and executive management (Useem 2019).

On October 29, 2018 Indonesian airline Lion Air Flight 610 plunged into the Java Sea, killing all 189 individuals on board the Boeing 737 MAX. Initially, pilot error and inexperience were given as causes of the crash (Langewiesche 2019). On March 10, 2019, only five months after the Lion Air disaster, 157 individuals perished when Ethiopian Airlines Flight 302 crashed. Federal Aviation Administration (FAA) and Boeing investigators looked beyond pilot error and began focusing on design problems in the Boeing 737 MAX. One flaw that caught

their attention was the 737 MAX's Maneuvering Characteristics Augmentation System (MCAS). In the two deadly crashes the MCAS automatically and repeatedly forced the aircraft to nosedive shortly after takeoff (MacGillis 2019). Boeing had known of this problem but believed that any pilot trained on the original 737 could make a quick manual adjustment to save the aircraft if the sensors were malfunctioning. So, they omitted placing information in the pilots' operations manual about this feature and how to recover the aircraft if the sensors malfunctioned (Zhang 2019; Langewiesche 2019; Pasztor et al. 2019). They also omitted most simulator training for the 737 MAX pilots (Kitroeff and Gelles 2020).

In both crashes the FAA and Boeing found the MCAS to be the problem but also did not rule out pilot error as well (MacGillis 2019). But by November of 2018, Boeing was attempting to redesign the MCAS. In the meantime, the FAA and Boeing sent urgent messages to airlines to emphasize a flight recovery procedure should the MCAS malfunction (Gates 2019). Boeing initially predicted that it would take approximately six weeks to fix the MCAS's automated software problems. Within days after the devastating crash of Ethiopian flight 302, the FAA grounded the 737 MAX. It was grounded internationally as well (Levin 2019). In November of 2020, the F.A.A. lifted its 20 month ban on the Boeing 737 MAX. The European Union, Canada and Brazil are expected to follow suit as soon a pilot training procedures are in place. The flaws were determined to be in the MCAS software and also on pilot training. The F.A.A. must still approve pilot training procedures for each U.S. airline that will use the aircraft (Chokshi 2020).

Initially, simulator training for 737 MAX pilots was discouraged by Boeing because of time and expense. One of the company's big selling points with customers had been that pilots who were certified for an earlier generation of 737 jets only needed a short computer course to brush up their skills to fly the MAX (Langewiesche 2019). According to *The Wall Street Journal,* when the 737 MAX entered service in 2017, the FAA had approved the airliner, stating that the agency's "certification processes are well established and have consistently produced safe aircraft" (Tangel et al. 2019). Those assurances helped make the 737 MAX a best-selling jetliner. However, there was an additional pressure. Because of an impending sale of planes by Airbus to American Airlines, the 737 MAX was pushed to market, not waiting for approval of the design by its board of directors before the sale (Cohan). Boeing's board didn't formally sign off on the MAX until a month later," (Tangel et al. 2019).

Additional problems have surfaced since the grounding of the 737 MAX. First, a software problem prevents the flight control computers from being turned on. The second problem involves sets of wire bundles on the plane in close proximity to one another, including in the electrical bay under the cockpit. An electrical short in any of these bundles could be devastating (Shepardson 2020).

How did this giant airline manufacturing company find itself embroiled in such catastrophes? Dr. Stan Sorscher, formerly Boeing engineer, now a Labor Representative at the Society for Professional Engineering Employees in Aerospace (SPEEA) and other employees believe that corporate climate changed around 1996 when Boeing purchased McDonnell Douglas for $13 Billion. At that point engineers were removed from the leadership team. According to *Vanity Fair*, "One of the most

successful engineering cultures of all time was quickly giving way to the McDonnell Douglas mindset" (Levin 2019). The mentality seemingly was to increase efficiency, cut costs and raise profits. The new Boeing President, Harry Stonecipher, who came from McDonnell Douglas, "brought his chain saw to Seattle" to separate the culture of engineering from the bottom line of making large profits (2019). Sorscher believes that the clash between profits and professionalism has had a dire effect on Boeing ever since.

Within 2 years of the merger, the next CEO of Boeing, Phil Condit, said they needed space between the engineers and executives, and moved Boeing's headquarters from Seattle to Chicago, while 40,000 engineers remained in Seattle. During that period before the crashes, Boeing remained a highly profitable company. As a Boeing press release details, "with the latest increase to the dividend (in 2018) Boeing has increased its dividend nearly 325 percent over the past 6 years and repurchased more than 230 million shares over the same time period" (Boeing 2018).

After the crashes, On January 10, 2020 Boeing released over a hundred pages of internal Boeing e-mails to the FAA and lawmakers who are investigating the 737 MAX, and the original processes that cleared it to fly. The correspondence backs Sorcher's speculations. The e-mails contained correspondence dating as early as 2015 expressing doubts about the safety and certification process of the 737 MAX. In 2018, one employee questioned, "Would you put your family on a MAX,,,aircraft? I wouldn't" (Kitroeff 2020). Dated 2016, one of the more volatile messages read, "This airplane is designed by clowns, who in turn are supervised by monkeys" (Johnsson et al. 2020).

The FAA, too, was under a siege of criticism. Roger Wicker, chair of the Senate Commerce, Science, and Transportation Committee expressed his concern regarding the FAA giving "increasing authority to Boeing to take on more of the work of certifying the safety of its own airplanes, and raised questions about the efficacy of the FAA's oversight of the certification process" (Johnsson et al. 2020).

Management Decisions and Engineering Decisions

Issues concerning "proper engineering decisions (PED) and proper management decisions (PMD)" are often discussed in engineering ethics (Harris et al. 2019). It is argued that engineers and management each *should* have necessary roles in considering the well-being of the company as well as well as the customers and community. Engineers should be in a position to forewarn managers of problems that that involve safety, health, or welfare of the products under consideration. PMD or management decisions involve areas such as cost, marketing, employee morale or welfare. Engineers should not make, or be forced by management to make, unacceptable ethical or technical compromises (82).

However, as the 737 Max case exemplifies, engineers were taken out of major decisions regarding the reengineering of the 737. Managers were making aeronautical decisions based on cost cutting and sales rather than the safety of their product. Later in the paper we will explain the dangers of "silo mentality," when one arm of a company makes major decisions without considering important factors in other

branches of the firm. In assessing the corporate culture surrounding the problems with the 737 Max, Boeing was preoccupied with efficiency and profitability and believed the demand for the reengineered plane would be strong. The demand turned out to be strong, but that encouraged speeding up the plane's production without proper testing. Pressures for these speed-ups contributed at least indirectly to the Boeing 737 MAX crashes.

This sort of preoccupation was also found in General Motors when its management ignored ignition switch failures. Problems with the ignition switch were detected in its Chevrolet Cobalt as early as 2002. But despite hundreds of injuries and fatalities from this failure[1] and thousands of complaints, the Company said it was a "customer convenience problem," (Valukas 2014, p. 2) and to redesign the switch properly would have been very costly(Valukas 2014, p. 8). Was this simply negligence; was there a preoccupation with profitability, or was it protection of the Chevrolet brand as a "safe" option? Finally, in 2014 a thorough investigation was initiated by GM using Anton Valukas and the firm of Jenner and Block. The investigation concluded that for several years of production, the ignition switch was defective and that customers were not notified of the lethal defect.

In another set of cases, NASA experienced two space shuttle explosions. In 1986, seven crew members died when the Space Shuttle *Challenger* disintegrated 73 seconds into its flight because of a failure of O-ring seals. Among the dead was high school teacher Christa McAuliffe, who was to be the first teacher in space. NASA managers and the chief contractor for the shuttle, Morton Thiokol, had known for several years that the shuttle had a potentially disastrous flaw in the design of the O-rings, but both organizations had failed to correct the problem. There was an urgency to launch as soon as possible, as the eyes of millions, including school children were focused on this novel flight. The evening before the launch, engineers warned NASA managers not to launch because the seals on the O-rings could fail with freezing temperatures. NASA disregarded this advice, violating their own safety rules. NASA was not preoccupied with profitability, but they were worried about losing popular and political support. That urgency may have prompted questionable decision-making on the part of NASA managers.

Seventeen years later, another NASA space Shuttle, the Columbia, lifted off at the Kennedy Space Center. It was another ill-fated flight. Only seconds after liftoff, a briefcase-size piece of the insulating foam that covered a large external tank broke off, hitting Columbia's left wing and leaving a 10-inch hole. The damage was fatal, but not until reentry of the spacecraft. Engineers had warned management of the problems with the foam in earlier flights, but NASA managers didn't believe the insulating foam could cause real damage. NASA ignored the warnings from engineers to correct the problem, and the lives of seven astronauts were lost (Harris et al. 2019, p. 51; Vaughan 1997; Werhane 1999; Werhane 2021, forthcoming). Proper Engineering Decisions (PED) could have been employed early in the flight to film the problems of the insulating foam. It may have been possible for the astronauts

[1] The actual number of fatalities has not been calculated in this study, in part because of deaths from airbag failures and other mechanical malfunctions as well.

to fix the damage, had they known the damage existed. The decision was made to ignore the insulating foam that was disrupted at lift off. If engineers and management had discussed the problem together, perhaps the cautions from the engineers would have been heeded.

The analysis

As we indicated earlier, when corporate disasters occur or a company is allegedly engaged in misdeeds, we tend to look for individual culprits, often the corporate CEO or senior officer. However, the Boeing 737 MAX crashes and the resulting consequences derive from what we would call a toxic organizational culture in which the flawed software for the 737 MAX was not considered an issue, despite its questionable performance. As one internal email from an employee mused,

> I don't know how to fix these things…*it's systemic. It's culture*. It's the fact that we have a senior leadership team that understands very little about the business and yet are driving us to certain objectives (Kitroeff 2020, our italics).

There are at least four interrelated organizational phenomena that contributed to these disasters: (1) profit seeking as the dominant organizational logic at Boeing, (2) the mindsets embedded in that culture that precluded asking questions about the design that created blind spots in engineering and managerial thinking, (3) the siloed mentalities of the organizational divisions, and (4) a hierarchical structure that discouraged asking challenging questions, so that most engineers at Boeing, even those who had grave doubts about the 737 MAX, went along and no one "blew the whistle" either to the Board or the press. And as we shall see, there are again parallels to the NASA and GM cases.

(1) Organizational dominant logics

"Dominant logic" refers to an organizational culture, a set of practices and habits that frame the organization's goals and modes of operation. Dominant logics are vital for the coherent functioning of an organization as an organization. However, sometimes a dominant logic can become so ingrained that it creates blind spots or hinders change. Worse, as Prahalad and Bettis, the authors of the dominant logic mindset, maintain, "…the more successful organizations have been, the more difficult unlearning becomes" (Prahalad and Bettis 1986, p. 498). Firms' successes fortify their habits and theories of action and make revisions significantly more difficult. "…[T]he longer a dominant logic has been in place, the more difficult it is likely to be to unlearn" (Bettis and Prahalad 1995, p. 11). Of course, a logic can change and reframe an organization's mission and focus, as we saw in the reorganization of Boeing in the 1990s. But the new "logic" of profitability-first blindsided Boeing's management into imagining that the MAX would function properly without much redesign.

During the first 80 years of operations, Boeing functioned as an engineering and scientific company. Engineering safety was a paramount function of all operations; this was its dominant logic. Yet Boeing was always profitable. But when Boeing merged with McDonnell Douglas, engineering dominance was replaced with business mental models that concentrated on overall production, efficiency and speed, with an aim to increase profitability. Engineers were identified as designers but not as decision-makers. For Boeing, after it moved its headquarters to Chicago, the decisions of the engineers were now 1500 miles from corporate headquarters. Executives then created a climate where the critical voices of engineers were discouraged and dismissed. Their competition with Airbus was often the focus of profits over other concerns. The changes in discourse empowered managers as decision-makers with authority over engineering design even when most managers were not engineers and knew little about aircraft manufacture and safety. In order to stay employed, engineers were pushed into the uncomfortable position of yielding to their bosses (Useem 2019).

Similarly, at NASA at the time of the Challenger and later the Columbia explosions, the dominant logic was, in short, that engineers designed, and managers made decisions. So, for example, on the night before the Challenger launch the project manager, Jerry Mason, told Robert Lund, the chief engineer, to "take off your engineering hat and put on your management hat (NASA, *Rogers Commission Report* 1986, Volume 1, pp. 93–94). Lund then overrode the objections of many engineers who had questioned the viability of the launch under what were predicted to be questionable weather conditions. By the time the Columbia was launched, the hierarchical logic was still in place, and engineers deferred to managers for decision-making. In that disaster, because foam tiles had fallen off every shuttle previously, this phenomenon was deemed to be "normal." An engineer's request to film the Columbia tiles "fall-off" was overridden by the project manager. Filming could have shown that tiles and insulating foam had punctured the space shuttle and caused the explosion (NASA, *Columbia Accident Investigation Board, Report*, 2003, pp. 145–147; 157). At GM, time and time again from 2002 to 2014, despite overwhelming evidence of the dangers of ignition switches on the Cobalt and other models, as well as engineering questions, management did not think this was serious enough to warrant recalls or redesigning the switch (Valukas 2014, pp. 1–8).

There is another element of the dominant logics of these organizations. Each should have focused on safety as its primary focus, but each was more concerned with other pressures. NASA was preoccupied with efficient launching and getting shuttles in the air as quickly as possible. Political pressure to show progress on the space program was an additional incentive. This could also be tied into budget requests to continue the space program. Boeing's rush to produce and market the 737 MAX was in response to pressures from rival Airbus who had been challenging Boeing as the largest commercial aircraft manufacturer (Cohan). The 737 MAX was developed to respond as quickly and inexpensively as possible to this challenge. By simply tweaking the 737 rather than engaging in a complete redesign, Boeing was able to create the 737 MAX in record time. Similarly, GM wanted to continue producing Cobalts with the fewest design changes possible. Notice that these organizations were driven by goals of efficiency and productivity, all values we teach in

business schools. These are ordinarily fine goals. The problem in all these cases is that these organizations let expediency surpass good judgment and lost sight of their most important stakeholders: customers, and automobile, airline, and space travelers, in other words, human beings.

In none of these cases did any engineer or manager blow the whistle before the event despite in all cases lives were directly at stake.

(2) Mindsets and blind spots

Mindsets are ways of representing, or cognitively framing, our experiences by attending selectively to stimuli in our social environment. These frameworks operate as "lens" that set up parameters through which our experiences are filtered and organized (Werhane et al. 2013, Chapter 2. See also Werhane 1999). Indeed, we cannot function otherwise, because without ordering and organizing our perceptions, our experiences would simply be chaotic without any framing or identification.

However, because we are fallible human beings and thus the organizations we create are also fallible, we often miss something, and sometimes something especially important and applicable. In an organization with a strong dominant culture, the dominant logic of that culture can focus attention on certain organizational goals such that other important corporate agendas are neglected. Because of a dominant culture that focuses attention on only one set of decisions, this focus can create blind spots, wherein what should be attended to is simply ignored or not even noticed (Moberg 2000).

Thus, perceptions can become blind to unethical, inconvenient, or negative information. The corporate culture at Boeing, where profitability drove decision-making despite the fact that the company was in the airplane business where hundreds of lives are at stake every time a Boeing aircraft flies, created blind spots wherein Boeing managers ignored their most important stakeholders: its engineering designers, airline staff, and customers. The list of those harmed is much longer when suppliers, airline corporations, and others who depend on Boeing for their survival are added to the mix (Cameron and Tangel 2020).

There are parallels with the other cases. At NASA, despite the Challenger crash, partly caused by dismissing engineering questions, the same hierarchical structure prevented Columbia management from addressing the shuttle's tile debris. Indeed, after the Columbia explosion, the *Report* comments that safety was of secondary importance and that "a broken safety culture…of blind spots" (NASA 2003, p. 184) created by many successful launches and managerial conviction that the past will always predict the future (182-4. See also, Werhane 2021, forthcoming). GM simply seemed to ignore or not "see" the ignition issues despite many accidents, hundreds of lives lost, and questions from their engineers.

(3) Silo mentalities

A third phenomenon contributed to the engineering mis-design of the 737 MAX: what we will call silo mentalities. "Silo mentality" is a widely occurring

phenomenon wherein a profession, a particular division of an organization or an organization itself is so focused on their priorities or their expertise that they neglect or fail to perceive how those priorities affect or are affected by other professions, divisions in the organization, or others in their industry (see Werhane 2021, forthcoming). At Boeing there were several silos, most of which did not communicate with each other. Some of the design engineers were working on a government contract for a refueling tanker aircraft. They installed the new MCAS software in these tankers, but with the necessary redundant software that would halt malfunctions. However, these engineers apparently did not communicate with the industrial engineers who designed the 737 MAX with the same software but without that redundant software (Langewiesche 2019). While often in large companies there is not much communication between divisions, the fact that both design teams were using the same MCAS software would seem to call for some cross-communication.

Similarly, at GM, although various divisions were working on the ignition switch problem, there did not seem to be any joint decision-making that might have provided fodder to plead with management to recall and fund the redesign of the switch (Valukas 2014, pp. 1–8). As a result, in 2015 GM settled nearly 400 claims and in 2016 GM paid more than $2 billion to settle more claims, including 124 death cases. The corporation also consolidated 235 death and injury claims for out of court settlements on these cases (Vlasic 2016). Ignoring a small but lethal problem in the ignition has cost the corporation countless hours in paying for lost lives, working through recalls, repairing the vehicles, and repairing their damaged reputation.

Aerospace analyst Richard Aboulafia explained to *Vanity Fair* that during the change in Boeing's management, it was not just technical knowledge that was lost.

> It was the ability to comfortably interact with an engineer who in turn feels comfortable telling you their reservations, versus calling a manager [more than] 1,500 miles away who you know has a reputation for wanting to take your pension away. It's a very different dynamic. As a recipe for disempowering engineers in particular, you couldn't come up with a better format (Useem 2019).

There are other silos at Boeing. Boeing has been a master in marketing the 737 MAX globally. For example, its marketing team sold 201 737 MAX planes to Lion Air. (Boeing.com). However, globally, Lion Air has the worst safety record in the airline industry, so bad that it is forbidden to fly in North American air space (Langewiesche 2019, p. 43). Part of this record is blamed on poor pilot training, a phenomenon Boeing has observed when trying, in vain, to improve these practices (Langewiesche 2019). Yet this questionable reputation and poor pilot training did not deter Boeing's marketing team from selling new airplanes to this airline. Perhaps the marketing team was unaware of Lion Air's bad safety record…a siloed view. To market an aircraft that depends on pilot acuity to an airline company or to a country where such acuity is not the norm for pilot training is, at best, ethically questionable.

Siloed mentalities abounded at NASA as evidenced in the documents available after both the Challenger and Columbia launches, as we have illustrated with the "take off your engineering hat" edict, and later when management at the Columbia

launch site ignored a plea for inspecting the falling foam tiles on the Columbia shuttle (NASA 1986; NASA 2003; see also Vaughan 1997 and Werhane 1999 on the Challenger disaster).

Reading the report on GM's ignition issues, it appears that no one took these failures very seriously. Corporate officials seemed to operate in separate silos, and no one in charge ordered recalls until, finally, with a change of management, GM engaged Jenner & Block to examine this lingering issue seriously (Goldstein and Meier 2014). Interestingly, GM as an organization "blew the whistle," albeit belatedly, on itself. In other words, GM publicly admitted to the flaws in its own ignition switches. And to be fair, after pressures from the FAA and media, Boeing has become transparent, and made all its internal emails publicly available about the 737 MAX issues and objections (Johnsson et al. 2020).

(4) Leadership, loyalty and whistleblowing

Fourth, and related to organizational weakness, was Boeing's culture of loyalty. Despite the fact that engineers apparently had strong concerns about the 737 MAX's design, as evidenced in the internal emails that were made public by Boeing, no engineer made public these concerns before the crashes, and those who voiced their worries to management were sidelined or dismissed. At NASA no engineer who was working closely with the Challenger blew the whistle outside the agency before the launch (although many did after the explosion). After the devastating crashes, many Boeing engineers came forward with their doubts about the 737 MAX. And again, as we have noted earlier, during the Columbia flight, the engineer who wanted the imaging of that shuttle's tiles accepted the managerial decision not to bother. At GM there were objections to the ignition switch but not public ones. In other words, the authority and judgment of the top managers at these organizations were not challenged even when there were serious doubts and evidence of impending dangers. These are examples of corporate loyalty and a sense that questioning management of these problems was not acceptable behavior.

Obedience to authority

An additional leadership problem is evident in a famous study involving obedience to authority. In the 1960s a psychologist at Yale University, Stanley Milgram, was trying to answer the question of why so many Germans were loyal to their country's leadership and went along with Nazism and the death camps, simply ignoring what was going on around them. Milgram conducted a long series of studies on obedience to authority, testing 840 participants. Milgram concluded that that those in leadership roles can, by virtue of their perceived authority, move decent individuals to do things that are ethically unacceptable (Milgram 1974; Werhane et al. 2013). Milgram found that in all those he tested, at least 60 percent went along with the study

under the orders of a man in a white lab coat, inflicting (what they thought was) up to 450 V of electricity to a perfect stranger. The backgrounds of the participants could not be correlated with these outcomes: the well-educated were just as obedient as those with only an 8th grade education, and the location of the experiments, either at Yale or in a storefront, made little difference. Although Milgram only tested 40 women, the results were the same. Women in this experiment were not kinder or gentler (Milgram 1974; see also Parmar et al. 2016 working paper).

The study was conducted over 50 years ago, and, as an experiment it has many issues. The participants were mostly white and from northeast United States. The participants were told that this was a learning experiment when all along the goal was to see how many people would be obedient to instructions from a supposed authority figure. The participants then naively followed the alleged authority even when other humans were in danger. Additionally, there is some evidence that the participants were not properly debriefed (Perry 2012). The current Institutional Review Boards were created in part, because of the flaws in the Milgram experiments (The Belmont Report 1979).[2]

However, despite these questions, different versions of the experiment have been reproduced several times in the last decades with similar results (see Burger 2007, 2009). John Greenwood a professor in CUNY Graduate Center analyzed the Milgram experiments, as well as recent iterations of the experiments. He found recent results mostly consistent with earlier results. He determined it was distressing that even in international contexts, obedience seemed to prevail even when physical harm was a result (Greenwood 2018).

In non-experimental contexts, we see this phenomenon reoccurring in the Rwanda massacre, at the Abu Ghraib prison in Iraq, and in organizations where employees and managers as well as engineers go along with management decisions, despite evidence that these decisions entail malfeasance, wrong-doing or harm. The Boeing 737 MAX, the NASA explosions, and GM's inaction to redesign the faulty ignition switch are such examples where managers and engineers knew about the pending problems but found no avenue for "blowing the whistle," or were afraid to, given the hierarchical structures of these organizations. The Milgram experiments, then, although they are flawed methodologically, present a mindset, a way of looking at experiences from an "obedience to authorities" point of view that provides an explanatory mechanism to account for whistle-blowing failures that, in turn, result in avoidable harms (see Parmar 2017).

In an ideal culture, any employees should be able to refuse an unethical request and be respected for that refusal, as Harris et al. have argued (2019). The Milgram studies and other examples are evidence, however, that the combination of deferring to authority along with an obscuring of ethical issues can make such ethical decision processes precarious. For Boeing, once the merger with McDonnell Douglas had taken place, and after Boeing moved its headquarters out of Seattle, executives then

[2] Interestingly, too, as Richard Griggs points out, many textbooks, and in particular widely-assigned psychology textbooks, that refer to these experiments often fail to mention its flaws (Griggs 2016). This neglect skews student thinking so that they often do not question the methodology of the experiments.

created a climate where the voices of engineers were discouraged and dismissed. In order to stay employed, engineers were pushed into what is evidenced in the internal emails as the uncomfortable position of yielding to managerial authority (Useem 2019). The NASA culture also promoted a culture of hierarchical concessions to the authority of management. Even after the Challenger explosion, the dominant logic at NASA did not change over the course of 17 years when the Columbia explosion occurred. Managerial pressures during the Columbia mission silenced the voices of those engineers who feared the tile expulsions could be fatal.

Inexcusability and Reform

The managerial performances of NASA, Boeing, and GM are inexcusable because they could have been prevented without scrapping the Shuttle program, or in the case of for-profit companies, without incurring serious losses or going into bankruptcy. But is this merely second-guessing, or is reform possible? We think reform is possible.

Returning to the assumptions made earlier in this paper, namely that our mindsets are incomplete representations or fallible reconstructions of the data of our experiences, one can step back from those constructions, reexamine a dominant mindset logic, and revise or change it. This is part of what Werhane has called 'moral imagination" (Werhane 1999). Moral imagination entails that an individual or organization should step back from its mindset or dominant logic to study itself in both its positive as well as negative aspects. Second, in this process the individual or organization needs to evaluate this mind set as to its viability, its logic, and its flaws. In this process an organization can begin to recognize and then challenge its siloed operations. These two steps are the hardest because often we are locked into long-held habits that have seemed to have been successful in the past. As an engineering company, Boeing was successful for an exceedingly long time, and after the managerial changes it was very profitable until the MAX crashes. So, it is no surprise that there was little questioning of the corporate culture. Perhaps well-intentioned new managers did not realize the negative consequences of sidelining engineering decision-making. Today (2021) it has had to cut thousands of jobs and in 2020 it had to reduce dividends as well (Chokski 2020). Boeing slipped to second place in airplane manufacturing and sales, with Airbus in first position (Cohan 2019).

As human beings we can step back from who we are, our surroundings, and our habits. We are doing just that in analyzing these cases in this paper, and organizations can do so as well. To break out of a silo, however, requires that organizations (and individuals) realize that one is *in* an organizational setting—a silo that is merely that and overlaps with other functions of the organization. This first step is important for employee development, management accountability, and to create instigators of change. At Boeing, a global company, considering the mind sets and cultures of

their customer countries seems obvious, and every executive, manager, scientist and engineer at Boeing should have been made aware of global safety issues, simply because they are in the aircraft business. Ignorance is not a good moral excuse in this or any industry.

The third step in a morally imaginative process is to evaluate alternatives, both as to the value that alternative may create, or not, and to its viability (Werhane 1999). Boeing, because it is a human-run organization, cannot create a perfect aircraft, but it can avoid obvious flaws that cause crashes and can be corrected, and the value of that for human lives and for the long-term health of the Company is clear. Evaluating moral alternatives to the production of this flawed aircraft should have happened long before Lion Air Flight 610 plunged into the Java Sea.

The fourth step is operationalizing this new framework and of course, reevaluating these changes. This morally imaginative approach seems simple on paper, but the first steps—breaking out of an organization's dominant logic is the hardest, because often individuals and organizations do not even realize that the fallible reconstructions or incomplete mindsets, logics and silos are inhibiting change. Breaking out of ingrained thinking is a difficult process (Werhane 1999). With Boeing's profitability on the rise prior to the two horrendous crashes, it was difficult for executives to consider that vital changes should be made to the 737 Max. Now in hindsight, it appears that numerous problems with the plane had to be fully addressed before it was deemed flight worthy. Boeing paid a hefty price for their inability to use moral imagination in assessing their organization.

Conclusion

To revise an organizational dominant logic, individuals in that organization, usually its leaders, and the organization itself have to realize that these silos exist. The dominant logic of the organization is just one way to think about organizational decision-making and goals, and a dominant logic may be contributing to potential failure. In our present, fast-paced, global economy, to compete, organizations must experiment with new logics, revise their goals, and be unafraid to change what seems to be "cemented" in place. As we argued earlier, this is the most difficult thing to achieve in any organization. We are all creatures of habit and when operations seem to be going well, we loathe change. But today we live in a global interrelated set of economies where each national organization comes from a particular belief set and where cultural and social as well as economic differences prevail. That sort of thinking must be part of any twenty-first century organization's mind set, or disasters such as the 737 MAX will keep reoccurring. However, NASA has been working diligently after the Columbia explosion to revamp its culture (NASA 2003, pp. 184–190), and there is some evidence at GM that such reforms are being initiated as well (see Valukas 2014, pp. 8–11; Vlasic 2016). At Boeing there may be additional upheavals before Boeing is functioning smoothly, safely, profitably, and ethically.

Finally, and this is only hinted at in reports of Boeing's crashes, probably because it seems obvious, Boeing is a massive organization consisting of a vast number of inputs from global contractors, subcontractors, engineers, managers, suppliers and governments. Rethinking Boeing's culture requires rethinking the hierarchical structure of the organization and its various stakeholders and remembering that safety should be its first and primary concern. Figure 1 is one image of the organizational thinking at Boeing. However, Fig. 2 places global passenger safety in the center to emphasize that passenger safety should be the primary moral focus of an aircraft manufacturer. They are simple graphics, but they can be effective in triggering organizational restructuring and revamping an organizational focus.

On December 29, 2020 the first commercial 737 MAX American Airlines jet flew from Miami to New York without incident. American's CEO was on board (Chappell 2020). Whether the organizational issues at Boeing have been adequately addressed remains to be seen.

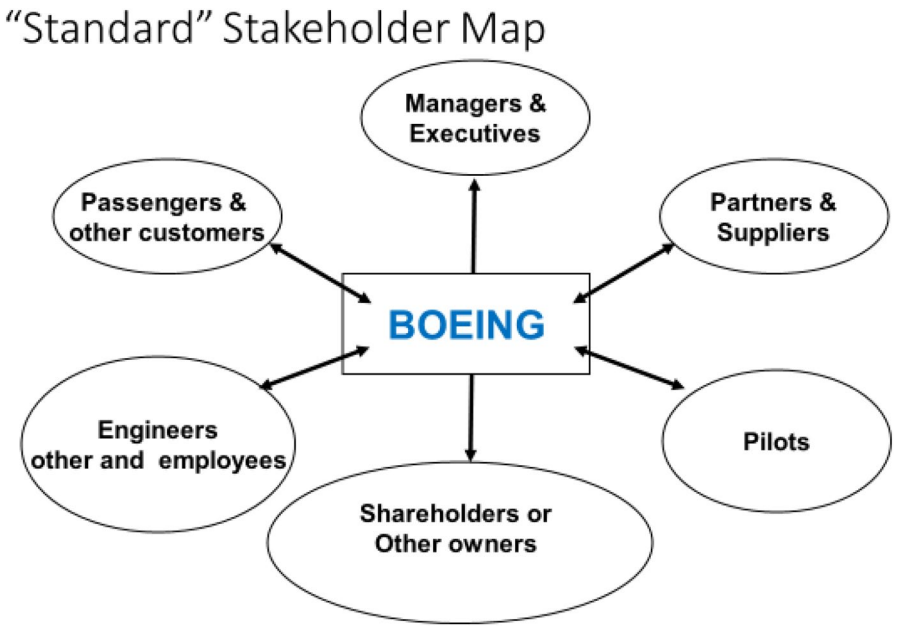

Fig. 1 Organizational thinking at Boeing

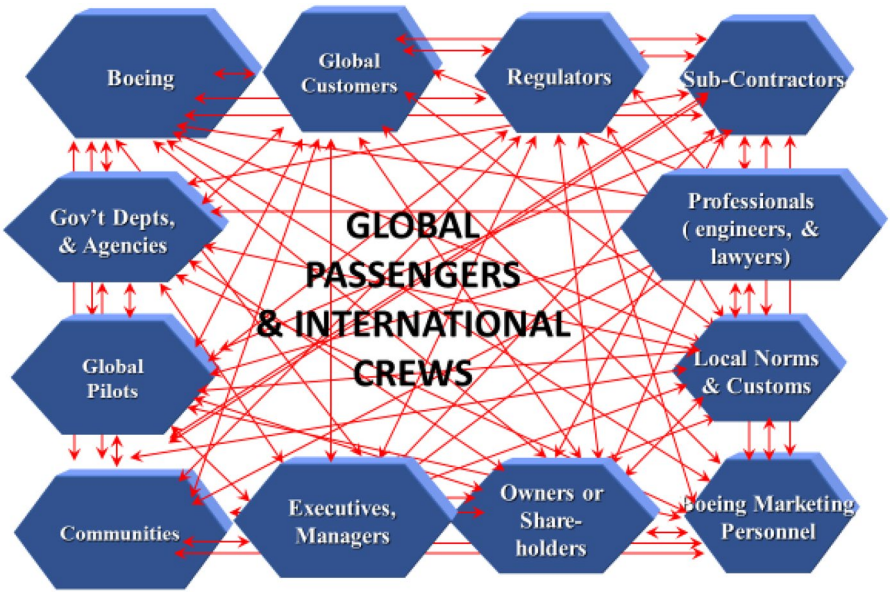

Fig. 2 Global passenger safety is in the center to emphasize that passenger safety should be the primary moral focus of an aircraft manufacturer

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