

Off the Rails: BART's Semicentennial Struggle with Automation and Corruption

Abstract

On the heels of a decade of nationwide reform, engineers designed the Bay Area Rapid Transit (BART) system to trailblaze a new future for modern public transportation. Along with aluminum chassis, thyristor propulsion, and wide-gauge tracks, contract engineers from Westinghouse Corporation implemented a cutting-edge automatic train control (ATC) system that sought to free the task of moving cars from human error. However, just weeks after the system opened to the public in 1972, a train derailed after the ATC failed to stop the car, injuring four riders. Thus began a half-century long struggle to wrangle BART's technology, management, and workforce into the sleek and efficient public transportation system it was designed to be.

This accident was not a surprise to three engineers who repeatedly voiced their concerns with the ATC to management. Instead of heeding their warnings, the board of BART voted to uphold the current management, and the three engineers lost their jobs soon after their objections. One of them raised his complaints to the California Society of Professional Engineers, which alerted the California State Senate and legislature. This started an open discourse over the ATC between the Senate and BART management, which devolved into vitriol after Berkeley professor Dr. Bill Wattenburg's vicious testimony. The political and technical chaos led to the firing of general manager B.R. Stokes and the transition to a hybrid or entirely manual control system. Did this solve the problems? As recently as January 2024, a BART car derailed. Outside of the ATC, ghost trains, overcrowding, and extremely tedious maintenance have plagued BART for its entire history.

The story of BART is an engineering failure intertwined with an ethical failure. Because of a lack of accountability for its success, BART managers and contractors prioritized their own security over the safety of BART riders. To have avoided this, both the board and Westinghouse should have had some skin in the game. If they were susceptible to legal retaliation for injuries, they would be more likely to test the system to avoid losses. If part of the engineering contract promised Westinghouse a share of ticket revenue instead of a lump sum payment, Westinghouse would forfeit money by designing a system that scared users. Finally, due to the sheer entrenchment of corrupt officials that persists to this day, BART needs a direct investigation into its culture.

Background

Robin Williams once said "if you can remember the 1960s, you weren't there," and no city holds a tighter claim to "there" than San Francisco (Curran 2018). Charles Manson, the Haight-Ashbury Free Clinic, the militant Symbionese Liberation army (captors of Patty Hearst), a Black Panthers HQ, and the original Church of Satan dotted the hills of Haight-Ashbury during

the decade, each with a radical vision for the future. Another milestone of progress and reform of the '60s was the first spike of what would become the Bay Area Rapid Transit system, or BART. Planners intended for BART to catapult public transit into the space age and designed the entire system from scratch. Taking inspiration from aerospace engineering, cars were built out of single aluminum chassis instead of the typical sheet metal. For propulsion, cars used the then-novel thyristors, which are also used in particle accelerators. The BART system famously uses its own signature wide gauge of rails to accommodate the lightweight aluminum cars and withstand heavy bay winds (Payne 2022). Their most impressive innovation was Westinghouse Electric Corporation's multi-million dollar automatic control system, which promised to liberate transportation systems of human control. In October 1972, just weeks after the future's flagship public transport system opened, a BART car injured four riders with a crash, taking the 1960s optimism with it (*New York Times* 1972).

The Engineering Failure

How did none of the engineers notice an issue with BART's automatic control system? Actually, some of them did notice as early as 1969. Three engineers—Holger Hjortsvang, Max Blankenzee, and Robert Bruder each expressed their dissatisfaction with the ATC project in memos to their management (Unger 2010). Hjortsvang calculated that at full ridership, BART would encounter a catastrophic failure every three-and-a-half hours. The trio sought the support of BART board member Daniel Helix, and the board convened to discuss the issue in early 1972. Unfortunately, the board overwhelmingly voted to uphold the current management, and BART fired the three engineers soon after. BART's officers then stonewalled efforts by the California Society of Professional Engineers (CSPE) to investigate them. Motivated by a concern for public safety, the CSPE then filed a report vindicating the engineers to the California State Senate and petitioned for the California legislature to look into the issue.

The legislature listened. The month before the disaster, analyst Alan Post reported that BART's administration failed to properly consider its engineering problems and recommended delaying BART's reopening until a total rework of the ATC system (*New York Times* 1972). After Post's description and the October crash, BART quickly released a long assessment that disputed their ignorance to BART's technical problems, but agreed with Posts's recommendations (Anderson 1980). Initially, BART committed to implement Post's suggestions, but the cooperation fell apart after a 1973 Senate Committee Hearing. UC Berkeley professor Dr. Bill Wattenburg unleashed a flurry of criticism against BART's management and design, calling it "the world's most expensive pinball machine." For example, one of the challenges with BART was dirt and corrosion on the tracks that inhibited communication. The team introduced scrubbers on the cars to lukewarm success, which Wattenburg compared to a nineteenth-century practice of young boys hired to scoop horse manure behind carriages. This dramatic hearing may have ended the chance of cooperation between investigators and the current board.

Wattenburg's testimony, the October crash, and numerous investigations from separate organizations prompted a resignation from general manager Stokes in 1974 (Anderson 1980).

This actually prompted a new beginning for the system, as a newly-elected board began incorporating Wattenburg's suggestions. The new board also took the offensive and sued Westinghouse and settled for sixteen million dollars. Lastly, engineers also replaced the ATC with manual operators who alerted each other by telephone (*New York Times* 1972). However, these changes failed to completely solve BART's reliability and safety problems. After Stoke's resignation, for the rest of 1974, about half of the white elephant's fleet of cars was unavailable for service due to maintenance (Teague and Clifford 1976). BART itself recorded that ATC caused only a tenth of the problems, and that other mechanical components such as electronics, the car body, propulsion, and suspension proved to be vulnerable. The computer system identifies incoming cars that do not actually exist so often that they have incurred a nickname: ghost trains (Bay City News 2005).

While BART has seemingly endless issues, it is important to contextualize it with other metropolitan transportation systems and factors beyond its first decade. For example, BART relies far less on public funding compared to fare revenue than almost any other American system. In 2020, BART made about \$340 million in fare revenue for about \$682 million in operating expenses, so BART pays for about half of its costs through fares (Federal Transit Administration 2020). In contrast, the Chicago Transit Authority spent more than double that of BART at \$1.4 billion, but raked in over one hundred million dollars less in fares. Other systems such as Massachusetts, D.C., and Los Angeles are similar, making comparable fare revenue but spending multiples of BART's expenses. In this light, BART is actually by far more economical than other systems. Furthermore, due to San Mateo, Santa Clara, and Marin County's refusals to share in the train's maintenance cost, the system also awkwardly only serves the East Bay and San Francisco. This severely limits BART's utility and ridership. Lastly, the COVID-19 pandemic diminished all public transportation usage, but slashed BART's ridership with a uniquely high severity. By 2022, BART had not even recovered half of its original users, while Los Angeles, Chicago, and New York had restored 60-70% (BART 2023). The combination of BART's laggard recovery and BART's uniquely high reliance on fare revenue has placed the system in a distinctively dire financial position. This lets us understand BART's issues in the light of not just initial technical dysfunction, but continuously low ridership and marginal public support.

Over fifty years later, the story of BART circles back to its tumultuous beginnings. As late as January 2024, a BART car lost connection to the station, and a manual operator was instructed to take over for the automatic system (Green 2024). The issue led to a derailment that injured nine riders, worse than the original 1971 disaster. This disaster recapitulates the initial derailment weeks after BART opened to the public, and casts a shadow of futility over half a decade of attempts to improve.

Ethical Analysis

Why should we not give up hope on BART a half-century later? Because when executed correctly, it provides much greater utility for a larger number of people than cars. Because

maximizing net benefit is generally the goal of public policy, utilitarianism is the most appropriate ethical framework for analyzing this situation. This school of thought directs individuals to make the choices that provide the greatest net happiness for the most people. Public transportation systems exemplify this philosophy above other ethical viewpoints. Because BART is mostly funded by taxes collected from citizens of California, their interests are priority. Governments also often use eminent domain to acquire necessary land for public transportation projects. Taxation and eminent domain both arguably violate other ethical frameworks, such as rights ethics, but a project like BART proceeds because it delivers immense benefits to riders compared to marginal costs to taxpayers and imminent domain victims. Since governments operate under a utilitarian framework, solutions to BART's problems should consider this framework.

When confronted by the engineers, the BART board and managers had two main options: suppress their concerns and proceed as planned or consider and adopt their suggestions. By choosing the first option, management initially evaded the consequences of admitting failure and delaying or dramatically redesigning BART's ATC. However, the board did not consider the harm caused to the engineers, the public, or themselves in the future. The three fired engineers suffered from months of unemployment and pay cuts after finally finding new jobs (Anderson 1980). BART riders have endured and still occasionally endure injuries from derailments, such as the nine injuries in January 2024. Finally, BART management ultimately faced retribution, because eventually manager Stokes was forced to resign and the rest of the board was voted out.

If BART management chose their second option and publicly acknowledged the train's technical issues and investigated them, they would have suffered considerable costs to their reputations and potentially their jobs. They would also have inflicted harm onto the ridership, who would not be able to ride BART until its safety is verified. However, these choices would have avoided longer-term damage to themselves and riders. Clearly BART management considered the costs and benefits to themselves only instead of including BART employees and riders in their analysis, directly contrary to the utilitarian mission of government.

While utilitarianism helps elucidate the underlying costs and benefits of different choices, it does not explain every choice or always provide a superior alternative. While governments generally employ utilitarianism for public projects, this framework cannot account for the idealism permeating BART's design. A truly practical organization concerned with costs and benefits would likely model BART after a pre-existing, time-tested public transportation system of another city, like the century-old Chicago L. That choice offers predictable and limited results. Instead, engineers intended to trailblaze a new model for public transportation with aluminum chassis, thyristor propulsion, wide-gauge tracks, and automatic control. With no previous examples to learn from, BART yielded the potential for unbounded catastrophe if these untested technologies failed. That is exactly what happened, but in another world, BART could have eclipsed every other system and propelled the evolution of metropolitan transit worldwide. It is difficult to frame their decisions solely through utilitarian calculus because their decision risked

extreme failure for the chance of extreme success. Therefore, analysts need a framework other than utilitarianism to adequately explain their decisions.

Recommendations

An organization operating with a utilitarian mindset would consider the benefits and harms to all constituents: riders, employees, citizens, contractors, and managers. However, BART leaders realized that their effect on the public's welfare had no impact on their own welfare. Unlike a company subject to profit incentives, they did not feel a financial pressure to deliver a usable product. A three-part solution that gives the BART board legal responsibility, performs a thorough investigation of BART's financial deals, and ties future contracts to the system's future success will confront the core issues of its inception.

Westinghouse and the board have already incurred losses for making incorrect decisions. The removal of the old board and the settlement with Westinghouse Corporation represented a first step, but that was half a century ago. BART itself does have legal accountability for people harmed by it. BART has paid nearly \$15 million dollars in settlements from four cases of often fatal police brutality (Brekke 2023). BART recently paid its largest settlement of over \$9 million dollars to a passenger who was dragged and brutally injured along the platform by the car, which closed on his jacket (Brekke 2023). However, while these lawsuits have penalized BART to the point of financial emergency, they have not affected any administrative official. Until the managers incur legal or financial accountability for BART issues, BART itself will continue to lose money, while the board remains.

In the face of all these problems, Governor Gavin Newsom created the Office of the Inspector General to uncover misuse of funds in 2018 (Cano 2023). However, BART board, managers, and unions incessantly stymied Inspector General Harriet Richardson's efforts. For example, BART unions required Richardson to inform BART two days before she interviewed an employee. Despite these hurdles, Richardson's office uncovered several corrupt contracts awarded to family members and former employees (Kamisher 2023). These discoveries can end BART's corruption and amend its financial issues. Unfortunately, Governor Newsom vetoed a bill to support Richardson's office, and she resigned in frustration. While the Inspector General's Office is floundering for now, a revitalized office would finally enable legal penalties directly against BART management.

Finally, contractors should have a stake in the success of BART. A company like Westinghouse had no utilitarian incentive to deliver a successful ATC system because it was awarded a fixed contract based on its bid. If Westinghouse had some of its compensation tied to the success of BART, just as any company has its revenue tied to the success of its products, the corporation would have ensured the reliability of its automated system. One caveat of this recommendation is that it will disincentivize many businesses from signing contracts with BART, because of BART's corruption and financial trouble. If the contracts are tied to BART's success, and BART is on a path to failure, then most companies will refuse to participate. BART should only adopt this recommendation after it recovers from its political and financial problems.

Until then, BART needs money. Drastically reduced post-pandemic ridership coupled with an unusually high reliance on fare revenue places the Bay's transportation in dire financial peril. Like other successful systems, BART needs healthy support from the public domain. BART should also expand into Santa Clara, San Mateo, and Marin counties. Adding nearly three million riders would

Conclusion

In the end, BART's designers' wish for a one-of-a-kind metro was granted, but they should have been more careful of what they wished for. Riddled with corruption, crime, failing technology, and derailments, BART may at first appear exclusively terrible. However, BART also serves hundreds of thousands of travelers at a fraction of the cost of other systems. Unsatisfied with America's mediocre public services, and instead of copying another city's system, Bay Area engineers attempted to invent an entirely new ultramodern paradigm for modern transportation. Because of their hard work, Bay Area citizens can proudly claim the lightest, cleanest, and most economical metropolitan trains in the country. As the troubled system recovers from COVID, roots out corruption, upgrades its old cars, and expands to the rest of the bay, its future will only grow brighter. BART truly embodies its 1960s San Francisco birthplace in its idealism and bipolar exceptionality.

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