

**Engineering as a Profession Assignment**  
**Fall 2/C Year**  
**EE353**

**The Aircraft Brake Scandal**

**Instructions**

- Read *The Aircraft Brake Scandal*, Department of Philosophy and Department of Mechanical Engineering, Texas A&M University, NSF Grant Number DIR-9012252.<sup>1</sup> (attached)
- Review the IEEE Code of Ethics, listed below.
- Answer the questions using the answer sheet attached.

**The IEEE Code of Ethics**

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. to accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. to be honest and realistic in stating claims or estimates based on available data;
4. to reject bribery in all its forms;
5. to improve the understanding of technology, its appropriate application, and potential consequences;
6. to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. to avoid injuring others, their property, reputation, or employment by false or malicious action;
10. to assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

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<sup>1</sup> The attached case study is an annotated version of the one found at the following website:  
<http://www.engineering.com/Library/ArticlesPage/tabid/85/PageID/61/ArticleID/70/articleType/ArticleView/Default.aspx> which is itself a modified version of the Texas A&M case study.

Name:

## **The Aircraft Brake Scandal**

Answer Sheet

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

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7. \_\_\_\_\_

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9. \_\_\_\_\_

10. \_\_\_\_\_

## Questions

- \_\_\_ 1. Who was Kermit Vandivier?
  - a. The engineer who designed the A7D four-rotor brake.
  - b. The engineer responsible for testing the brake system.
  - c. A company technical writer tasked with writing the qualification test report.
  - d. The project manager for the A7D brake system.
  
- \_\_\_ 2. What was the technical issue at the heart of this scenario?
  - a. The brake was fundamentally too small for the load of a normal landing.
  - b. The brake lining was defective.
  - c. The rotors within the brake were defective.
  - d. The testing procedure for the brake system was inadequate.
  
- \_\_\_ 3. What were the allegations reported by Vandivier to the *Troy Daily News*?
  - a. That Goodrich had not actually conducted the reported qualification tests on the brake system.
  - b. That Goodrich had falsified the qualification test results in their report.
  - c. That Goodrich had covered up the injuries that had occurred during the flight qualification tests.
  - d. That Goodrich executives had attempted to bribe testing officials to overlook poor test results for the brake system.
  
- \_\_\_ 4. Which of the following were **not** contributing factors to this scenario?
  - a. Representatives of neither the Air Force nor the main A7D contractor (Ling-Temco Vought Co.) were present at the flight qualification tests.
  - b. Lawson's immediate supervisors were busy with other projects and seem to have had little time or attention for the A7D brake project.
  - c. The brake design was considered innovative and was significantly different from prior systems.
  - d. The mission for the A7D was significantly different than for prior light attack bombers.

- \_\_\_ 5. Which of the following was **not** a consequence of the incident and subsequent investigation?
- More checkpoints were enforced in government inspection procedures.
  - Goodrich had to scrap the four-rotor system and instead absorb the cost of delivering a redesigned five-rotor brake system for the program.
  - Vandivier lost his job with Goodrich.
  - The engineers responsible for testing the system were fired.
- \_\_\_ 6. Which articles of the IEEE Code are most relevant to this case study?
- 2, 4, 6, and 9.
  - All of them.
  - 1, 3, 7, 9, and 10.
  - 1, 4, 8, and 10.
- \_\_\_ 7. If the four-rotor brake system had been accepted based on the test report, and had resulted in a pilot's death, who would have been morally responsible?
- Lawson
  - Goodrich company management
  - The program manager from Ling-Temco Vought who is overseeing the A7-D.
  - The Air Force systems engineer overseeing the procurement of the A7-D.
  - All of the above.
- \_\_\_ 8. What should Vandivier have done differently, according to the IEEE code?
- Nothing. He made the most ethical decision at every turn.
  - He should not have allowed qualification report Q6031 to be submitted with his name on it, even if it meant losing his job.
  - He should not have spoken to the FBI or the Troy Daily News.
  - He should have gone public at the first moment when he learned of the brake systems' poor performance in order to receive protection from reprisal from the government.

Whistleblowing is considered to be morally justified<sup>2</sup> when the following criteria exist: a) The potential harm is significant, b) the employee has exhausted the channels available to him or her within the organization and has received no satisfaction; and c) that making the information public will prevent the harm.

\_\_\_ 9. Some have argued that Vandivier had not exhausted the channels available to him within Goodrich before he made his concerns public. What is the best rebuttal to that argument?

- a. Vandivier told his immediate supervisor and received no satisfaction. In a big company such as Goodrich, that constitutes sufficient notice of the chain of command.
- b. Vandivier had already reached one step above his immediate supervisor with his concerns, which was as high as someone in his position at that time could reasonably be expected to go.
- c. Vandivier was complicit in the original deception, so he is really blowing the whistle on himself and therefore the chain of command does not apply.
- d. None of the above. Vandivier was wrong to have gone to the public without trying to notify everyone in his chain of command first all the way up to the CEO if necessary.

\_\_\_ 10. One could also argue that Vandivier was not morally justified as a whistleblower, because at the time he went to the press, Goodrich had already begun work on a replacement brake system. What is the best rebuttal to that argument?

- a. Goodrich may have already begun actions to address the immediate harm of the defective brake system, but if the cover-up had been allowed to continue, the record would still indicate that the four-rotor brake design was safe, which could have led to harm.
- b. By removing him from day-to-day operations, Goodrich was punishing Vandivier for bringing forward his concerns. An organizational culture that actively punishes employees who bring safety concerns to the attention of management also creates potential significant harm.
- c. Both of the above.
- d. None of the above. Goodrich had already responded and the harm was averted. Vandivier was wrong to go public with his allegations.

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<sup>2</sup> Whistleblowing is a controversial topic among the scholars who study engineering ethics. However there is general consensus for these criteria which were articulated by Richard De George in "Ethical Responsibilities of Engineers in Large Organizations," *Business and Professional Ethics Journal*, 1 (1): 1-14.

# The Aircraft Brake Scandal

## Introduction to the Case

On June 18, 1967, the B.F. Goodrich Wheel and Brake Plant in Troy, Ohio, received a contract to supply wheels and brakes for the new Air Force light attack aircraft. Goodrich won the contract based on their competitive bid and, more importantly, their innovative technical design, featuring a lightweight four-rotor brake<sup>1</sup>. Before the Air Force could accept the brake, B.F. Goodrich had to present a report showing that the brake passed specified qualifying tests. The last two weeks of June 1968 were set aside for flight-testing the brake, giving Goodrich almost a full year for design and testing.

Following brake failure at the June 1968 flight tests, and the ensuing accusations by a former B.F. Goodrich employee, Kermit Vandivier, regarding qualification test report falsification and ethical misconduct on the part of specific B.F. Goodrich personnel, Senator William Proxmire (D-Wisconsin) requested a governmental inquiry into the brake qualification testing performed by the B.F. Goodrich Troy Plant. On August 13, 1969, a four-hour Congressional hearing<sup>2</sup>, chaired by Senator Proxmire, was held to investigate the Air Force A7D Aircraft Brake Problem.

In 1972, Vandivier wrote a well-crafted article, "Why Should My Conscience Bother Me,"<sup>3</sup> which depicted his version of the Goodrich incident. His article formed the basis of what is now known in professional business and engineering ethics circles and in the literature of whistle-blowing as "The Aircraft Brake Scandal." As one of the most famous whistle-blowing cases in the literature, *The Aircraft Brake Scandal* has been hailed as a paradigm case of the courageous individual challenging an unscrupulous corporation.<sup>4</sup> Whistle-blower Vandivier is treated as a hero, a man who lost his job for doing the right thing.

However, life is more cluttered and more ambiguous than Vandivier presents.

### Notes

1. The rotor is a rotating metal disc interspersed with stators, which are stationary metal discs carrying brake lining material. The rotor and stator discs, when compressed, perform the braking action.
2. Air Force A7-D Brake Problem: Hearing Before the Subcommittee on Economy in Government of the Joint Economic Committee, Congress of the United States, Ninety-First Congress, First Session, August 13, 1969. LC card 72-606996. Herein after referred to as "Goodrich Hearing."
3. Vandivier, Kermit. "Why Should My Conscience Bother Me?" in Heilbroner, Robert L., et al., *In The Name Of Profit*, Garden City, New York: Doubleday & Company, Inc., 1972, pp. 3-31. See also the reprint of this article, "The Aircraft Brake Scandal," in *Harpers Magazine*, 244 (April 1972), pp. 45-52.
4. Fielder, John H. "Give Goodrich a Break," *Business and Professional Ethics Journal*, Vol. 7, No. 1 (Spring 1988), p. 21.

## **Background**

### **The LTV contract**

On June 18, 1967, the Goodrich Troy Plant received Purchase Order P237138 from the Ling-Temco Vought (LTV) Co. of Dallas, Texas, contracting for 202 brake assemblies for the new A7D light attack aircraft. While built for the Navy, the A7D light attack bomber was procured by the Air Force; hence, the A7D was a joint Navy/Air Force program. LTV was awarded the prime contract for the A7D, and was responsible for subcontracting to other specialists in the aircraft industry. LTV awarded Goodrich the contract based on Goodrich's competitive bid and, more importantly, their innovative technical design (that is, Goodrich was introducing a lightweight four-rotor brake).

Once discs replaced drums, the industry standard for Air Force aircraft brakes was based on a heavier five-rotor model. Because the design of the aircraft disc brake is very tough technically, and costs associated with improving it often outweigh the benefits from so doing, there was little innovation in the aircraft brake industry through the 1960s. Thus, Goodrich's proposed lighter-weight, four-rotor brake was considered state-of-the-art design in a relatively static industry. Goodrich's innovative brake design meant that the A7D light attack aircraft could carry a heavier payload (that is, munitions). Considering the cost and payload advantages, both the US Navy and Air Force supported the LTV decision, and Goodrich was awarded the A7D contract.

### **QA procedures**

Standard governmental qualification testing specifications and procedures were written with the five-rotor brake in mind. Qualification testing specifications were written by specialists in the aircraft brake industry, and procedures ensured that any properly designed five-rotor brake could meet, with some engineering discretion, testing qualifications to the letter of the government's specifications. With the five-rotor precedent as their guide, both the government and LTV specification documents adopted these long-held, five-rotor standards for the Goodrich four-rotor brake. Meeting specifications was not difficult, and when brakes did not meet the intent of the specifications, compromise was commonplace. The subcontractor had license to modify procedures as necessary, provided they kept the prime contractor apprised of adjustments or problems.

A common understanding developed over time between those working within the brake industry. And while rules were not meant for breaking per se, trust was cultivated between the various specialists. With professional understandings between prime contractor LTV and subcontractor Goodrich in place, LTV set the last two weeks of June 1968 aside for flight testing. This gave Goodrich almost one full year for designing and testing the four-rotor brake.

### **Brake development**

John Warren, one of Goodrich's best engineers, designed the initial A7D four-rotor brake. In his early 30s, Warren had an excellent track record in aircraft brake design. He was involved in notable designs, including the Air Force C5A brake contracted to Lockheed and General Electric, as well as the Boeing 727 brake. After he had completed the design, Warren handed off the brake so that he could work on the many other brake projects in progress at the Troy Plant.

Searle Lawson, a young and recent aeronautical and astronautical college graduate, was assigned the task of testing brake lining temperatures in Warren's design prior to building the final prototype of the A7D brake. This was Lawson's first real job working on brakes. Through March of 1968, he built and tested sundry prototypes so that appropriate lining materials could be chosen. During Lawson's laboratory test stops, however, he was alarmed by the brake's high temperature reading, as well as the fact that it glowed a bright cherry-red and threw off sparks.

Following several simulated landings, Lawson examined the linings and noticed that they had disintegrated. In December of 1967, a full six months into the project, Lawson realized that the A7D brake had a fundamental design flaw. From his training, Lawson understood the brake was too small and could not withstand the demands of a normal aircraft landing. "The brake would not make the required number of stops as far as [specification requirements for the] life of the brake [were concerned]. It just would not make it."

Lawson reported his findings to the design engineer, Warren, who assured him it was not a design problem. Warren said the four-rotor brake design was neither too small nor in need of more material, and he instructed Lawson to try still other lining materials. Lawson then spent much of his time in Cleveland, learning about lining materials. Trying countless materials, he continued testing the brake, but the results were always the same: the Goodrich brake could not meet the Air Force and LTV specification requirements without "nursing" the brake through the various tests.

Warren was busy with other projects in the plant, and had disassociated himself from the A7D brake. He did not advocate misrepresenting the A7D brake; he just no longer wanted a role in the A7D because his project segment was complete. Thus, as engineer responsible for testing the brake, the A7D was now Lawson's exclusive domain. Unable to discuss the possible implications of the overzealous goals of the four-rotor brake with Warren, and deciding he was still not satisfied with the designer's recommendations, Lawson took his concerns to his immediate supervisor, Robert L. Sink, Goodrich A7D project manager. Sink told Lawson to keep testing different materials, noting that he had already assured LTV several times that the brake design was a success, and that Warren's design would work. Sink further reminded Lawson that if the design did prove faulty, Sink would answer to Goodrich executives and LTV. Parts began arriving at the plant and, over the next few months, a working model was built so that full qualification tests could begin. By late March, 1968, Goodrich attempted qualifying the brake by military specifications 12 times, and each time the brake failed the specified temperature tests. At the same time, Sink continued assuring LTV that brake tests were going smoothly. As far as Lawson was concerned, however, Warren's innovative design was a dismal failure, and the June flight testing dates were fast approaching.

### **Kermit Vandivier's role**

Kermit Vandivier was then a technical writer for Goodrich. He had worked for the company for six years, the first three as an instrumentation technician, and his last three as a writer. As low man on the Goodrich totem pole, the major component of Vandivier's work involved reading numbers off the testing strip chart, and plotting the curves for inclusion in qualification reports. The writing task was routine, and a boilerplate format was used. Although a time-consuming effort, it did not require an engineer's expertise. After plotting the engineering curves, Vandivier wrote the appropriate documentation that would accompany the testing data in the qualification report.

In April of 1968, Vandivier was tasked to write the qualification test report for the A7D brake. On seeing the discrepancies between the military specifications and the Goodrich four-rotor brake test results, Vandivier questioned whether he should compose a report that was so out of step. While not formally trained, Vandivier had worked as official scribe on enough Goodrich reports to feel something was awry in this particular case. "All of these incidents were in clear violation of military specifications and general industry practice."

Vandivier took his concerns to his immediate supervisor, Ralph Gretzinger, Test Lab Supervisor, who assured him that the testing laboratory would not issue a misrepresentation of the qualification tests. However, virtually every entry in this so-called copy of the test logs was drastically altered. As an example, the stop time for the worn brake maximum energy stop was changed from 141 seconds to a



mere 46.8 seconds. Within a few days, a typewritten copy of the test logs of test T1867 [the 13th attempt] was sent to LTV in order to assure LTV that a qualified brake was almost ready for delivery.

On hearing of the interim report, Vandivier questioned Richard Gloor, test laboratory engineer, who told him that Lawson had directed the test lab to miscalibrate the instruments, at the order of one of Lawson's superiors. When Vandivier approached Lawson about qualification test T-1867, Lawson confirmed Gloor's account. Lawson told Vandivier that they were going to make a 14th attempt at qualifying the brake and that Robert Sink, A7D project manager (Lawson's immediate supervisor), and Russell Van Horn, manager of the Aircraft Wheel and Brake Design section, had told Lawson that, "Regardless of what the brake does on the [14th] test [conducted in May, 1968], we are going to qualify it," and that, if the 14th test failed, the report would be written based on test T1867.

That said, Sink left for California on Troy Plant business. In his absence, Sink left Warren in charge of the A7D, but Warren was busy working on other design-related projects, and had little time available for helping Lawson.

On May 2, 1968, the 14th attempt at qualifying the brake was made. The brake was nursed along, and little lining was left after the 45 simulated stops. While the tests were conducted, Lawson asked Vandivier to commence writing the qualification report. Vandivier was incensed and refused to write a qualification report that he felt was based on falsified data. At first, Gretzinger backed Vandivier's decision. He said he would approach his own supervisor, Russell Line, Manager of the technical services section, and get the matter cleared up. "He consulted Mr. Line and assured me that both had concurred in the decision not to write a qualification report."

Meanwhile, on return from California, Sink told Lawson to start writing the report, and then Sink again left Troy on Goodrich business. When Lawson told Vandivier his predicament, Vandivier offered to help gather the test data.

By the end of May, 1968, Vandivier and Lawson completed the graphic portion of Qualification Report Q603139, and discussed the implications of what they were doing. Vandivier was so concerned about the implications of a falsified report that he even went above his own immediate supervisor to discuss the matter with Line. In many companies today, never mind in a company operating in 1968, his was a pretty daring move. Goodrich had not yet developed procedures for problems like the one Vandivier found himself embroiled in; thus, going over his immediate supervisor and sidestepping discussions with Sink (because he was out of town) meant that Vandivier had already started the whistle-blowing process.

Having taken his concerns to everyone but the chief engineer, Bud Sunderman, and having the graphic portion of the report complete, Vandivier felt his involvement in Qualification Report Q6031 was at an end. However, despite Vandivier's efforts to avoid writing the narrative portion of the report, Gretzinger told him he had no choice.

Goodrich submitted Qualification Report Q6031 to LTV on June 12, 1968, without either Vandivier or Lawson notifying Sunderman or Goodrich corporate headquarters in Akron of their misgivings. Lawson's testimony at the Congressional Hearing helps explain why this was so. "I really didn't feel there was anybody above [Sink] that I could take it to."

### **Whistle-blowing**

In mid-June, flight tests on the brake began at Edwards Air Force Base in California. On Goodrich's behalf, Lawson witnessed the tests. No members of the Air Force were present at the flight tests, as their presence was not required. And while LTV officials were present at some preliminary tests, no LTV representative attended the final flight test.

When he returned two weeks later, Lawson told Vandivier about various mishaps during flight testing. Listening to Lawson's concerns about possible dangers associated with the brake convinced Vandivier that he should contact his attorney, which he did before the day was out. "[My attorney] advised me that, while I was technically not guilty of committing a fraud, I was certainly part of a conspiracy to defraud." Vandivier's attorney also suggested that Vandivier meet with US Attorney Roger Makely in Dayton.

On his return, Vandivier told Lawson that his attorney had advised him that both he and Lawson were guilty of conspiracy; not that they might be, but that they were. Fearing conspiracy charges, Lawson asked Vandivier if he would arrange a meeting for him with Vandivier's attorney. Asked at the Congressional Hearing why he made the statements he did to the FBI, Lawson responded:

I believe my [real] feeling for going to the FBI was one of just, I guess, protecting myself. I realized from speaking with Mr. Warren, who had made statements to me to the effect that whenever something gets in trouble (referring to being at the Goodrich plant), you were on your own, don't look for your supervisors to be around, and from seeing experiences, experiencing things at Goodrich, where Mr. Sink had been involved in another incident, and somebody else was demoted, and other items like that, I felt that I needed to talk to somebody about it, because it was a pretty serious situation, and the only person I could think of was to consult an attorney, and then he advised me to talk to the FBI.

On Saturday morning, July 27, a damage control meeting took place between Vandivier, Lawson, Warren, and Sink. Sink had been away, off and on, for almost three months. He called the meeting to discuss how best to tell LTV about the discrepancies or *engineering interpretations* inherent in the test results of the four-rotor brake. Finances no longer mattered, for Goodrich was well over-budget given all the extra testing associated with the four-rotor brake. Lawson manned the blackboard, and together the four meeting participants compiled a list of discrepancies. Of the 43 discrepancies noted, Sink made the final decision that 40 of the discrepancies could be considered inconsequential, so only three were deemed worth mentioning.

As often happens, Vandivier, the bringer of bad news, was now alienated from day-to-day operations, and openly hostile to Sink. He no longer expressed his concerns, and instead relayed his suspicions to FBI agent Hathaway.

On August 26, 1968, Mr. Bruce Tremblay, Systems Group Leader for Landing Gear for the Air Force Systems Command, submitted his official letter to Robert L. Hartman, Chief Systems Engineer, Headquarters, Aeronautical Systems Division (AFSC). Because the Goodrich report contained no original test data, only replotted information, and "The method of conducting the test was highly unconventional and without suitable explanation acceptable to this office," Tremblay recommended withholding approval of Goodrich's four-rotor brake.

Meanwhile, work had already commenced at the Goodrich Troy Plant on a five-rotor brake that would replace the disqualified four-rotor model.

A number of visits took place between Goodrich Troy staff and LTV staff in Dallas throughout August and September. The activities between Air Force, LTV and Goodrich Troy Plant personnel paralleled Vandivier's clandestine meetings with FBI agents, where he transferred sundry documents to agent Hathaway and others. From Vandivier's now-limited vantage point at Goodrich, the October 8 meeting was just another forum for Sink, where Sink could ensnare others in his own prevarications. Vandivier did not attend the October 9 meeting, and work continued apace on the new five-rotor brake, with all indications that it was meeting standards to the letter of the military specifications. In fact, one of Lawson's initial designs had been reworked, and he was immersed in the five-rotor brake project. As with so many whistle-blowers, Vandivier was frightened, knew he was low man on the totem pole, and was

now walking alone. He found himself talking about the brake problem with anyone who would listen; however, most employees were busy on other projects and preferred not getting involved. His training was in outmoded electronics and writing, and he had a family of seven to feed. His situation looked grim at best.

Vandivier submitted his own letter of resignation on October 18, replete with accusations against Goodrich. As the Plant's chief engineer, Bud Sunderman was not always privy to day-to-day operations within the plant, instead leaving Sink and Line that task in their respective departments. Thus, it is conceivable that rumors of Vandivier's allegations had not reached him, so when he read Vandivier's letter, Sunderman was likely shocked. On October 25 Sunderman called Vandivier to his office and dismissed him immediately for disloyalty. When Sunderman asked if Vandivier would take his allegations further, Vandivier said, "Yes." Ushered out of the Troy Plant on October 18, Vandivier started working for the *Troy Daily News*, a local newspaper for which he had been writing local political commentary part-time since 1965.

### **Congressional hearing**

Vandivier told his editor at the *Troy Daily News* about his experience at Goodrich. The editor had just received a Ford Foundation grant, and passed his story to others in Washington. The story reached Senator William Proxmire (D-Wisconsin), and he was receptive to Vandivier's tale of misdeeds at Goodrich. Proxmire had earned the distinction of *quality assurance* senator, for his tough stand on government waste.

On May 13, 1969, Proxmire requested that the Government Accounting Office (GAO) review the brake qualification testing performed by the Goodrich plant in Troy. The GAO reviewed the operations at Goodrich and submitted a report to Senator Proxmire on July 3, 1969, with a follow-up letter dated July 11, 1969. On receiving the report, and without consulting Goodrich personnel, on August 4, 1969, Senator Proxmire made the first public announcement on the Senate floor, both about Vandivier's allegations against Goodrich and the GAO investigation.

On August 13, 1969, a four-hour Congressional Hearing, chaired by Senator Proxmire, was held before the Subcommittee on Economy in Government. The purpose of the Congressional Hearing was to determine: (1) the accuracy of Goodrich's reported qualification test results; (2) the effect the defective brakes had on the test pilot's safety; (3) the identification of additional costs, if any, incurred by the Government to obtain an acceptable brake; and (4) the responsibilities of the Government, including Air Force actions, in the qualification testing.

GAO Report B167023, as well as the Congressional Hearing testimony presented by GAO representatives, showed that Goodrich's qualification testing procedures did not comply with Government specifications, that some of the discrepancies in the report were indeed significant, and that, overall Qualification Report Q6031 did not present an honest picture. In general, report findings support Vandivier's claims that the report was falsified.

Congressional Hearing testimony confirmed that no additional costs were incurred by the Government in obtaining an acceptable brake, and that aircraft delivery and testing was not hindered in any way because of the Goodrich brake problem.

This leaves us with puzzling points involving qualification testing procedures. In addition to haphazard events caused by technology-related and communications problems, the evidence supplied by witnesses at the Congressional Hearing raises other issues surrounding culpability of Goodrich, LTV and Air Force personnel. Because aircraft five-rotor brake technology had changed so little and failure seemed so

remote, those concerned with the A7D brake allowed what we now perceive as slack in the qualification testing procedures.

When Proxmire questioned witnesses at the Congressional Hearing, no one other than the GAO representatives thought the testing procedures then in place were odd, even though they revealed that testing procedures were indiscriminately monitored, critical LTV and Government officials missed witnessing important flight tests, and no definite procedures were in place. At first blush, Congressional Hearing evidence points to ambiguous qualification testing procedures. But if a company can be trusted, why not cut down on supervision? Part of what contracting with professionals means is that you can avoid the additional supervision costs. Government and industry alike now often omit certain kinds of monitoring for companies that have quality control and ethics procedures in place.

Gutmann noted that Government signatures on reports seemed to carry little or no force, and that Government quality assurance seemed lacking at final testing; for example, there were no Defense Contract Administration Service (District) personnel present during any of the test flights. Richard W. Gutmann, deputy director of the Defense Division for the GAO, stated that the deficiency in government quality assurance left the entire subcontracting responsibility with the prime contractor, LTV, a situation that seemed unacceptable in government procurement. Gutmann said that because discrepancies found in the report were significant, and that having a government presence before the final flight tests was necessary, that "... it is basically the lack of participation in the qualification testing where we consider the procedures inadequate." And Gutmann again confirmed that while a government official had signed the qualification report, it was essentially meaningless. It simply meant the official had seen it, not that he had necessarily approved it.

Finally, the Congressional Hearing lasted only four hours. This conveys the relative insignificance of the case as it was perceived by contemporary standards. Finding no "golden fleece" on which to ride, Proxmire merely wanted to confirm that the Government's nose was clean, that the taxpayers were not being ripped off over yet another Air Force cost overrun like the C5A.70. No action was taken against Goodrich.

### **The Fallout**

The major change following the Goodrich incident involved governmental inspection procedures. With more people involved in fulfilling a contract, and with technological shifts, more checkpoints were enforced. Essentially, the cost of information (that is, finding out which professionals you could trust) had increased. The other change that occurred was that Goodrich, because of its blunder, was forced to deliver a redesigned, traditional five-rotor brake, so that the A7D aircraft could make its successful debut at Luke Air Force Base, Arizona in November of 1969 without murmur of impropriety.

No one then at Goodrich lost his (there were no women involved in this particular incident) job because of the incident; however, no one ascended the corporate ladder either. Warren, Line, and Van Horn continued working for Goodrich, with the usual promotions and perks. Sink was not promoted. Instead, he was reassigned to the technical writing division, arguably a step down from managing technology-related projects. This is significant, for it shows that Goodrich took corrective measures with personnel-related problems in the Plant, and took remedial action where Sink was concerned.

Evidence provided shows that the long-term implications of what happened at Goodrich remain unresolved. Those involved in the Goodrich case were lucky; however, our failure to learn from the past is much in evidence today witness what happened with Challenger when pressures for fulfilling a government contract outweighed presenting an honest picture of a technology's limitations.