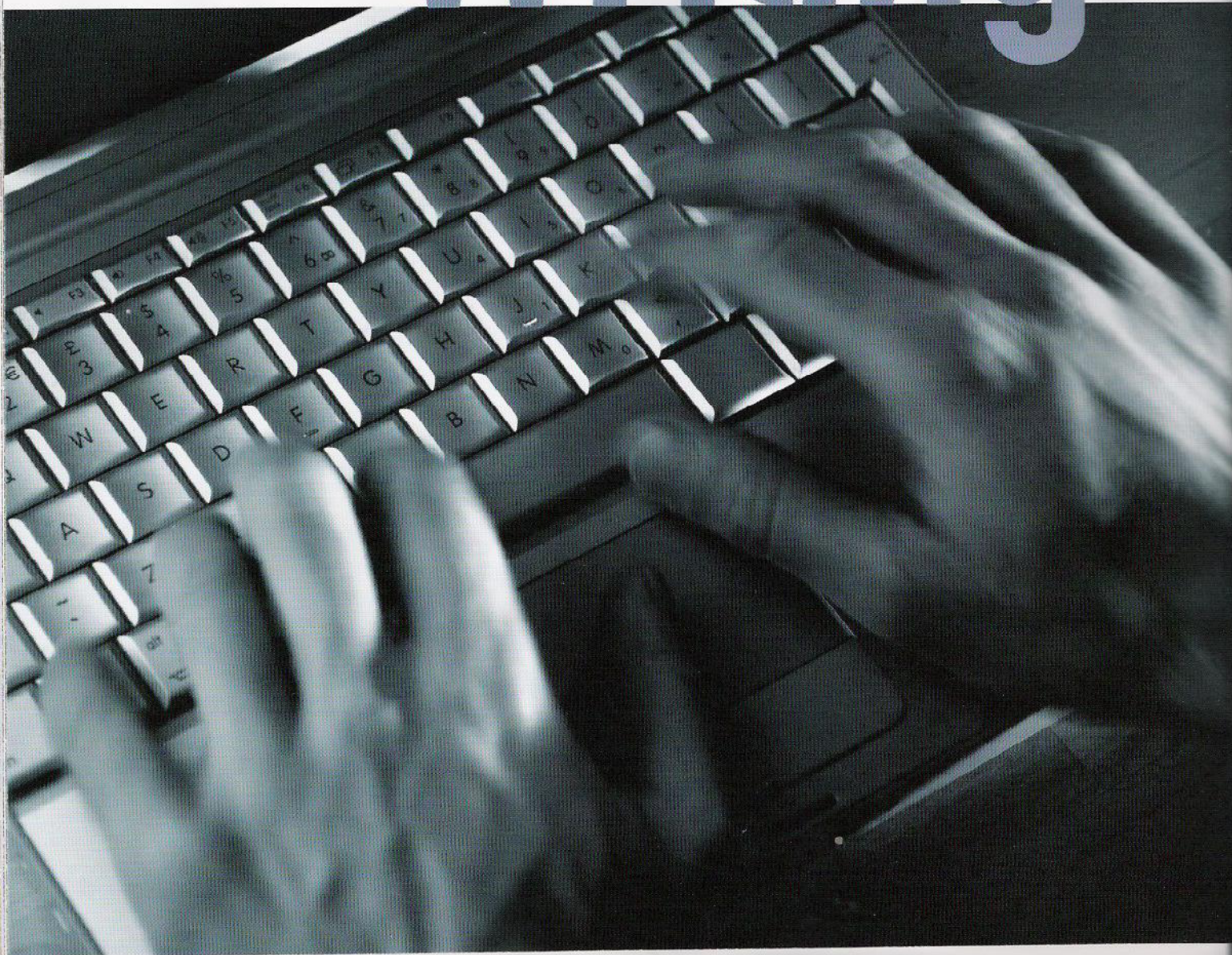


The Skill Many Engineers Wish They Didn't Need

# Writing

By Larry Burrowsky



Weeks before the space shuttle Challenger launch of January 28, 1986, two engineers from aerospace contractor Morton Thiokol concluded that an O ring on the shuttle's solid rocket boosters was susceptible to failure. The engineers provided their test data to their supervisors at Morton Thiokol and to NASA officials, all of whom disregarded the report. • The incident has become perhaps the most heavily studied engineering failure of all time. The federal government immediately launched an investigation, and the ensuing report contained thousands of pages of data, testimony and analysis. Hundreds of books and articles have since been written about the Challenger disaster, focusing on everything from faulty engineering, to lax oversight, to organizational dysfunction at NASA. But very few of those inquiries have focused on a plain and simple fact: the disaster was the result of a failure to communicate effectively. • Dorothy Winsor, an English professor at Iowa State University and a respected analyst of technical communications, contends that the Morton Thiokol engineers didn't effectively communicate the test results that predicted the O-ring failure. "They apparently believed that if they simply sent the data to their managers, the managers would automatically be convinced by it," she writes. "The meaning of the data required interpretation. The existence of data alone was insufficient to create knowledge." • This type of blind spot still exists in engineering, but it's getting smaller, not only in industry, but also in engineering education. Colorado School of Mines has been at the forefront of a growing trend to incorporate communications training into engineering curricula. Although many undergraduates arrive on campus with the expectation (and hope) that their courses won't require much in the way of writing, they quickly learn that they can't earn a Mines degree without gaining some facility with the machinery of language.



© Claudia Dewald/istockphoto

"Writing is not my strongest skill," says recent graduate Andrea Ham '08, "nor is it what I wanted to do in any of my classes. But despite my grumbling, I'm thankful for all the practice I got in the various forms of writing that I will need ... as a professional."

"Many of our graduates will be moving into management within a few years," adds Jon Leydens, writing program administrator at Mines. "When they do, the skill set they need will shift dramatically. They'll need skills that they may not recognize as part of their engineering tool kit."

Students need communication skills in the workplace and engineering institutions need them in their curricula. "An ability to communicate effectively" is one of the 11 requirements listed in ABET's Criterion 3, which enumerates desired outcomes for graduating students.

U.S. engineering schools have been understandably hesitant to embrace this trend. The volume of technical and scientific material that must be packed into a four-year undergraduate program continues to grow, and there's precious little time left over. But Mines has used creative approaches to win faculty buy-in and develop a robust writing program that is tightly integrated with core engineering curricula.

"At Mines, we learn that engineering is the bridge between the scientific community and the 'everyday' world," says Zach Aman, a junior studying chemical engineering and the former editor of *The*

Today's Mines undergraduates get writing instruction from the moment they arrive.

*Oredigger* newspaper. "Effective communication is as essential as superior technical ability if we are to truly succeed."

That may not have always been the message at Mines. Matt Moore '96 says when he attended Mines in the mid-1990s, "writing was out of sight, out of mind. We didn't get any education on it. And that was okay until I got into the work force. That's where I learned that communicating clearly and efficiently is a tremendous tool. Without it, we end up selling our intelligence short."

"Our final product is typically a written report," adds Lauren Evans '82, president of a Lakewood-based consulting firm called Pinyon Environmental Engineering Resources. "A lot of times the work is for a client who's not a technical person, such as a banker or a real estate developer, so we have to be able to communicate our findings and recommendations to them in a way they can understand."

Moreover, she says, the report has to be persuasive. It's not enough simply to present data clearly; that data must also be placed into context and shaped into an argument. In other words, rhetorical skills are important for the engineer.

While the term "rhetoric" can be used correctly to describe "overly elaborate, pretentious and insincere speech," its primary meaning is much more positive, referring to "the art of using language effectively and persuasively." Winsor's charge against the Morton Thiokol engineers is that their report lacked an effective rhetorical component: "People needed to persuade one another of the meaning of the data they had, but they failed to do so, partly because they did not seem to know such persuasion was necessary."

The need to overhaul writing instruction at Mines began to surface in the early 1990s. "In conversations with employers of Mines graduates," says Leydens, "faculty and administrators were hearing again and again that Mines did a fantastic job of preparing graduates who were technically excellent, superior to peer institutions, but we were lacking in the area of communications, especially writing. Then the 1994 alumni survey came in, and it too indicated that our quality was high for technical education, but not for professional skills such as writing."

In 1998 Leydens was appointed to the newly formed Writing Across the Curriculum committee, a group of about half a dozen faculty charged with bolstering the writing curriculum at Mines. The committee asked each academic department to name a designated



© Jacob Wackerhausen/iStockphoto

WAC liaison, and it used those channels to gather input from across campus and build consensus around key program features.

One major decision made early on concerned whether to segregate communications instruction from the rest of the curriculum by, for instance, requiring a sequence of composition courses, or alternatively, to integrate it within existing coursework. The committee, and most liaisons, argued for the latter, so that students would come to regard writing and communicating as *engineering* tasks.

"If you outsource writing instruction to a division of liberal arts, you send the message that it's not that important for engineers and scientists," says Leydens. "But if engineering and science faculty incorporate it into their assignments, the students write texts that directly relate to their field. For example, geological engineers might write the type of report that a geological consultant would write, giving students the message that effective writing is a vital professional skill."

Today's Mines undergraduates get writing instruction from the moment they arrive. During their first two years, they take three required courses that carry significant writing loads: Engineering Design I and II, and Nature and Human Values. In addition to upper-division requirements in the liberal arts, students in their junior and senior years must take another 12 credits in their major that are designated as "writing-intensive" in the Undergraduate Bulletin.

This approach carries a major challenge. It requires engineering and scientific faculty to teach writing in their own courses and many

Engineers in the professional world face a diverse audience and will end up writing for a wide variety of purposes.

were initially apprehensive about that prospect, even while they recognized the importance of teaching communications. To address those concerns, WAC instituted annual faculty workshops and ongoing consultations focused on incorporating writing into technical courses. Since 1998 more than 70 faculty members have attended these workshops, and more than 40 have received WAC consultations—significant numbers on a campus with around 200 full-time faculty.

Kevin Moore, an engineering professor who took the WAC workshop, is in a good position to comment on the content. In his previous post at Utah State University, he administered a portion of their Senior Design class, into which he incorporated a novel and very successful writing program. His overall impression of the WAC workshop was positive, particularly the emphasis placed on writing for a variety of different purposes. He pointed out that academic faculty tend to be most familiar with writing for academic journals that are read by a narrow audience and generally have a similar purpose. On the other hand, engineers in the professional world face a diverse audience and will end up writing for a wide variety of purposes. "As faculty, we need to make sure our writing assignments are a good match for the content of the course and for the needs of our students."

Leydens believes the strength of the WAC model ultimately rests in its high degree of faculty involvement and commitment. Some programs try to mandate; we try to enable, so that faculty can teach writing in the way that best serves their needs and supports their overall educational objectives."

Some Mines students may always chafe at writing and communication assignments. But most undergrads become less hostile once they gain a little exposure and improve their abilities. And without question, they recognize that good writing skills will help them professionally. "I think my written skills have improved enough so that peers and superiors will take me seriously and will be able to focus on the content of my writing instead of the writing itself," says Ham. "I was often irritated about being forced to write," she adds, "but I'm grateful to Mines for forcing me to do it." ■