

The Demise of Aerospace, part 2. We doubt it.

BY DR. JOHN H. MCMASTERS AND DR. RUSSELL M. CUMMINGS

"To prove that a pig cannot fly is not to devise a machine that can do so."

*Dietrich Küchemann, Ph.D., FRS
(The Aerodynamic Design of
Aircraft, page 2).*

122). Since then, he has been joined by a bevy of malcontents, and a response, even if belated, seems necessary.

We have probably been in the airplane business longer than "Dr. Sliderule" and can recount horror stories of excesses and acts of vandalism that are more recent than those in his little jeremiad. We are also well aware that our business has been one of continual boom and bust cycles since long before we all got into it. So far, it has always managed to rebound, and it has been very good to a lot of us—at least until the Soviet Union had the ill grace to collapse like a wet sack. With the Cold War out of our way, we now seem to have an annoyingly large number of colleagues writing our history as an obituary. Our current crisis is, in fact, *our despair*. And, worse yet, we seem to be trying to pass this pox to our children.

Seriously annoyed, we recently used the writings of folks like Dr. S as an excuse to take a closer look at current popular assertions. (A professional society paper we wrote on the subject can be supplied on request to interested readers.) Just as we surmised, "facts and data" can be used to cry any variant of "wolf." Consider, for example, Dr. S's opening: "Since 1989, more than half the workers in aerospace have lost their jobs." Well, yes, as Marx (Karl or Groucho—reader's choice) warned us, capitalism can be very cruel. And contrary to the view implicit in Dr. S's screech that the aerospace industry should not be seen as an entitlement program. The statistic cited counts *all* those displaced. These were primarily production workers and secretaries *and* their bosses and yes, even *some* engineers—though not in the numbers usually assumed. It is not our intent here to make light of *anyone's* job loss, but the "collapse" of our industry that children (and their parents) hear about when choosing a college major just *isn't* happening.

Dr. S also observed (correctly) that in 1990, there were still eight prime airframe contractors in the U.S. and only (maybe) two and a half today. Gee; looking back a bit further, we see that in 1945, there were around 15

while back, *Flight Journal* published a "Tailview" opinion piece by one "Dr. Sliderule" ("The Demise of Aerospace", December 1999, page



major independent airplane companies (ignoring commercial companies (ignoring general aviation business). We have seen a lot of consolidation in recent years, but that doesn't signal a probable extinction. It's actually very difficult to see who the "winners" and "losers" are in the massive rearrangements to which we've been subjected, but if it takes becoming a 10-ton behemoth for at least a few famous names to stay in the phone book for a while more, so be it. Mere engineers like us will never be paid enough to make those kinds of judgment calls.

One statistic that's consistently ignored in all the gloom is that our industry still seems to find a healthy multi-billion-dollar-a-year market for its goods and services—despite the apparent shrinking in the number of major companies (we tend to forget the engine manufacturers and the vast supplier network that are also part of the industry). Indeed, every estimate we have seen (by Boeing, Airbus, etc.) suggests that, barring a complete collapse of the world economy, there will be a global demand for approximately one trillion dollars worth of commercial transport aircraft over the next 20 years. And in the commercial airplane segment of the aerospace business alone, there's *another* trillion dollars worth in spares, modifications, services and infrastructure maintenance and enhancement.

That sum still translates into quite a few good jobs. True, exploiting new market opportunities may not result in all the really cool jobs we enjoyed in the "faster, higher, farther" era of our history, but the new era of "cheaper, better, quicker" has its own suite of very interesting challenges. Those who do these jobs should be left to make their own value judgments about the jobs' quality and level of excitement without the undue burden of nostalgia for a past many never experienced.

Another whine we hear among our older peers across the industry is some variant of "Our bosses aren't interested in technology anymore; all that matters to them is near-term profit and cost reduction." We confess to being of several minds on this subject and must share some measure of culpability for being part of the problem. We grew up in a culture in which the job of the engineer was to come up with ever more clever or diabolical—and often more complex and expensive—solutions to problems. We never learned (*nor were we encouraged to learn*) the equally important need to "close a business case" for what we designed. Changing geopolitical and economic times have removed many of the imperatives of the Cold War environment in which a lot of us existed for most of our professional lives, and

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that "loss" is reflected in our current malaise.

On another side of this coin, we see that a lot of money continues to be spent on the technology and development of the tools we need to do a better job than was possible even a decade ago. For example, not too long ago, having access to our own company Cray supercomputer was a really big deal. Now, every "upstart" on the floor has more computing power available than those old museum pieces provided. That isn't the end of it, either—as long we teach our next generation what the results obtained from ever more powerful computer models actually mean. This, too, can be done in ways we didn't seriously dream about even last year. Consider the electronic gadgetry available at reasonable prices at any hobby shop. It doesn't take much imagination to see that we might replace some (but not all) wind tunnels with a continuum of various scale "X-plane" projects—and at a reasonable cost. From student-level learning exercises to full-blown, fully instrumented, proof-of-concept vehicles, "robot airplanes" would allow a degree of experimentation with real flight hardware that we haven't been able to enjoy for the past half century. As a side benefit, the experience void being created by the increasing rarity of major new airplane programs could be filled with the lessons gained in these less expensive design-build-test projects. Though this approach to future airplane development may not revitalize our industry, it could change the landscape in aerospace engineering education.

So, is everything actually swell in the volatile, ever changing airplane business these days? Of course it isn't. In addition to its identity crisis, our industry is now about to be plagued with a serious generation gap—assuming we take the necessary steps to ensure that there is a future generation of aerospace engineers. Opinion pieces like Dr. Sliderule's aren't very helpful in that regard. We who have devoted our professional lives to the airplane business can take real pride in that we have literally helped to change the world (several times, in fact) and we haven't finished yet, by any means. We, as engineers, should be able to do better than cry over our perceived losses and instead, should look forward *realistically* to what can be our future. The only limits we see in this are those of our will and imagination.

Editor's note: For 40 years, John McMasters [mcmaster@drizzle.com] has been an aeronautical engineer in industry, academe and the USAF. The opinions expressed here are solely his and do not necessarily reflect those of his current employers (who have a well-developed, but sometimes unpredictable, sense of humor). Russ Cummings [rcumming@calpoly.edu] is a professor of aerospace engineering at CalPoly-San Luis Obispo and has extensive industry experience.

Dr. Sliderule responds

Dr. McMasters and Dr. Cummings are, of course correct that aerospace as an industry is in no danger of disappearing. Much of what they say is correct, and the American Institute of Aeronautics and Astronautics (AIAA) paper they recently co-wrote makes some very valid points about

the state of the industry and how to properly organize it to preserve knowledge and experience. Our corporate masters would do well to heed what they say.

As Dr. Sliderule, I wrote to call attention to serious problems that threaten the future health of American aerospace. I wrote the piece because I love airplanes, and hope to be able to spend the rest of my life in the industry. It was intended to be a wake-up call. Space did not permit a long dissertation on how to solve the problems discussed.

As McMasters and Cummings point out, some of the problems we are experiencing are the inevitable consequences of the cyclical nature of the industry and major changes in the international political landscape. Some, however, are the consequences of flawed vision, "fad" management theory and poor decision-making. I fear that we are in danger of following the path that Britain followed after the infamous 1957 Duncan Sandys White Paper, which declared the manned military airplane obsolete and almost led to a near collapse of the industry. Its effect was devastating and long-lasting. Although British aerospace did recover to some extent, it was permanently diminished.

I agree that we have a developing generation gap in engineering. The problem is far deeper than the "scaring off" of young who are people making a career choice as they enter college. One thing that drove me to write was watching young engineers, who already had gotten degrees and jobs, leave aerospace after two to five years. They did not leave because of incorrect information they were given while making a career choice. They arrived full of enthusiasm and departed after experiencing in full what the modern aerospace workplace has become. This is far more alarming than the decline in engineering-college enrollment that inevitably accompanies each downturn in our industry. If we do not offer the combination of respect, salary, career path and interesting work necessary to hold the interest of bright young people, the problem will worsen. Other industries offer them more and treat them better.

I think our difference of opinion about the state of the aerospace industry is, in large, a difference in perspective. Both Dr. McMasters and Dr. Cummings have the good fortune to be in relatively secure and respected positions. Dr. McMasters is an almost legendary senior fellow at Boeing, and Dr. Cummings is a tenured professor at CalPoly-San Luis Obispo. As such, they are somewhat sheltered from the day-to-day effects of the recent "commodity" attitude that has developed toward engineers.

I must respectfully disagree that pieces such as my "Demise of Aerospace" are counterproductive. Some things need to be said, even if they are politically incorrect and unwelcome. Ending denial is the first step to recovery.

There is no problem we cannot solve if we have the courage to face it squarely and acknowledge it. If all that "Demise of Aerospace" accomplishes is to be the irritant upon which grow pearls of wisdom such as those offered by McMasters and Cummings, then I have succeeded in my purpose in writing it. †