

# National DEFENSE

JANUARY 2018

THE BUSINESS AND TECHNOLOGY MAGAZINE OF **NDIA**

## Viewpoint

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## Consumer Electronics Industry Shows How to Break Augustine's Laws

■ A book published in 1984 references two tongue-in-cheek “laws” to be avoided within the Defense Department, Congress and the defense industrial base.

The most famous of these laws is: “In the year 2054, the entire defense budget will purchase just one aircraft. This aircraft will have to be shared by the Air Force and Navy three and half days each per week, except for leap year when it will be made available to the Marines for the extra day.”

This book, *Augustine's Laws* by former secretary of the Army and industry executive Norm Augustine is a collection of anecdotal market trend observations that highlighted the Defense Department's growing dependence on electronic systems in the mid-1970s. Another famous law is: “After the year 2015, there will be no airplane crashes. There will be no

takeoffs either, because electronics will occupy 100 percent of every airplane's weight.”

Now in its sixth edition and published in six languages, the book's lessons ring true today, as it appears the department and the defense industrial base have adopted many of the laws as goals.

However, it might come as a shock to both entities to learn that Augustine's Laws have been broken by commercial aviation, commercial electronics and the auto industry.

For decades the Defense Department was the driving force behind the development of microelectronics. The Army funded the micromodule project, precursor of the integrated circuit. The Defense Advanced Research Projects Agency funded the very-large-scale integration project, which created today's electronic design architecture companies and resulted in the development of multi-chip wafer fabrication technology. Today's microelectronics technology would not exist if not for a few brave and visionary defense project officers.

Most of the critical technologies developed under Defense Department science and technology programs have successfully transitioned to the commercial market. “Free market” competitive forces incentivize the commercial industry to invest considerable internal resources to advance and mature these technologies, resulting in affordably priced — and profitable — cutting edge technology products that have “broken” Augustine's Laws.

Microelectronics technology is the most visible and significant example of the commercial market not only transitioning, but significantly advancing defense developed technology. This article is being written on a device that wouldn't exist without this technology. It is also the enabling technology that will allow the Defense Department and defense industrial base to break Augustine's Laws.

Consider the following when assessing the technological state of consumer electronics product development.

When was the last time a commercial company released a “beta” version of their product to the public? When was the last time a major electronics company slipped a product launch date? When was the last time a consumer electronics product wasn't profitable? When was the last time a consumer electronics product had to be recalled?

Success of today's consumer electronics companies is due in large part to the “first-pass success” enabled by electronic design automation tools and processes. These tools and processes, developed by companies that invest up to 40 percent of their annual sales in internal research and development are a result of the intense competition within the unforgiving consumer electronics market, which thrives on getting new products out for next year's big holiday season.

These “first-pass success, future-proofed design” tools and processes are the basis of on-schedule, on-cost product development.

If it is generously assumed that the Defense Department and defense industrial base electronics development process and the commercial electronics development process both achieve “first-pass success,” the commercial pro-



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cess timeline is at most 30 percent that of the defense industry process. However, past program performance has proven that the Defense Department process does not achieve that.

Not having to develop hardware design test articles and eliminating the need for application-specific integrated circuit/system on chip re-work has a factorial impact on the reduction of commercial product development costs.

So, why aren't these processes being adopted wholeheartedly by the defense sector?

The sad fact is that while science and technology programs have consistently focused on developing and demonstrating technologies that would break Augustine's Laws, these laws are on track to become a self-fulfilling prophecy because of a phenomenon that is unique to the defense industry the so called "Valley of Death," where good ideas in the lab don't make it to the intended end user.

The uninformed say this Valley of Death is a result of unfocused DoD science and technology projects. Yet, as recently as two years ago, an extensive investigation of the S&T program again affirmed that it is focusing on the right advanced technologies to allow the right warfighting capabilities.

The truth is that this Valley of Death was created and is maintained by the Guardians of the Status Quo. These guardians, represented by a variety of support companies and internal DoD organizations, all have a common trait — they don't like change.

These guardians have the greatest weapon on their side — fear. Followers of the adage, "If it ain't broke, don't fix it" create false fears to sow seeds of doubt in the minds of the decision makers concerning the operational payoffs from advancements and achievements made by the community.

The "seeds of fear" statements that the Guardians of the Status Quo plant are:

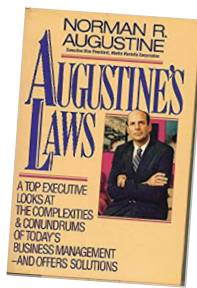
- DoD systems are much more sophisticated than commercial systems, so these tools won't work.
- DoD systems operate in very harsh environments, so these tools can't meet reliability.
- Commercial electronics design tools aren't "trusted" and we need the security of older, proven tools.

To quote the late, great Paul Harvey, here's the "rest of the story."

In 2005, the F-22 went through initial operating capability and the Ford GT sports car was launched. Both required 2 million lines of software to operate. The F-35 requires 8 million lines of software to operate. The 2018 F-150 pickup truck requires 150 million lines of software to operate. And the F-150 comes with a rebate, a warranty and free software upgrades. Not to mention cut-rate financing, but that might be unfair.

At last year's Los Angeles Auto Show, the keynote speaker on industry day was Intel CEO Brian Krzanich, who delivered the address, "Data is the New Oil in the Future of Automated Driving." And data is the new oil in just about every military electronics application. Yes, data is going to transform the world, and there will be a huge demand to process that data efficiently using artificial intelligence, convolutional neural networks and many yet-to-be-discovered technologies. It is worth reading his remarks, which are found on the Intel website.

After reading his remarks, think of the reliability and time-



liness demanded from smartphones. By the way, cutting-edge implantable medical devices such as pacemakers and insulin pumps are also designed and fabricated with state-of-the-art electronic design tools.

No one who banks using a smartphone app, or uses Google Home or Amazon Echo devices wants hackable systems. The reality of today's electronics development is that security is an utmost concern.

The commercial electronic products industry already demands "trusted" designs. The system-on-chip design will perform only what the operating software will ask it to perform and when every circuit within the design has a defined purpose. The realities of today's electronics development and fabrication require a new definition of "trust," which Congress has mandated the Defense Department develop.

Congress seems to appreciate that transitioning commercial electronics best practices to the Defense Department is the basis for the much-desired firm, fixed-price acquisition. They seem to have seen through the false narrative by the Guardians of the Status Quo concerning the adaptation of commercial electronics best practices. The fiscal year 2017 National Defense Authorization Act has an entire section on transitioning commercial electronics best practices to the Defense Department. Its program offices, tired of paying for expensive electronic mistakes, are seeking a better way.

Brave individuals within the defense industrial base are sensing their customer frustration and seek to understand the better, proven way to design electronics that will reduce the design schedules by at least 70 percent, producing "first-pass success, future proofed" system-on-chip designs. And they see that maintaining the country's technological superiority depends on taking advantage of these newer, much more capable technologies.

These courageous individuals in Congress, the Defense Department and its industrial base need much more support to generate the momentum to rapidly adopt commercial best practices. And as the number of key individuals within both the executive and legislative branches of our government learn, understand, appreciate and require the benefits from the adaptation of these best practices, even the most ardent guardian of the status quo will have to stay out of the way, allowing the defense industry to fully adapt and benefit from the use of these tools.

This soon-to-be-irreversible trend should provide a path for other Defense Department developed technologies that have been significantly improved by the commercial free market to be adopted by the military.

And when this happens, I look forward to telling my friend Norm, "We broke your laws."

No doubt, he will answer, "It's about time." **ND**

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This article is reprinted from the January 2018 issue of *National Defense*

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