1998 Woodruff Distinguished Lecture
TRANSCRIPT

Lutz's Laws: A Primer for the Business Side of Engineering

Given by

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Chrysler Corporation

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The George W. Woodruff Annual Distinguished Lecture was established in 1990 to honor an engineer who has made an outstanding contribution to society and to provide a forum for that person to address the Georgia Tech community.

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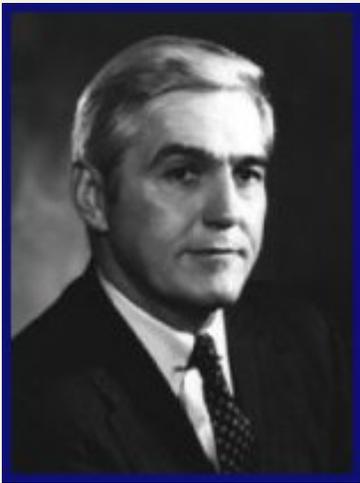
Robert A. Lutz retired from Chrysler Corporation on July 1, 1998 as Vice Chairman, a position he held since December 5, 1996. As a director of the company he focused primarily on Chrysler's product development activities. As a member of the office of the Chairman, he was involved in all major decisions and acted as coach and advisor.

Prior to this position, Lutz was President and Chief Operating Officer for Chrysler's car and truck operations, including International Operations. He led all of Chrysler's automotive activities including Sales, Marketing, Product Development, Manufacturing, and Procurement and Supply. He had been President of Chrysler since January 1991.

Lutz joined Chrysler in June 1986 as Executive Vice President of Chrysler Motors Corporation, and was elected to the Chrysler Corporation Board of Directors in June 1986. He was named President-Operations in January 1988, and President-Chrysler Motors in November 1988. Prior to Chrysler, Lutz spent twelve years at Ford Motor Company, where he was Executive Vice President of Truck Operations. Prior to that, he served as chairman of Ford of Europe and Executive Vice President of Ford's International Operations.

Lutz started his automotive career at General Motors Corporation, where he held a variety of senior positions in Europe. Later, he served three years as Executive Vice President of Sales at BMW.

Lutz is a member of the Board of Directors of Northrop Grumman, ASCOM (a Swiss telecommunications and electronics company), and Silicon Graphics, Inc. He is also a member (and former chairman) of the American Highway Users Alliance. He serves on the Advisory Board of the Walter A. Haas School of Business at the University of California, Berkeley.

He is a member of the Michigan Cancer Foundation, the executive committee of the National Association of Manufacturers, and

Lutz received his B.S. in 1961 (he was a Phi Beta Kappa) and an M.B.A. in 1962 (with highest honors), both from the University of California, Berkeley. He served as an aviator in the U.S. Marine Corps from 1954-1959 and attained the rank of Captain. He was born February 12, 1932 in Zurich, Switzerland.

Introduction

[Editor's Note: Mr. Lutz used slides to illustrate a number of the statements in his lecture. Due to production limitations, the majority of the slides are not included here, and the text of the lecture was modified accordingly to compensate for this lack of visual references.]

It's great to be here - and a real honor to deliver the 1998 Woodruff Distinguished Lecture. When Dr. Winer invited me to be here, my first thought was that there must have been some sort of mistake - since I'm not an engineer! I do, however, sometimes "practice without a license" at Chrysler - and on more than one occasion I've been mistakenly called an engineer by the press. (Which, by the way, I consider a very high compliment, even if it is, like much of what you read in the press, entirely without substance!)

I've also, by the way, occasionally been called Chrysler's "top engineer." And that's doubly wrong, because that honor belongs to my boss, Bob Eaton - who's not only a degreed engineer but, just last week, was named by the President to be chairman of the Congressionally-sanctioned National Academy of Engineering.

One thing I am for sure, though, is a friend of engineering, especially mechanical engineering. Ever since I was a youngster, I've been absolutely, totally smitten by machines - most notably cars, motorcycles, airplanes, helicopters, boats, submarines, and just about anything else that falls under the category of mechanical conveyance. And I do feel that I have a fair amount of affinity with the bona-fide engineers who make these wondrous machines so "wondrous."

Finally, though not an engineer myself, I think it's fair to say that I have pulled off a feat that many thought harder than landing a man on the moon: I helped, at Chrysler, to actually get engineers truly working together in teams ... and to begin thinking with the intuitive, nonquantitative right side of their brains just as much as with the highly-trained, very rational left side. (An amazing feat, I know, but we actually made it happen!)

Today, I thought I'd tell all of you a little bit about not so much how we did that, but why we did it. And, more specifically, why I think engineers entering that strange world called "modern business" (which I imagine is most of you) ought to do so armed with a mental toolkit that goes well beyond conventional ways of thinking, toward a way of thinking that I call "corporate (or "enterprise") schizophrenia."

Poetry in Manufacturing

First, a bit of an historical overview - using my industry (automobiles) as the example. The American automobile industry, which turned 100 years old a couple of years ago, was built by a bunch of freewheeling, "can-do," intuitive geniuses. Men like the original Henry Ford, father of the Model T and of the moving assembly line; Billy Durant, the hot-headed founder of General Motors, who was twice ousted from that company; and the namesake of my company, Walter P. Chrysler, a man who, earlier in his career, was a "real" engineer - chief engineer of the Chicago Great Western Railroad ... and who went on both to head the Buick Motor Company and then to form the Chrysler Corporation, in 1925.

The quintessential "engineer's engineer," Walter P. wrote in his autobiography - and I quote - "There is a creative joy in manufacturing that only poets are supposed to know." This is a beautiful line - and one that is very true, I believe.

And, by the way, ol' Walter P.'s hand-built railroad tools and tool chest are on display in the lobby of our new 4.4-million-square-foot technology center and world headquarters in Auburn Hills, Michigan, which, as a recent article in The Wall Street Journal put it, is definitely "Not Your Father's Chrysler." Soon, those tools of Walter P.'s will be moved to a permanent display in our new museum, which is going up right next door to the tech center on our Auburn Hills campus. We're proud of our heritage at Chrysler - including being known throughout much of our history as "the engineering company" - and we're going to make sure that our heritage is preserved and open to the public for all to see!

The Limits of Left-Brained Thinking

A funny thing happened, though, to the almost poetic creativity of the U.S. auto industry - and of much of the rest of American industry - in the years following World War II. We came to be dominated by "scientific management" - epitomized by Robert McNamara, the Harvard-trained "Whiz Kid" who became president of the Ford Motor Company (under Henry Ford II) ... and who later, by the way, became even better known as one of the architects of the ill-fated Vietnam War, as Defense Secretary under Presidents Kennedy and Johnson. McNamara was a man who believed that everything could be quantified - and that the purest answer to any question lay "in the numbers," and only in the numbers.

A classic McNamara story (from David Halberstam's 1986 book about our industry, The Reckoning): One Monday morning, McNamara hands his product planners a church leaflet. Obviously he had been day-dreaming in church, for there was scribbling all over it - of a new car McNamara had in mind; only the scribbling wasn't a drawing of what it should look like, or how it should perform, or who might even buy it; instead it was rows and rows of statistics: weight, cost, expected return on investment, etcetera.

When asked by his product planners what kind of car he had in mind, McNamara replied: "That's very interesting. Write down what you think is right." Well, a certain amount of "left-brained thinking" definitely has its place. For one thing, the reason the Robert McNamaras of the world were brought into industry in the first place was because companies like Ford had been almost driven into the ground by some of their early, freewheeling leaders. What happened over time, however, is that the infamous "bean counters" came to totally dominate American industry - even, by the way, some of our most creative industries, like Hollywood.

I've long thought, in fact, that there are a lot of parallels between the car business and the movie business, and I think this next quote - from George Lucas, of Star Wars fame - is very telling. Every time Lucas says the word "movie" here, I think you could just as easily substitute the word "car," and every time he says "Hollywood," I think you could easily plug in the word "Detroit":

When I began, you'd go to a studio and there'd be three or four people and they'd say, 'Okay, do the movie,' or 'Don't do the movie.' That was in the '70s. But once the corporations and Wall Street took over, their way of operating was to create a huge middle-management structure. These are people more interested in stock options than in making good movies, people earning large amounts of money and pretending that they were experts in making movies - and they weren't. And they began to look on the people who made movies as sort of assembly-line workers. They fostered the idea that 'the talent' doesn't know anything, that the talent are idiots, or idiot savants. I mean, it's crazy. And you end up with bland and uninteresting movies.

That, I submit, is also how you wind up with bland and uninteresting cars and trucks!

And, unfortunately, not only did the bean counters come to dominate our industry and many others, but a lot of their corrosive brand of totally left-brained thinking came to rub off on "the talent" - that is, our engineers.

In the case of Chrysler, for instance, by the time the early 1980s rolled around (immediately following our famous brush with bankruptcy and the Federal loan guarantees and all that), our legacy as "the engineering company" was history. For example, the car that came to characterize Chrysler throughout most of the 1980s was the "K-car." Some in the press called it: "A car that only an engineer would love."

That statement was both cruel and, unwittingly, accurate: It was a well-engineered car (the first six-passenger, front-wheel drive, transverse-engine car in America), and in many ways, it was the right car for the times. Initially, it was also a breakthrough exercise in economies of scale - as it served as the base platform for anumber of other cars (like the humble egg that can be made into an omelet or a soufflé, as well as over-easy and scrambled).

Our problem was: We just served too damned many eggs! By the late 1980s virtually all of our cars were K-car derivatives. (As one journalist put it, our product lineup looked as if our engineers had fallen asleep at the typewriter with their finger stuck on the "k" key.) The company, which with so much celebration had been saved from bankruptcy less than a decade earlier, was right back in trouble once again. And, worst of all, the technical community in our company, led by our engineers, felt dejected, dispirited, and defeated.

Retiring the Battleship

A big part of our problem, at least of our competitive problem, was this: Like much of Western business, we'd allowed our product-development structure to become hidebound, inward-looking, and overmanaged.
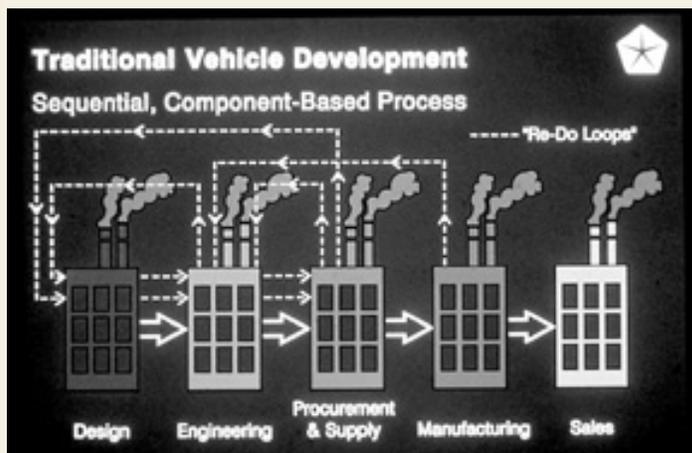

The figure here shows what our product-development system looked like: Super-strong functional organizations - *silos* to others, *chimneys* to us. (Hey, we're a "smokestack" industry.) Each functional department would do its job and then "throw it over the wall" to the next, and because there was little communication up front, there'd inevitably be all sorts of doubling-back, or "re-do loops" (depicted by the small white lines). Plus, the whole organization was only as fast as its slowest part. For example, if the "locks, handles, and mechanisms" department in the Engineering Chimney was backed up with work, the entire company had to wait. (A real-life example: Once, as President of the Company, I had to settle an argument between the Vice President of Manufacturing and the Vice President of Engineering over whether a brazed joint or a welded joint was the best way to join together two pieces on one of our cars.) The ultimate result: Suboptimization ... lowest-common-denominator products ... uninspired employees.

But there was change afoot at Chrysler. About a half-dozen years ago, we took a bigger step toward pure team-based product development than virtually any company in the Western world. We blew apart our old functional chimneys, and replaced them with totally cross-functional teams (what we call *platform teams*) - one for each vehicle type we produce (large car, small car, minivan, Jeep, and pickup trucks); see page 8. Why have our teams have worked so well (while others haven't): Often, teams like these are merely little tugboats trying to push around the still-existing battleship. We traded in our battleship on five, nimble guided-missile frigates! Senior management still sets the general *what* of any given program, but the *how* is left totally up to the teams.

Our very first exercise in team-based product development was our V-10, 400-horsepower, "zero-to-jail-in-four-seconds" Dodge Viper. This car meant a lot to Chrysler, in a lot of ways. But, more than anything else, it was "The Revenge of the K-Car

Engineers": The very same, allegedly left-brained (or "brain-dead") engineering organization that had been doing K-car derivatives, did this incredibly right-brained piece of machinery. (Although I must admit, it did occasionally take some doing to get the Viper team to abandon some of their traditional engineering ways. For instance, there was a lot of interest early on in doing the conventional thing with the Viper - adding a sort of entry-level V-8 version, giving the car a proper top and door handles, making an automatic transmission available, and so forth. But, of course, that would have defeated the whole purpose of what Viper was all about to begin with. So the lesson here is: *You can take the engineer out of the silo, but sometimes it takes a little time to take the silo out of the engineer.*
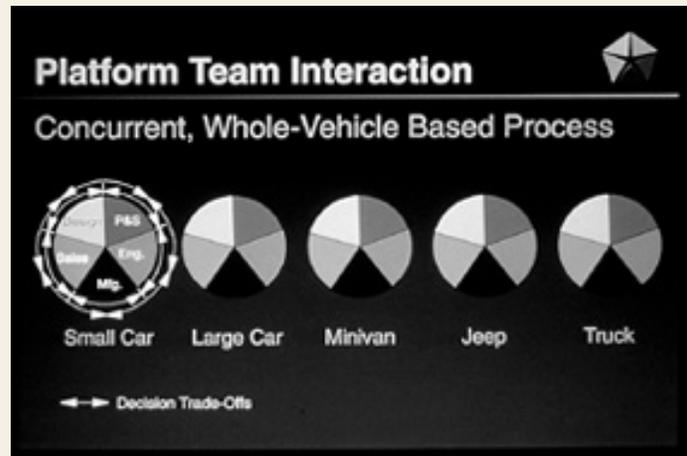
However, once we got everybody going, it was "Katie, bar the door!" Starting with our first fully-blown platform-team effort - the original Dodge Intrepid/Chrysler Concorde/Eagle Vision program in 1993 - our product-development lead times have been dropping like a rock: from 39 months, down to 23 months for our recently-introduced Dodge Durango sport utility. In fact, all told, we've introduced more all-new products in the 1990s than Chrysler introduced in the 1970s and 1980s combined.

And it's not for nothing, I believe, that *Fortune* magazine recently said that we have, "the hottest hand in Detroit" - including the all-new 1998 Chrysler Concorde. And there are two things worth noting about this car, by the way.

First, the Concorde has a drop-dead-gorgeous, Ferrari-like grille on the front - a design element that the automobile press is going absolutely ga-ga over. Well, an engineer, not a designer, was responsible for the final look of that grille design. That's Chrysler's highly cross-functional, "everybody-gets-his-say" platform-team organization in action. And second, we have a new advertising theme line: "Chrysler: Engineered to be Great Cars." A few years back, we wouldn't have had any credibility calling upon the company's bygone heritage like that. But today, I think we do. (In fact, we've also resurrected the Chrysler's "winged badge" of yesteryear. And somewhere, I believe, ol' Walter P. is smiling down on us.)

Lutz's Laws

Now, over the last couple of years enough people have asked, "What, exactly, is the secret of Chrysler's success?," that I finally decided to tell people (in 80,000 words or less) in the form of a book. (By the way, I don't want to turn this into a promotional stop for my book, but its title is Guts!: *Unconventional Business Wisdom from Chrysler's Dramatic Second Turnaround* ... and it's scheduled for November 1998 publication by John Wiley & Sons - just in time to be a great stocking stuffer.) Among other things, I'm going to take a cue from your 1996 Woodruff Distinguished Lecturer, Norm Augustine - whose first book was called *Augustine's Laws* - and lay out in my book what I call "Lutz's Laws." (At least I've got alliteration going for me. Norm should have called his book "Augustine's Axioms".)

Anyway, I thought I'd wind up today by sharing a few of my laws with you. (To get the whole list, you'll have to buy the book.)

Law 1. *The customer is not always right.*

Translation: There's a difference between "listening to the customer" and asking the customer to do your thinking for you. The latter: Shirking your responsibility as an "expert" in your field.

Law 2. *The goal of business is not to make money.*

Translation: It doesn't make sense to view the product, as Robert McNamara did, as just a "transitory conveyance" through which money passes, on its way toward some hypothetical return on investment target. A better approach would be to focus on building great products and, nine times out of ten, you'll make more money in the long run.

Law 3. *Too much quality can ruin you.*

Translation: Quality isn't just an absence of things gone wrong with a product; it's also the total amalgamation of "things gone right." Like a watch that tells perfect time, but that's as big as an alarm clock and so ugly that nobody wants to wear it. The last kind of car you want to build is one where the customer takes it home to show his neighbors and says, "Notice anything new?" And they say, "Yeah, did you get a haircut? To put it another way, a total, left-brained focus on "things gone wrong," at the expense of "things gone right," may win you kudos in J. D. Power surveys, but it doesn't necessarily turn customers on and get them to actually buy your product.

Now, those are sort of my laws for developing the right brain. But, of course, having only a half-developed brain makes you a half-wit! So, here are a couple more:

Law 4. *Teamwork is not always a good thing.*

Translation: Teamwork is a wondrous thing, and it is sorely needed - but it can be taken too far. The danger is that everybody loves one another, but the amorous lemmings are all running off the cliff together. As Harvard's Jon Katzenbach (author of *The Wisdom of Teams*) put it in a recent *HBS* article: "Spending time together is not the same thing as doing real work."

Law 5. *It's okay to be anal sometimes.*

And this one comes with a codicil: Law 6. Real creativity has nothing at all to do with 'casual day.'

Translation: As much as business today desperately needs more right-brained thinking, being creative is no excuse for being irresponsible. There is a question I always like to ask our engineers: "If you owned this company, would you be adding that program or letting that part pass?"

Finally, my capstone law:

Law 7. *Business is all about common sense - which, unfortunately, is not all that common.*

The real key is balance. Not just left-brained thinking and not just right-brained thinking - but hard thinking.

Here is a great quote along those lines, from the writer F. Scott Fitzgerald: "The test of a first-rate intelligence is the ability to hold two opposed ideas in the mind at the same time - and still retain the ability to function."

Lutz's Laws: The Rest of the Story

Now, I gave a speech somewhat similar to this a couple of months ago at Harvard Business School. (I'm almost embarrassed to tell you that I spoke to a bunch of MBA's, or to admit to you that I have an MBA myself - which I got in my youth before I knew any better.) That day I finished up with a couple of additional Lutz's Laws:

Law 8. *MBA equals More Brains than Ability.*

Law 9. *MBA should equal Must Build Things Again!*

Well, I racked my brain trying to come up with something clever to put to BSME and MSME for all of you here today - but frankly, I struck out.

So, instead, I'll refer to some words of wisdom from that sage management guru, Dilbert: For those of you who've never seen it, here is the multiple-choice **Engineer Identification Test** in *The Dilbert Principle*:

You walk into a room and notice that a picture is hanging crooked. You ...

    A) Straighten it;
    B) Ignore it;
    C) Buy a CAD system and spend the next six months designing a solar-powered, self- adjusting frame while often stating aloud your belief that the inventor of the nail was a total moron.

According to Dilbert, if you answered **C**, you're a certified engineer. You are not, however, the kind of engineer we're looking for at Chrysler.

Instead, the kind of engineer that we want - and, I believe, the kind of engineer that all of American industry needs - is the one who can relate to this description of what engineering is all about (from Robert Pirsig's classic book *Zen and the Art of Motorcycle Maintenance*):

> The Buddha, the Godhead, resides quite as comfortably in the circuits of a digital computer or the gears of a cycle transmission [or, I might add, in the recesses of that piece of mechanical art called the automobile] as he does at the top of a mountain or in the petals of a flower. To think otherwise is to demean the Buddha - which is to demean oneself.

That, I submit, is pure poetry.

In closing, I wish all of you Godspeed in your quests to become poets in your own right.

Thank you.

QUESTION AND ANSWER SESSION

Q. Looking at the industry, aside from the Vipers; what do you see in the area of creative, cutting edge engineering at Chrysler? Where do you see it going?

A. When we talk cutting edge, don't talk NASCAR because that's an oxymoron. We did the Formula 1 for awhile when we owned Lamborghini. We developed the Formula 1 Lamborghini engine. We took young kids from Detroit and had them work with the Lamborghini engines. When we look at racing, we have to decide where we get the most bang with Chrysler engineers. Not only in public relations, but in engineering rub off. Formula 1 is great if your primary marketing focus is Europe, but in the United States, nobody cares about Formula 1. What we like to do is Winston Cup racing with pickup trucks - there you're really allowed to get into the engine, and a lot of engineers are developing ours between the 318-cubic-inch and the 360-cubic-inch blocks (about a 340 block) to 600 horsepower and gaining all the time. The guys who are working on that program are near genius. The most exciting program that we have is the GT2 World Championship with the Viper, and they're cleaning everyone's clock in Europe, including the Porsche GT. There is only one American manufacturer that ever won an FIA championship with an in-house car, and that's Chrysler last year with the Vipers. Ford got in with the GT-40s, but they didn't make the GT-40. We're now running about 755 horsepower, which is way more than we had with a much larger restraint of two years ago. If you want to come to Chrysler, and work on that program, I think it would keep you occupied.

I want to win. I was very pleased that we did win, but what I'm honestly less in favor of is fiscal responsibility. I would much rather give the guys limited amounts of money than say, go in and pick up a truck, or go in GT2 with a multi-hundred million dollar program, which frankly, I don't think you get a return for.

Q. The engineers at Chrysler, Ford, General Motors, and others have succeeded in making cars that last longer - from 100,000 to 200,000 miles. How are you going to keep up? People will keep their old cars or buy used cars. Also, how can you compete with this trend?

A. Well, it simply means that you're going to have a better quality of used cars. That's one of the things that's depressing the new car business now. It's making it harder to sell new cars because a two-year old, off-lease car; let's say something neutral - a Chevy Lumina with maybe 21,000 or 22,000 miles on it, is going to be a perfect car, with the original factory warranty, showing no signs of any type of wear. It's probably got another eight to ten years, and another 150,000 miles on it with almost no maintenance, and sells for maybe 35% less than a new one. If I didn't get free cars (and I tell this to my kids and friends) I'd go to a dealer and buy a two-year, old off-lease vehicle. So why don't we like this? *The Wall Street Journal* got this completely wrong when they said that Detroit had defeated the Japanese. That was about three years ago. Now the Japanese have come back and they're nastier than ever. But Detroit has conquered the menace and now a new menace looms on the horizon - this is American journalism for you - and according to the press, it's called used cars, and they don't know whether Detroit can win this one. I know the journalist, so I called her and asked her to tell me where this used car factory is. People fail to realize that it's all one closed system, and the more demand we create for late model used cars that are in good condition, the less is the price to trade for a new car. So, nothing is better for the new car business than a very healthy used car market.

Even if we look at it from a societal standpoint, as cars last longer, and emission systems are tamper proof, as these cars move downstream through the socioeconomic strata, it means that more people who could only afford a ten-to-twelve-year old used car to get to and from work, instead of driving a horrible junker that is pouring out smoke, they're going to drive a pretty good car that is ecologically sound and very safe. I don't think you can lose by building a durable product, but it does mean this; when you bring out a new product (a new version), people have to see a reason to switch. The lust to own a new model must be triggered, otherwise you won't do much for yourself.

Q. You've said some interesting things about designing cars. What about the manufacturing of these cars? What technology is

being provided to your plants about automation?

A. It's just like writing software; you want to simplify your thinking before you write the software, otherwise it isn't efficient. What we've done in Detroit, and in much of American industry, is try to wholesale basically inefficient processes, and inefficient manufacturing philosophies, and then automate all of it, which requires huge amounts of capital. We were getting rid of the direct labor, but we were having to add indirect labor in the form of programmers and maintenance people. Plus it will increase the fixed costs because of the depreciation. What we're doing now is, I would say, unashamedly following the teachings of Taiicho Ohno, who invented the Toyota production system. This means that you first need to get the system to be lean, waste free, very fragile with minimum inventories, with minimum paths between things, and get to the absolute optimum use of labor before you start to automate. When I flew in the Marine Corps, even then we were talking about pilotless aircraft. People would say, "you fighter pilots are history because in another five years we'll be able to fly these things from the ground." I said, don't forget, the human being is the most complex and easily programmable nonlinear servomechanism ever devised, and is cheaply and easily reproduced by unskilled labor.

Q. I was listening to a broadcast on National Public Radio, and the head of a consumer product group was discussing the improvement of sport utility vehicle (SUV) safety regulations. I'm interested in how this relates to the small-car driver, and how will cost affect these improvements?

A. This is almost worth another lecture, but this whole SUV scare thing was created by a certain newspaper that was cynically out to win the Pulitzer Prize. They needed to find some big public issue so that they could rip the lid off the whole sordid mess. This newspaper received four Pulitzer Prizes, but I'm happy to say that they didn't get one for this. (Though they did get one for writing about the mating habits of birds.)

Statistically, if you have a side collision with an SUV and a small passenger car, obviously the people in the passenger car are going to be hurt. Also, if you run a large van into the side of a small car, the people in the small car are going to be hurt; if you run a 1979 Cadillac into the side of a small vehicle - it's the law of physics; it has more mass. If we had self-deploying airbags in the front of SUV's you could do it, but it is true that the risk of a person dying in a side collision if hit by an SUV or another light truck, is four times greater than if struck in the side by a passenger car of the same weight. If you look at the absolute numbers, they are so low, it's almost statistically insignificant. Far more people are killed by running into bridge abutments or single-car collisions than in SUVs.

Your point is an excellent one. We could theoretically make vehicles so safe that people are running into each other all day long; nobody gets hurt, but it would no longer be affordable, so we defeat the purpose. Whenever that comes up, I say and how about individual ejection capsules in airliners? In the first class section, I'd like a self-contained ejection capsule. I'd close the latches, put the arm rests up and squeeze the handles, and I'll shoot out of this thing. It would probably only triple the cost of air fare, and make basic airliners structurally unsafe with all those opening hatches.

The National Highway Traffic Safety Administration (NHTSA) just published a list of killer trucks. There is no rhyme or logic to it. The number one killer truck in hitting small cars is the big Dodge van - the big V8 tin cans - not the minivans. I don't know why it's worse than the Chevy van or a Ford van, but it's at the top of the list. Then the Chevy Suburban is near the top, but the GMC Suburban is near the bottom - they're the same vehicles. The NHTSA has concluded that you can't make any sense out of this.

I hope someone is teaching you folks about product liability lawyers, and to what extent they will challenge you in your search for creative solutions. Also, their legal departments will tell them not to keep many files, and not to write memos to colleagues saying "I really think we should reinforce this product." You tell them that it might be a good idea, but don't write it. This was a trumped up thing. The safety advocates are in league with the product liability personal injury lawyers and they're always looking for deep pockets. In this case, they found another gold mine by suing General Motors, Ford, Chrysler, Toyota, etc. for injuries. Some

lawyer is going to say my client died in this Toyota Corolla that was hit by a Chevy Suburban, and for only $1,000 per vehicle, General Motors could have devised a system that would have caused my client to be alive today, and I think that's an easy 50 million dollars because greedy GM makes at least that much by not providing the safety device. These are some of the downsides of the way we do business.

Q. People sometimes compare the auto industry with electronics technology. For instance, the cost of a computer today is $500 that sold for $2000 two years ago. Will the cost of cars go down in the future?

A. Unlike computers, we can't make cars smaller until they are only one inch. It sounds like a smart answer, but it's true. We are dealing with physical mass; the average car weighs 3700 pounds of aluminum, plastic, rubber, and glass, and there is no way we can go down the slope on that because the price of that stuff tends to increase each year. Where there is a real price reduction, because in the last few years prices really haven't moved much, is in the technology that's been incorporated in terms of emissions, new engines, and transmissions - it's really quite remarkable. The content has gone up, but the prices have remained pretty stable.

Q. General Motors has its sports car, and Chrysler has its minivans. With strict regulations and high insurance premiums for the SUV, what's the next type of automobile?

A. We have some thoughts on that. In about a year, we will be introducing a type of vehicle that nobody will know how to categorize. That's basically what you have to do. You won't get it from market research or pie charts because pie charts are a depiction of the market as it is today. You have to think outside of this framework, and ask yourself, what else can we do? To me, that is the real role of the creative top management of an automobile company. I am not going to divulge what we're going to do next.

Q. Please comment on the government's role in the automobile business. How do businesses in Japan intertwine? What about your government loan?

A. We never got a loan with the federal government; that is a popular fiction. We got the next best thing, though; a loan guarantee. The government said that if we defaulted, then they would cover it. Luckily, the government never had to step in. I worked for Ford at the time Chrysler got the loan guarantee, and I thought it was absolutely obscene - a terrible intervention on the part of government, and that Chrysler should have been allowed to die. Naturally, I feel somewhat differently today - I think it was an example of good government.

I thought you were going to ask about our government and the regulatory climate, which becomes very stringent and overly severe, beyond the point of diminishing returns, and no thought is given to cost effectiveness, because we just have an army of bureaucrats sitting in Washington, D.C. with nothing better to do than devise new regulations. They are not going to say we've done everything we can. That is one of our problems.

The Japanese system intertwines government and industry and banking most importantly; for a long time, I thought they had found the unbeatable system - that sort of mercantilistic approach, where the whole thing is one big Oliver Stone movie, where there's this vast conspiracy of everyone helping out everyone else and everybody owns each other's stock, nobody goes broke, and foreigners are kept out. I thought, we ought to organize our society like that. Now I realize that market forces will eventually kill that system. Unless Japan deregulates, gets rid of all that stuff, makes the banks face the bad news, and lets some of their corporations go bankrupt, they are going to face a very serious situation. As messy as our system gets, one can conclude that it's the best there is.

The George W. Woodruff School of Mechanical Engineering is the oldest and second largest of eight divisions of the College of Engineering at Georgia Tech. The School offers academic and research programs in mechanical engineering, nuclear and radiological engineering, and health physics.

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