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Session 1GS
Change Is Our Bread and Butter: Doing It Better Than Others is Our Job Security

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Keynote Speaker: M. JAMES BENSEN†
Welcome: SAM GUTTERMAN

Mr. Sam Gutterman: Our keynote speaker, Dr. James Bensen, is the president of Bemidji State University. He previously served as president of the Dunwoody Institute in Minneapolis and dean of the School of Industry and Technology at the University of Wisconsin-Stout. Dr. Bensen holds a Bachelor's degree from Bemidji State and a Master's from the University of Wisconsin-Stout. His doctorate is from Penn State University, with specialties in curriculum coordination, administration, and educational development.

An active and popular speaker both nationally and internationally, Dr. Bensen makes more than 100 presentations a year on topics relating to change, technology, educational excellence, quality, and the future. I don't know how he did it, but he just told me that one year he made a total of 210 presentations. His published works range from philosophical perspectives to quantified research, and have appeared in more than 60 journals, books, and periodicals. He has been the recipient of numerous honors, including an Award of Distinction for Research, Training and Scholarship from the International Technology Association. He received the Outstanding Teacher Education Award from the Council on Technology. He is also the recipient of the Leadership Award from the American Vocational Association. He also has received outstanding alumni awards from both Bemidji State and the University of Wisconsin at Stout. Dr. Benson has been named by Minnesota Governor Arnie Carlson to serve on two statewide groups: the Board

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Of Directors of Minnesota Technology, Inc. and the Vocational High School Planning Committee.

Dr. M. James Bensen: I'm going to be talking about speed, about change, about your profession, and about the society within which you work. I want to open up my presentation with a little limerick that goes this way:

> There once was a man from Dresser,
> who progressively knew lesser and lesser,
> and finally in the fall when he knew nothing at all,
> they made him a college professor.

That has a funny twist to it, and I'm going to ask you at the end of the presentation to think back to the opening limerick because it will not have the same kind of humorous twist. It will have a different meaning for you.

I've titled my presentation "Change Is Our Bread and Butter: Doing It Better Than Anyone Is Our Job Security." That might sound a little odd, but I picked this theme up from the president, CEO and founder of Quad Graphics out of suburban Milwaukee. He runs a web printing operation, and not only does he say change is our bread and butter, and doing it better than anybody else is our job security, but he also says if you looked in every one of our departments, you will see that almost everything we do is completely different than how we did it six months ago.

Here's an incredible perspective as we look at this business of change. Change is going to be coming in many different colors. Change is going to make us look at things differently because anything is possible if you think it is.

Many of my comments are going to come out of three contexts. As Sam mentioned, I spent a lot of time at the University of Wisconsin-Stout. In fact, I spent 23 years there. I headed up the School of Technology which is a very large school of about 4,000 students, and we had seven, self-sustaining, research and development (R&D) centers, and many of those R&D centers had multi-million-dollar projects in it. I went on to the Dunwoody Institute. It's a private, nonprofit institute of technology on the very high end of the applied activity that's going on and is operated in over 27 different countries and now at Bemidji State University. As we take a look at that, we see that we have to start looking differently. The way we look at life determines our experience, and such a simple insight presents each of us with an opportunity to make momentous changes in our lives, and the only limits are the ones that we create.

If you look at those fish in that bowl up there, you'll notice they're all looking out the same side of the bowl, except for one. There's one that's turned around and is looking at the world completely differently than the rest of them. That's our job as leaders in our profession, because we know that everybody is seeing the obvious. What you and I have to do is turn around and look at the unobvious things to spot the trends. We need to be looking at the kind of things where we can provide leadership because, as we start to see that, we see that most ailing organizations have developed a functional blindness to their own defects. They have not suffered because they cannot solve their problems; they suffer because they cannot see their problems.

We must see things differently and find whole new perspectives. For instance, I have in this little bottle some white powder. What is in this bottle is powdered water. And you might say to yourself, what do you do, just add water to it? No. This is already water, and the way I turn this powder back into liquid form is I put 140° temperature underneath it, and, bang, it turns back into liquid form. It's a terrific technology invented by a corporation in Beloit, Wisconsin, that bills itself as the world's leader in powdering technology. In fact, their motto is: You name it, and we can powder it. They powder meat, cheese, and vegetables. They build equipment for powdering systems. They developed the powdered water for the federal government, and it's a terrific technology.

Let's say you're out in Desert Storm, and you're stomping around in that cold sand dune, and you'd give anything for a good old, hot bowl of oatmeal. Well, you pull out your tin cup, and you throw some freeze-dried oatmeal in it. You put some powdered water in there, put a flame underneath it, stir it up, and you've never had a more satisfying bowl of oatmeal. You say, "Wait a minute. What are we talking about here?" Really it's a simple form of technology; the dimensions that they've taken it to are absolutely elegant.

What I have in this jar actually is encapsulation technology. You know when you buy an M&M® you've got a chocolate drop that's encapsulated in a candied skin. If you open up a 12-hour cold capsule, there's a whole bunch of little beads in there, and each one of those beads has a membrane with a different thickness around it. The beads dissipate through your bloodstream over a six-, eight-, ten- or twelve-hour period. NCR paper, carbonless paper, that is encapsulation technology. Buried in that paper are tiny ink droplets that have been encapsulated. When you write on it or type on it, all you're doing is rupturing those ink droplets. What I have here is an atomizer. When the water comes out of this atomizer, it's busted into a fine mist. Notice the little water drops sitting out there with air around them. Those little water droplets are only two to five microns in diameter. In this case they blow a

soybean-based oil right through the droplets. They call it side dressing. They blow it through that mist; it hits that water droplet, captures it, drops it into this bucket.

Now, what would you do with powdered water? It's starting to enter all kinds of fields and possibilities, from medicine to food stuffs. Let's say that you're a cooking manufacturer, and you have this certain brand of cookies that you want to remain moist on the shelf longer than your competitors. What do you do? You stir up your formula that contains some powdered water in it. You'd calculate out the soy-bean-based oil against the shortening in the recipe, and you'd throw your cookies into the oven. What part of that cookie's going to get hot first? The outside of the cookie. And it gets hot, releases the moisture so you get a cookie that's crispy on the outside. What part is going to get hot last? By the time the inside of the cookie gets hot enough to release the moisture, it can't get hot anymore because of the crispy outside of your cookie. You can put them on the shelf, and they'll stay moist three to four weeks longer than your competitors would.

Now they've got another one. Instead of using a soybean-based oil encapsulator, they use a caramel glaze or a candy-based glaze. When this water comes out of this atomizer, it's busted into a fine mist, they blow that caramel glaze through a water droplet, it drops into a bucket, and you have this dark brown powdered water. What do you do with dark brown powdered water? Put it in a bag with some popcorn and toss it into the microwave. The caramel glaze is inert, but the little old water droplet on the inside turns to steam, explodes, and when you open up your bag, you have caramel corn. Let your mind roll around a little bit and see where it goes. It will entertain a whole new way of looking at this world of ours.

What you see here, if you look carefully, is a silhouette of an airplane wing. For you and I, as leaders in any profession, it is no longer good enough to be on the leading edge. Let me repeat that. It is no longer good enough to be on the leading edge. Where you and I need to be is in that red-hot spot out here in the front. That's called the envelope of change. That's where the leading edge engages, in this case, the atmosphere, and that's where the stress and the strain and the heat and the ambiguity and all the problems seem to be. However, that's where you and I need to be so we've created the optimum conditions so when the leading edge comes into it, we've created a situation for our professions to work in that kind of a setting. So, as we see that sort of thing going on, we realize that there's danger; there's always danger for those who are afraid of it. We see that what lies behind and what lies ahead of us has little importance compared to what lies within. We see that the great thing in this world is not so much where we stand; it's in what direction we're moving. "I dream things that never were, and say, Why not?" As you look across at that sunflower field, you'll see it's a beautiful field except for that one oddball plant that's sticking up higher than all the rest of them. Most people in

society would say, go cut that big one off so that the field looks nice again. However, the most precious plant in the whole field is the one that is bigger than all the rest of them; we have to be able to tolerate those kinds of conditions.

Unless a company sets up to compete against itself, it will go out of business. Even if you are the very best in your business or your business is the very best, and there's nobody left to benchmark on, then you've got to start competing against those that are within—your colleagues.

I was doing some consulting for the Mayo Clinic a couple years ago, and they brought in their managers from their Scottsdale, Arizona clinics, their Jacksonville, Florida clinics, the new Wisconsin clinics, and the Rochester clinics. We had about 150 people in this room, and we were discussing some of the things that were going on. I made the comment that this was the most dangerous time in the history of the Mayo Clinic. One of the doctors shot his hand up and said, "Why do you say that?" I said, "because you are the very best." That's how the rest of the world views the Mayo Clinic. People are sent from all over the world to Mayo to get to the bottom of health problems. What is the clinic the best at? Diagnosis.

During break time we were gathered, talking a little bit, and another doctor came up to me and he said, "Why did you say it was so bad to be the best?" And I said, "I didn't say it was bad to be the best. I said it was dangerous to be the best." "Well, it's the same thing," he said. And I said, "No, it's very different." And he said, "Well, what do you mean?" I said, "While you're pushing that envelope of change, you're getting better and better. What are you going to do when somebody comes out of left field and changes the rules on you?" Those things are called paradigm shifts, and some other people call them step-function changes. What are you going to do when that happens? And he said, "Well, I can't imagine what that would be. What would it be?" I said, "I don't know. I'm not in the health care industry." He said, "Just give me an example." So I asked him, "have you ever heard of the fifth generation computer?" He'd never heard of that. I asked him if he'd ever heard of parallel processing systems. He'd never heard of that. Of course he hadn't heard of massively parallel processing systems, but, ironically, four days after that conversation, a company announced the release of a massively parallel processing system. When all that comes together with programming and inferential calculations, that system will be able to make one billion inferential calculations per second. That's not one billion crunching ones and zeros. That's one billion complex decisions.

What is the Mayo Clinic best at? Diagnosis, right? If I'm not feeling good, I might finally end up in Rochester. Now, let's say that they start checking me out. I sit down in front of the doctor, and she puts the old band around my arm and pumps it up. She says, "Wow, Jim, your blood pressure went right through the end of the

tube here. Your white count's right off the chart. Your eyeballs are green." She tells me what's wrong with me and what I have to do. That's the old way of diagnosis. That's what the Mayo Clinic is so good at.

Let's say we have the world's information superhighway all hooked up with all the latest things going on all over the world in the medical profession from surgery to disease control to biotechnology to genetic engineering, aftercare, gerontology, and pediatrics. Everybody is putting the latest thing into this system so what's happening on the other side of world during the night is being fed into the system. It's just sitting there, and it's time for another check-up. What am I going to do this time? I'm going to take a urine sample in a baby food jar to the Kmart® lot. As I come into the Kmart® lot, I notice three things in front of me. There's the rocking horse, the photo booth, and the medical booth. I go into the medical booth, shut the door behind me. There's a place to pour my urine sample. I prick my finger and put a blood sample on an electrode. Then I hook myself up to a few other things, put some bands around my arms, and then I pull out a $20 bill, I stick it into the slot, and hit the button. Let's say I stayed in there for 15 seconds. Do you know what I just got? Fifteen billion inferential calculations. I could go to every clinic in the world simultaneously for the next 200 years and never even make a dent in that.

I looked over at the doctor who asked me the question, and his jaw was hanging down to about his chest. He said "I understand." As the late Sidney Harris says, "The horizon is a definite place when you're standing still, but it always recedes as we approach it." This is worth keeping in mind when we think we have the future well in hand. What you know may be more of a deterrent than what you don't know. That little old mouse is running around in that snow tunnel feeling just fine. He didn't even know he was in trouble, but when that fox's nose punched through the snow, it was over, curtains, no time out, no second chances.

Over the past years, I see at least one company a month that doesn't even know it's in trouble. If they stay on course, they will no longer be around five years from now because, as George Romney says, there's nothing as vulnerable as entrenched success.

We see, for instance, that an idealist believes that the short run doesn't count. The cynic believes that the long run doesn't matter. The realist believes that what is done or left undone in the short run determines the long run. We see that happening all the time in every profession. For instance, in the past a survivor may be defined as a person strong enough to cope with hardship, but in the future the survivor may be defined as a person smart enough to adapt to change. We resist change, and we have to start entertaining it and getting excited about change and being able to get involved in it.

When we start to see what is happening in computing capacity, we see how much it's opening up your profession and mine and everybody else's. Computer power is now 8,000 times less expensive than it was 30 years ago. If we'd made similar progress in automotive technology, you could buy a Lexus for two dollars. It would travel at the speed of sound and go 600 miles on a thimble of gas. That's what we're getting in computing capacity. In fact, it is moving so fast it's hard to keep your head on straight. If you bought a new luxury car this year, there's more computing capacity in that car than there was in the lunar lander that landed on the moon, and we had NASA engineers and scientists all over the world monitoring it to make sure everything would go right. You jump in the front seat of your luxury car, turn the key and drive off, and don't even think about it, because it's so user friendly.

The other day I went to a birthday party, and somebody bought one of these birthday cards that has the little chip in it. You open it up and it sings out "Happy birthday to you." After the party, when they were cleaning up everything, and they were throwing all the paper away, the cards were thrown off to the side. When they threw that birthday card off to the side, they set aside more computing capacity than there was in the world in 1950. Think about the changes. Think about the capacity. Think how much access you and I have to these kinds of things. And we'd better be careful how we are looking at the world because we need to learn from the mistakes of others. You can never live long enough to make them all yourself.

We see that the world is full of people whose notion of a satisfactory future is, in fact, a return to the idealized past. We have lots of people looking on into that hole of the past and saying that's where we want to be. If you have to be honest with yourself and look ahead, you see that there's an enormous amount of things going on out there as we're leading it because if we start looking at ideas, one great idea can generate more great ideas, which, in turn, can generate even more great ideas. You must start thinking differently because, as we start to see, the reality of the universe is pure thought of time, space, energy, matter, and wind; there's a main driving force of will and brains driven by the values and passion of what we want to do.

Here's a little motto from the 3M Corporation. It's goal is to have 30% of its earnings each year coming from technology that has been developed in the last five years. In theory, then, in five years everything it will be doing will be different than what it's doing today. What a theory! What a company! Here's a company that has 65,000 products, and is producing 400 new ones a year. The 3M corporation's best guess is it takes 100 ideas to have one come out a year. Imagine all the ideas that are going on inside that company. They even make money on their mistakes.

Glue that won't stick is sold as Post-It® notes. Spencer Silver said if I'd have thought about it, I wouldn't have done the experiment. The literature's full of examples that says you can't do this. They've made millions on glue that won't stick. One day a technician was running around and had some dirty tennis shoes on, and there were some little sprinkles on her tennis shoes that looked kind of clean. They said what did you spill on your tennis shoe? She didn't know. They did a little reverse engineering and isolated the chemistry. Today they sell it as Scotchgard®. The ideas that are going on within that kind of a context are being driven by a genie called technology, that great, growling engine of change. If you want to look at it in its most simplistic terms, you realize that it is know-how or an extension of the human potential. That's basically what this phenomenon is.

You and I have certain body mechanics, and if we go out there and press them up against Mother Nature, we'd come out second best in one big hurry, because you and I can only lift so much, see so far, and hear so well. But if we want to lift more, see better, hear better, and thousands upon thousands of other kinds of things, we rely on this technology genie to do it. For instance, how far can you see? Not very far, but by using the Hubble telescope, you can see to the theoretical edge of the universe, 14 billion light years into early cosmic time.

How much can you feel? We can pick up the heat from a human body 1,000 miles away. How much can you lift? I know people who can lift four pounds, 40 pounds or 400 pounds, but at some point they reach their max or want to save their backs. So we rely on other ways. We have boom trucks, cherry pickers, forklifts, hydraulic jacks, elevators, escalators, and all kinds of ways of leveraging things.

A company in St. Paul, Minnesota makes booms and derricks and cranes, and they engineer and build an offshore oil drilling device that can lift the equivalent of 94 Boeing 747s all at the same time. At one end of the scale we've got this capability of building monster machines. On the other end of the scale, we have tiny machines that are so small you can barely see them. This is one of the fastest growing technologies in the world today. It's something called micro-machining. A gear that's the thickness of two hairs on your head, in the micro-machining business is a great, big, clumsy, oversized gear because they've discovered that the smaller you make them, the less friction they have, the longer they last, and the faster they run. They're running longer and longer. They're going faster and faster. Someone at the University of Wisconsin-Madison, under the magnification of X-ray lithography, is building these machines. The motor that runs this machine is so small, you can put five motors in the dot of an i. That tiny motor one-fifth the size of a dot of an i is currently running in a research lab at 15,000 rpm. That's three times as fast as an automobile engine wide open for nine months with zero wear on it.

The biomedical field is just panting to get their hands on this stuff. You could drop that little bead in your vein, and through remote control send that little roto-rooter around and clean out the cholesterol in your arteries, you kind of get reamed out. Now they've got another one, for instance, that is kind of a chip shot. It's a smart medicine dispensing machine. You can slip that thing into your vein and send it to where you want it to be, and it'll release the medication to only the spot that you want it. They developed one that's like a little Pacman that gobbles up pollution and solutions. They developed one that'll head off into space. Can you imagine how little energy it'd take to send that little speck off into space so it can send back information?

Two professors in Scotland last year invented a video camera on a chip. I mean it doesn't have to go from analog technology and be converted to digital technology. You can shrink that camcorder down to virtually nothing. Today we have big camcorders you hold in the palm of your hand. A couple Christmases from now when the two cutest grandsons in the world—Andy and Josh Bensen—come back to my house, I'm going to pull out my camcorder, and I'm going to take their picture with a camcorder that will be about the thickness of half a marble. Imagine what you could do for controls and monitoring and data gathering and all this sort of stuff with miniature camcording.

If you bought a new Chrysler car this year, buried in the hub of the steering wheel is a micro-machine that kicks the airbag out into your face. If you bought a Nike tennis shoe with the bubble in the heel, and you pump up that bubble, how high do you want to fly? Buried in that bubble in that tennis shoe is a micro-valve that controls the amount of air. It's in thousands of products. It's so user friendly; you don't even know that you're using it.

We are in an incredible knowledge explosion. It's unbelievable! And 90–95% of all the knowledge in the world has been developed in the last three years. That means that every middle school kid, while they're going through middle school, will have their knowledge base doubled. Then they go into high school, and bang, we double it the second time on them. Then they go to colleges and universities, and bang, we double it the third time on them. We're talking exponential growth here, not linear growth. We're not just adding it on. We're talking exponential growth.

Meadows and Meadows, in their book *Limits of Growth,* got a tremendous concept of exponential growth. They say imagine you had this pond, and on this pond is a lily pad, and every day the lily pads will double. When you look down at your pond, you now see that it's one-fourth full of lily pads, and you have only two days left. That's exponential growth. That's what we don't understand. That's where we

are technologically. A person I know has been tracking this knowledge base, looking at the patent applications, the prototypes, the technical reports, and the publications. He says it's a given, even if you play it ultra-conservative, a child born today who obtains a Bachelor's degree at age 21, will be dismayed to know that the half-life of a Bachelor's degree will be one week.

What in the world are we talking about? I always thought that a university degree kind of set you for life. Wrong paradigm. I don't care how many degrees, diplomas, or certificates we have. There are three important things for Jim Bensen to do tomorrow: (1) He must get up and exercise; (2) he must have breakfast, and (3) he must learn. And that's why I tip my hat to the SOA and its heavy emphasis on learning and moving the profession along. It is a daily responsibility of every one of us as we're dealing in these kinds of conditions. There's a tremendous amount of things going on out there as we start to see the potentials and the possibilities of what we're talking about.

The pioneers cleared the forest from Jamestown to the Mississippi with fewer tools than were stored in the typical modern garage. Think about that. My Grandfather Bensen immigrated from Norway when he was 18 years old. As he got himself a homestead in northern Minnesota, he got 160 acres of solid, white oak timber. He had to build a cabin there with one door and one window, of certain dimensions. He had to live there six months a year for five years running, and then the claim was his. What were his tools? How did he clear the forest? With an axe and a saw and horses, right? What did his first plow look like? He put the reins around his neck, and he walked behind it. When he was in his middle-80s I sat on his knee and listened to pioneer stories. They were exciting to a little kid. I know he embellished them a little bit, but he talked about wolves and hardships and those kinds of things.

What would Grandfather Bensen say if we had a chance to sit down and talk again today? His head would literally spin. The other day I got up and had breakfast, jumped on a plane, flew to Washington, D.C., worked all day, caught the early flight back in and was home in time for dinner. I had breakfast at home, I had dinner at home, but my workday was in Washington, D.C. What would Grandfather Bensen have said? He would not understand it, just like my grandson Andy will not understand it some day when I tell him that. He'll say, why did grandpa have to go do that? He'll be in the interactive environment and looking at the world differently than I am looking at it. There's an incredible amount of change, and nobody is immune to it.

I want to tell you a little story that happened at the Dunwoody Institute. We were involved in a large project in Indonesia. Freeport Minerals had opened up a very

large copper mine on one of the islands. That island is right across the top of Australia. It's a great big land mass. The ore boats are sitting in a tropical rain forest harbor, and the mountains jump straight out of the ocean bed right up into the sky to 13,700 feet, and 74 miles up into that mountain chain is the world's largest known copper deposit. About 15,000 people work in that mine. How in the world do they get that ore out of that mine 74 miles down these rugged mountains into the tropical rain forest harbor to fill up the ore boats? They cut a hole in the mountain, half a mile straight down inside the mountain, and they bulldoze the ore into this hole. It free-falls for half a mile into the middle of the mountain. Then six miles off to the side of the mountain is a huge tunnel with a six-foot wide conveyor belt that moves the ore out to the side of the mountain, into another plant, where there is the first reliable water supply. They extract the non-ore out of it, and the enriched ore goes into a sluice pipe 68 miles down the side of the mountain, into another plant that extracts the water out of it. It then goes into the ore boats, off to the world smelters.

Two summers ago two members of my faculty were riding in a Jeep four miles inside this mountain, bouncing over rocks in hubcap deep water, and all of the sudden the driver stopped dead, and they look off to the side, and there's a little glow in the dark. The two faculty members jumped out and realized they're in ankle-deep water. They walked over to this glow, and when they got there, there were two native Indonesians with an AT&T fiber-optic splicing kit, splicing the control system that runs the ore conveyor system that brings the ore out the side of the mountain. Friends, there's no more remote place to be on the face of this earth than four miles inside this mountain, and there's no higher technology to be dealing with than fiber-optic systems. But both came together in an environment like this.

In the spring of 1992, I had the privilege of keynoting the World Conference on Technology held in Weimar, Germany. It was the first time that the old east and west block countries had a chance to come together and take a look at the technological world. After 50 years of isolation, about 50 countries showed up for that conference. On the second day the keynote speaker was a fellow by the name of Sir Robert Telford, the lifetime president of Marconi Company. He gets up and says, if you don't remember one other thing than my lead statement, I want you to take this home with you. He started off the conference by saying 60% of the technology that Marconi Corporation will be using by the end of this century, which was seven-and-a-half years away, has not been invented yet. Can you imagine that? A worldwide company dealing in the international marketplace with global competition saying, as of today, we have only 40% of the tools in our toolbox we will need to be doing business seven-and-a-half years down the road. Is he right? He's absolutely right on the money.

Willard "Yellow Wood Wolf" Nelson lives on a Pinewood Indian Reservation in South Dakota. His heart is being monitored 24 hours a day in a Los Angeles Clinic off the NASA satellite. We are starting to see things like super-insulators. Put a torch on your hand, and you don't even feel it. They say you could put the stuff around a thermos jug, fill it with coffee, throw it in the deep freeze for a month, take it out, and your coffee will still be too hot to drink.

You think that the fax has changed your life? What about the three-dimensional fax? I could draw something on my computer screen, and when it is the way I want it, I could hit the button and, bang, I could fax it to Austin, Texas, Bemidji, Minnesota, or Singapore. We have speech recognition, acoustical pattern recognition, grammatical processing, symmetric processing. When you say pair, pare, or pear, it knows which one you're talking about. We have the capabilities today, for instance, of in-line foreign language voice translation. I can pick up a phone in Paris, call somebody in London, speak slowly to them in French, it comes out English on the other end, and I could answer in English, and it could come out French on the other end. If I have a safety deposit box in Highland Park, Texas, and I want to go into it, I walk up to the front door, the laser beam scans the back of my eyeball, opens up the door and opens up my safety deposit box. At Tufts University they just invented the robotic nose. It's called a robonose, and it's made out of a technology called single-minded fiber sensors. I could run a million people in front of that smeller, and it'll pick all one million of them out again. Can you see the potentials and the possibilities?

Think about fiber optics. The little glass thread there is one-sixth the thickness of a hair on your head. It's made out of glass so pure that if you made a windowpane out of it 74 miles thick, you would have zero distortion in your windowpane, and with a pulsing laser that pulses 432,000,000 times a second you can send over 10,000 simultaneous telephone conversations over that little glass thread. Then along comes Bell Labs with the multiplexors about the size of a half a loaf of bread. And then GTE comes up with a new laser that'll pulse 22 billion times a second which gives us the capability of sending 20 complete sets, not volumes, 20 sets of the Encyclopedia Britannica word for word across that little glass thread in one second. Our mind can't even comprehend it. Electronics doesn't permit us to get onto the optics fast enough. Along comes the all-fiber network which gives us incredible capabilities. When this baby comes along, and we're using photonics instead of electronics, we'll be able to make all the phone calls made on Mother's Day simultaneously on this network and only be using 1/25,000ths of the capability of the network. The rest of the network will be sitting there in a dark band width. Incredible? You better believe it. But we haven't seen anything yet.

Right around the corner is something that's going to blow us right out of the water. This is something called nanotechnology. It's been in the journals a lot in the last month. Let me give you an example of what I'm talking about. I have a computer chip that has been magnified five times, and you see the circuitry on that chip. I can take that same computer chip and slide it under electron beams, a scanning microscope. Instead of magnifying it five times, we're going to magnify it 300,000 times. I can slide that same computer chip under an electron-beam tunneling microscope and go ten times this to the three millionth power, and you see one little spot on that thing, and it happens to be pointing at a brown spot on the chip. You start to see the crystalline structure, but at eight times that, at the 24 millionth power, lo and behold, we're able to take the first photograph ever of the atom.

Think back to the opening limerick. Every day we know lesser and lesser, and it's a good thing. That means things are happening out there, but when we start to see the potentials and the possibilities out there, we realize that time is flying, and our job is to keep focused on the main thing. How will we make our lives better? It's by staying out in front of that envelope of change, in front of the leading edge, and providing the leadership for this nation, our companies, our communities, our society, and this world.

Mr. Gutterman: I'd like to take the prerogative of starting the questions. I think you've convinced me that there is change and that there will be change. How do you suggest that any actuary keep ahead of all the other actuaries in any practical techniques?

Dr. Bensen: Well, actuaries are good at projections. So make projections about where we are going to be going. I have a concept that I've used with a lot of organizations in strategic planning. It's a concept called planning from the future—not to the future or for the future, but from the future. You often say, well, how do you know—how can you plan from the future when you don't know what the future is? That's a trap you get into. There is not "*a* future" or "*the* future." There are all kinds of alternative futures out there.

At one of the institutions we pulled off a strategic planning. We did a Delphi study of the future, looking at global change, international competition, and technological explosions. We could be many things. Then we chose. We identified and carefully defined what we wanted to be. Then we planned backwards to where we are now. Our chances of getting there are extremely good. In fact, you almost universally get there in half the time.

The last time this nation did that was when President Kennedy said by the end of this decade we're going to put a person on the moon. The goal was set, and the

time line was set. What did NASA have to do? It started planning backwards and they pulled off an unbelievable engineering feat in eight-and-a-half years. I can almost guarantee if President Kennedy would have said, "We're going to start planning to go to the moon," we probably wouldn't be there yet. We'd have found a million ways to run that thing in the ditch with arguments and filibusters. He sold a dream. So for actuaries to stay ahead, they must take a look at the future, determine what they want to be, commit themselves to that dream, plan backwards to where they are, and their lives will be changed forever.

From the Floor: You have talked about the physical solutions, like magnetism, taking a treatment to a certain part of your body. My reaction is that there's an enormous amount of mental stress that goes with this technology. Some of the topics that we're going to talk about are equality of physical disease and mental disease. I wonder if in talking with the heads of corporations that you deal with, you get any sense or parity in mental health benefits. As a corporation changes, and they have 40% of the tools that they need in the next seven years, they are going to have some people who can't keep up, meaning they'll be out of jobs, meaning they're going to go through stress. I've been in health care for 25 years. I can see that instead of mental benefits being say 7% of the health care dollar, maybe they're going to 93% of the health care dollar because physical illnesses will be taken care of.

Dr. Bensen: That's a very good question because the one thing we have to realize, is that technology is neither good nor bad. It only opens doors, but it doesn't compel you to enter, and so we've got to sit back and say, is this something we want to engage in or not? There was a lot of stress, for instance, when Gutenberg invented the movable type press. It put all the scribes out of work, and it's similar to what we're starting to see going on now. When the Industrial Revolution came about, it changed the world because it created a new way to do physical labor. We have to realize that we're into a knowledge-based revolution that's going to be many times greater and have much more of an impact than the Industrial Revolution. Fields like education, law, medicine, real estate, actuarial science, and insurance are going to go through that same revolution that the scribes did when Gutenberg came along or that the guilds did when the Industrial Revolution came along.

Young kids today seem to be able to roll with this a lot better than those who are 45 and above. It scares the heck out of us because we look at it and say the technology that we know that was mechanical—gears and shafts and belts—we could see it. I can't see software switches and 1's and 0's; that's mysterious to me. It wasn't a part of our experience. If you go into any computer lab at Carnegie-Mellon Day Care Center they have computers in the day care center, and there are only two

rules to get on the computer. One is you have to be able to stand up, and second, you have to be potty-trained. It's just a part of life for these children.

From the Floor: A few minutes ago you used the example of President Kennedy envisioning the future and saying we're going to put a man on the moon by the end of the 1960s. Many people use that example. Nobody seems to use the example of Vice President Agnew saying we're going to put a man on Mars by the end of the 1970s. I was wondering, in envisioning the future, what type of lessons are there besides it's always better to be president than vice president?

Dr. Bensen: Looking at Gore and Clinton today, I'm not sure but, yes it's really being able to envision something and then commit to it. Just last week a little community 30 miles from Bemidji—Foston, Minnesota, which has 1,500 people in it—was named one of the ten top cities in the U.S. That little community took on New Orleans which was the biggest one in the bunch, but how in the world could a city of 1,500 do something like that? It's an incredible feat. It's a little community that has had vision and done a lot of things that people told them couldn't be done. They just said, well, why couldn't it be done? They went out and did it. And when you go in there it's obvious.

From the Floor: My question is tied into the second question. I have young children, basically starting school. I guess I'm as concerned for the actuarial profession and the continuing education process as I am about my kids' regular education process. My main concern is how much time we spend in education. It seems to me that kids going to school from 9:00 to 4:00 isn't going to work anymore. There's just too much to take on. And I guess I'm also worried about where actuaries should be. We should be taking sabbaticals so practicing actuaries can head back to school as opposed to just attending sessions like this.

Dr. Bensen: Very good point because, as I mentioned, the revolution in education is just starting. What's going on right now is kids are watching six hours of television a day on the average, and that's not a very good high-quality education. It's sort of baby-sitting them, getting them through time and holding them until the parents come home or the meals are ready. What's going on in the education field? I'll give you an example. George Lucas from Star Wars is getting into curriculum development. Steven Spielberg is too. So are corporations. The most sought-after degree in the world today probably comes from Motorola University, which has North Central committee accreditation.

I was in Kansas City a couple years ago the week after the Future Farmers of America (FFA) Convention. High school kids come from all over the country into Kansas City. We were looking at bringing a convention into the city, and so we

went to the convention floor and looked at all this. We went to the Holiday Inn one night for dinner as their guest, and the manager of the Holiday Inn was showing us this room. It was not a very big room, and he said last week we cleaned out this room, and we went 50/50 with the local computer arcade company in town, and we kept it open 24 hours a day for a week, and at the end of the week we split $30,000 four ways. What were those kids doing in a computer arcade game for one week? They were just throwing quarters in this machine to get this visual charge. Can you imagine if that machine was teaching Algebra II with that kind of excitement?

If you'd have said World Wide Web in this room five years ago, there would have been less than 100 people who would even know what you're talking about. Today it's common; everybody's on it. We're teaching courses on it. We're delivering courses this fall to Canada and to Toronto, using the World Wide Web, CD ROM, and interactive video.

From the Floor: Current science fiction and futurists are all talking about nanotechnology and virtual reality as the waves of the future. I remember when I was a kid everyone said, when you grow up you'll be vacationing on the moon, and I'm here in Colorado Springs, and unless you go up in the mountains, it doesn't really look much like the moon. Do you have any ideas as to how to spot the current technology fads that are actually going to collapse?

Dr. Bensen: The head of NASA one time said if you can think about it and define it, and say it's going to take 50 years to do that, generally on the average, we're coming in half the time. With nanotechnology and virtual reality, some of that stuff is coming out right now. We're doing those sort of things. Our students are creating fly-through home pages on the Internet and stuff like this with today's technology, which is incredibly short term. If we can deliver a little computer chip with 15,000 times more capacity than we're at today, that will be another incredible leap that'll give us many more possibilities. I don't know how to spot the ones that are being pushed by the charlatans or will not pan out. What happens is that one begets another, and then they're pulled together; and those are the things that are starting to come out. Animation, interactive video, and creation stations are leveraging one against the other. Many of you have used virtual reality and surrounding experiences that are really an educational experience to go through.

We're living in a rapidly technological culture, as I showed you today, and for most of us, we're technologically illiterate by and large. We're becoming more illiterate in our technological culture. We need to be introducing more experiences in our K-12 school system so children can experience the technologies so that their math and science and social studies come alive in this new context.

From the Floor: Doctor, from what I read I see that the university system in this country is probably the greatest in the world, but also I read that is not true of our grade school system. The bureaucracy of the grade school system seems to impede the change you're talking about. As an educator I wish you would comment on that issue, and particularly some of the changes that are being sought, like the voucher system. Would you comment on what you think that would do for the education system. How does that fit into the change you're talking about?

Dr. Bensen: I've spent my whole lifetime working with K-12 systems. Over the past ten years, I have personally talked to 10,000 kids, thousands of teachers and the school administrators each year, and it's true. We built a K-12 educational and a university system, too, but it hasn't caught up to us yet, because it's based on the past.