

*Phil McKinney:* In this episode of the Killer Innovations podcast I interview Chuck House. Chuck is one of those individuals whose impact we've all felt but didn't immediately realize. With the recent anniversary of Neil Armstrong stepping on the moon, Chuck turned out to be timely in this interview. Why? He's the inventor of the early display technology that resulted in Chuck ultimately creating the moon monitor. It was the moon monitor that allowed NASA and the rest of the world see Neil Armstrong step on the moon. Now the interview lasted more than two hours. The following podcast is just a few of the highlights. Enjoy.

*Male:* This is the Killer Innovations podcast with Phil McKinney. Keep in mind that the information and opinions expressed in this podcast are Phil's and Phil's alone. And they don't necessarily reflect those of his past, current or future employers. Now here's Phil McKinney.

*Phil McKinney:* Talk a little bit about how did you get into HP.

*Chuck House:* How'd I get into HP?

*Phil McKinney:* Yeah. So how'd you get into HP?

*Chuck House:* Well, it was interesting. The first thing was I interviewed because they were on campus. I was at Cal Tech. And I was a physics major. And I had not done – I had had one lab that was pretty good. I didn't know anything about double A. And they were looking for double A's. And somebody said, "You ought to go – use this as a practice interview to learn what it's gonna be like when you go talk to real companies." So I went. And I liked –

*Phil McKinney:* HP was your practice interview.

*Chuck House:* Yeah. And I liked what I heard. And about three weeks later, I haven't told this story in a long time. About three weeks later I get – actually all the guys that got reject slips got them. And all the people, the couple, three people got a letter said, "Come on up and visit us." Right. I didn't get either one. So I called. I said, "Hey, I didn't get either one, but I've got an interview with Sylvania, could I just tack a day on with you guys?" Sure, come on over.

So I come on over. I got an offer about four weeks after that addressed to another guy in my class.



*Phil McKinney:* Oh, your offer letter was actually addressed to somebody else's name.

*Chuck House:* Yeah. Yeah. My address. His name. So I accepted. And in my personnel file I think it's still probably here. Lew Platt on my exit interview was looking, "Who the hell was so and so? Cause here's your offer letter."

*Phil McKinney:* You got an offer letter with somebody else's name to your address. You went ahead and accept. So you're not even sure if the offer was coming to you or to the other guy.

*Chuck House:* I don't know to this day.

*Phil McKinney:* But you accepted.

*Chuck House:* I accepted. I got here. And Barney Oliver wanted to interview me. He hadn't interviewed me during the interview time. And he said, "Well, you know who exactly are you?" And he put me in the scope division. And the reason was he said, "Everything else we have is number one." He says, "It's the only division to be in that you got a chance to go up as well as down. Right." And he said, "Creative guy like you it'd be really cool. And besides that, your mother's from Colorado I see here on your form. And we're going to Colorado with that division next year."

And I said, "I don't want to go except I'd love to go after I get a master's at Sanford. If you'd let me do that I'm your \_\_\_\_\_. I'd go." Now my thinking was, I'll stay the two years, get the degree and boogie. Turned out I stayed two years and got the degree and went to Colorado Springs.

*Phil McKinney:* And you went to Colorado Springs.

*Chuck House:* Did 28 years, 10 months and 27 days later I left HP. But fundamentally every two years I interviewed elsewhere for 28 years.

*Phil McKinney:* You did?

*Chuck House:* Yeah.

*Phil McKinney:* Why?

- Chuck House:* Need to stay current. What are you worth? And what happened is I wound up having to change what I was doing, because you don't stay current.
- Phil McKinney:* You find out you're not quite worth as much as you think –
- Chuck House:* You're not worth as much. Yeah. You get a groove. So I've got four degrees in four major schools – business, engineering, science and humanities. I've got five minors underneath those four majors. And I've worked in five disciplines. One of which is one of the nine.
- Phil McKinney:* Only one.
- Chuck House:* Only one. And I think what that says, and I don't think I'm completely rare in that respect. I think this world is such that you can't imagine studying something that's gonna be of much value later in life. Learning how to study, learning how to cooperate with people somewhere you're not and learning how to be empathetic to the needs of what's out there is the only game you can succeed at. So every couple years I would sample you know what's going on out there and change what I was doing to some degree. But I was in 13 divisions. I started like 11 divisions in some form or another.
- Phil McKinney:* Well that's back when the divisions, Bill and David kind of had this rule of thumb when a division got too big –
- Chuck House:* Yeah. Split it at 5- or 600 people or a thousand people.
- Phil McKinney:* And then split it.
- Chuck House:* -- off. Yeah.
- Phil McKinney:* What was the thinking behind that? Why? I mean it's kind of – I know kind of the keep small –
- Chuck House:* Barney had a great theory. And the theory was if you find a company of ten people there's always a genius. Find a company of 100 there's a couple. Find a company of a thousand there's only three maybe, right. And he said, "And here we are 5,000 people and when we get to 10,000 how many are we gonna have?" And we all said, this is our opening dinner. And we all said, "Four. You know we know that rule." He said, "No, none. They'll all have been driven

out.” He says, “So we’re gonna parse it N times a thousand and we’ll have three times N geniuses around.”

Hewlett had a different stance. And the stance he had was he wanted an informality about the thing. And he said, “The whole way the other companies operate is they’ll have engineering as a discipline. Manufacturing as a field. Marketing as a specialty. And they’ll house those in different buildings. I want to have the team eating lunch in the cafeteria together. And then if something’s wrong that isn’t selling, the Q&A guy says something to engineer who says something to the marketing guy.” The feedback loop gets close. And he said, “The only way that can work is if you know each other by first name and you sit down at that table.” And he said, “Past about 500 people you can’t remember the names.”

*Phil McKinney:* Part of all the curiosity that people have about HP from the early days, cause you think about it, two guys in a garage come together and now you see this, you know number one technology company in the world. But when you think about the early days, cause that really set the values. So talk a little bit about kind of those early days. Cause you came in 60 –

*Chuck House:* Well let me – I came in ’62. So it was 23 years old by the time I got here. Almost 100 million dollars. I was the ninety-eighth engineer. So it wasn’t like, you know it was not a huge set of people. And my dad’s reaction was, you know, “How come you didn’t go to a real company?” You know Bell Labs exists and IBM exists and all that. But Dad, I think this is going somewhere. He finally, like in 1990 buys one share of stock or something so he could track it.

The thing about early was Bill and Dave were deeply involved in every project. Deeply in the sense that they reviewed every project in the company every year. And there’s something magic about that. Especially in Bill’s case as technical as we he was. And then he would bring Barney Oliver to boot most of the time. So you’ve got essentially this, what I would describe as a mater’s if not a Ph.D. level oral exam.

*Phil McKinney:* Every year.

*Chuck House:* Annually. On your stuff and the questions were of the form, “What contribution does it make? Why is it ahead? What’s the next step after this? And what’s the science underneath it?” And the view was that this is instrumentation science. That you can’t go to any school in the country and learn instrumentation science. You can learn how to be a double A. You can learn how to design circuits. You can learn, you know biology or astronomy. You can learn a lot of disciplines. But nowhere can you learn instrumentation.

And that’s what we’re about. And so the notion is you’ve got to be part of a team. And the team has got to understand all the science around that particular thing you’re working on. Not just how you build it, but what the application will be and what you’re gonna be measuring and who the people are you’re gonna be doing it for. So you wind up knowing oceanographers and astronomers and biologists and chemists and things like that at more than a peripheral level. You know. And that was the drill. Every one of us had to go ride the Neely bus. Just telling my wife this story.

*Phil McKinney:* The Neely bus?

*Chuck House:* Yeah. The Neely bus. Norm Neely ran the California sales representative team. He bought a Greyhound and stripped it. An old Greyhound. Stripped it. Put seven work benches in it. Had a micro engineer’s workbench. Had the circuit design engineer’s workbench. Had a mechanical engineer’s workbench. Everything outfitted with HP gear. And your assignment usually after you’d been at HP maybe three years, was you have to go ride the bus for a week. What they would do with it is drive it onto the Redstone Arsenal at Huntsville or down to Canaveral or up to the main tracking station. And you and the bus driver, the bus driver knew all this stuff. And he got a 52 week assignment. You got a one week assignment. So you parachute in.

And they stop – so I drew the Huntsville assignment. And they stopped outside Intergraph. A little tiny company at the time. And Jim Medlock came out. And my job was to explain all seven workbenches with probably had 50 instruments. And my plea was, I’m from Colorado Springs. I know about my product and I know about scopes. And this guy’s point, you know Sunday when I arrived is he says, “Tomorrow you’re gonna know about every product on this bus well enough to describe it to a working engineer at

Intergraph.” Really? No one ever told me that. Well that’s a big deal.

So you learned to be a generalist not just in terms of, you know you’re gonna work around your program. You learned it around the whole Hewlett Packard tool kit.

*Phil McKinney:* So how long did this bus go around?

*Chuck House:* It went around for years and years.

*Phil McKinney:* I’ve never heard this story.

*Chuck House:* Probably ended in – we built a flying bus for Asia when we opened Asia in the late 60s. Had a DC6 that flew around.

*Phil McKinney:* So an HP DC6 all equipped out with benches.

*Chuck House:* We’d fly to Thailand. You know and Philippines and Singapore.

*Phil McKinney:* Then invite the customers to come on, show them the bench, walk them through all the products.

*Chuck House:* Exactly. Yeah.

*Phil McKinney:* Oh, wow.

*Chuck House:* Huh. I mean isn’t that crazy?

*Phil McKinney:* That is crazy.

*Chuck House:* But it was an effective way to do things. And it was with Medlock at Huntsville that I really was able to understand for the first, that’s why the thirteen hundred became the moon monitor.

*Phil McKinney:* Kind of have this reputation inside of HP as, you know the bull in the china closet. Break a little china. Step on some toes.

*Chuck House:* It’s unfair. I was a perfectly normal guy. I just had a couple of excitements here and there that other people took in a strange way. And so that reputation gets built. And, you know how do you get rid of the mythology?

*Phil McKinney:* So talk about the award of defiance. You know David has it in the book.

*Chuck House:* Yeah. Yeah.

*Phil McKinney:* So give us the Chuck House version.

*Chuck House:* So what happened was really pretty simple. I worked on the 1402 dual channel scope.

*Phil McKinney:* So this is an oscilloscope.

*Chuck House:* So my first assignment when I came to the company was I drew the short straw. And they had a good guy who left the company unexpectedly. And he was working on the flagship plug in for the 140 plug in scope. And Techtronics was the only company beating HP at the time. So this was sort of, you know a front and center project. What I put on it was a billion algebra trigger. It was a two channel scope. And you could do A plus B or A minus B or Minus A plus B. You could do the billion set for triggers. And no one had ever thought about that. And the reason for that was IBM was just starting to do **an gates** and **or gates**. And so I thought it'd be fun to be able to trigger on a gate like that. So it was kind of a novelty to see some IBM stuff early. This is 1962/3.

My second project was we figured out how to stabilize a scope screen. So we had a feedback circuit that we would sample five times a second on the front. Compare it to ground. And then – these are all vacuum tube stuff. So the trace always drifted all over. So you always had to – every measurement you had to recalibrate where ground was essentially. This thing would do it automatically. The problem was I couldn't figure out how to stabilize two channels at once. I could figure out how to do one. And my boss thought that was great. In fact, he had helped work out all the formulas it was, you know elegant.

So we had one channel stabilized really well. It was to be a comparative scope. You're gonna compare an unknown to a known. Right. The problem is it's useful to have two channels if you're gonna compare something to something else. And he kept saying not to worry about it. We got this thing done. And not very many customers wanted one for exactly that problem. And I'm like, "Well, shit. You could do a **thod** \_\_\_\_\_ for ten minutes and conclude that's gonna be a

problem. Why didn't we test it on the market?" And the answer was at the scope division, if we show anything in advanced the customers will call Techtronics and our secrets are out. Right.

We get an FAA control tower spec in like weeks later. And they wanted to take these four foot long great big cylindrical things and shrink them so that you could have more terminals in a control tower to watch planes. And we had hired the guy who did those tubes for GE. And he said, "I've kind of perfected the expansion mish lens." And it basically was you took a mandrel that was shaped like Mount Fuji. And you smashed this thing down on it and so you built this conical lens. Looked more less like one cup of a brassiere. And the lens, the electrons would come and they'd hit this lens and they'd bend. So you could get a very wide deflection. So I could do a 14 inch CRT with a gun that usually drove a 5 inch CRT. So I had this big picture.

And then the question is who wants something like that besides the FAA. And the first problem we discovered with the FAA is not only did it bend the beam, it expanded the spot size. Okay. So you could show the plane circling around. But when you wrote UA72 it was more or less writing with a paintbrush. It didn't quite solve the problem. So had an elegant solution for a problem that didn't work.

So I kept thinking, "This would be useful for graphics. You know classroom graphics or who knows what." And everybody was just, you got to be kidding. And they said, this is an answer to your question by the way. They said, "This would be good for nearsighted long arm engineers or for watching Gandhi in three minutes." Cause it was a 20 megahertz XYZ. Twenty megahertz XY. It wasn't megahertz Z. So that is, you know it's a very fast television set or it's a, you know an oscilloscope for a guy with very long arms. And that's about all you can think of. And the marketing forecast came back at 31 units.

*Phil McKinney:* Total.

*Chuck House:* Total. And that's what they told Dave. So Barney was excited. He said, "The mandrel won't work. That technology won't work. You won't be able to build it with enough linearity. And I know cause I invented stuff on the East Coast for Harrison Labs and I've got patents and you guys

can't do it." So I flunked the technical evaluation with him. But he couldn't figure out on screen that it was nonlinear. And if he flipped the time Switch I'd have been dead but he didn't ever flip it so that was great. So I had a technical –

*Phil McKinney:* You faked your review.

*Chuck House:* And then Bill Terry, who was later a VP of instruments, was the marketing guy. And he says 31 units. But I'm not in the room. I've been shunted off to, you know go back to the lab. And Packard says something like, "Well, when I come back next year I don't want to see that product in the lab. That project in the lab." We had about another two years to go we thought. Things were more leisurely back then. Next morning I come into my work and my boss, the engineering director says, "We've got to cancel the project." "Well why is that?" "Well, Dave said, you know Bill said 31 units and Dave said, 'When I come back I don't want to see it in the lab.'"

"Well, two questions. They didn't talk to my dad. He wants two. So shit, that's 6 percent of the market right there." Right? So they've underestimated. I'll go check it out. On the 155 you guys never asked the customers. I know where to go ask. So let me do a market research trip. And if I find anything, we can have it done inside the year. It won't be in the lab when he comes back." And my boss said yes. And I didn't view that as anything other than, "Hey, you know."

*Phil McKinney:* Don't give up.

*Chuck House:* Yeah. So we got it done in ten months. We had it on the street. Packard shows back up and he says, I mean we're in a division review and I'm up on stage. And we had just changed marketing managers from Terry to Hal Edmonson. And he says, "Hal, is this thing selling?" "Oh, yeah, it's selling beautifully. It's selling." "Well, where is it selling?" "Well, it's selling to all the same customers that buy our scopes." So we're not screwing up the channels kind of. Then I stand up to talk about what the next project is. And I say, "Well, what he meant to say it's actually selling some very unique places. We sold to Doug Englebart for the fall joint computer conference thing."

I didn't know then that we sold one to Alan Kay for what became the Flex Machine, the predecessor of the \_\_\_\_\_.

And I didn't yet have the Emmy award out of Hollywood and we didn't yet have the moon monitor. But I said, "This is going – we sold one to Argon Labs. We sold one to – you know all these neat places." Packard was just livid. He says, "I thought I said to kill this son of a bitch." I said, "No, sir. What you said was you didn't want to see it in the lab and it's not. It's in production."

*Phil McKinney:* Then what did Dave say?

*Chuck House:* He kind of grumped. But he said, "Well, so let's talk about what's next." You know and we talked about it. And then we had an eight channel medical box being built. And then I got a journal article. And the labs never talked about it. Maser never talked about it for the next four and a half years. But the annual report every year had it in the annual report somewhere. This was the first display out there for computers.

*Phil McKinney:* So when did you get your –

*Chuck House:* So 13 years after that – well, no, let me – 16 years after that I'm gonna come out and be the corporate engineering director. And the going away gift in Colorado Springs on April 1, 1982 is what the certificate says. I get this thing presented by my boss, actually by the division manager, to the site manager. I was the division manager. That said, you know medal of defiance. Signed Dave Packard. And I thought then it was a joke. I mean just a roasting. It's a classic right.

*Phil McKinney:* Just fake thing or whatever.

*Chuck House:* Yeah. And I'm out here and it gets printed in Gifford Pincho's book and, you know HP PR, you know came up so we got this book and you're taking the Lord's name in vain and, you know the Lord is in that next office. I sat next to Dave. But he's sort of retired at that point, so it wasn't like he was there daily. But I just, your whole career flashes before you eyes and you think, "If I show him this chapter I'm dead. And if I don't show him I'm dead."

So I walked over and I said, "You know I've got this thing here and you probably don't remember this situation." He scans this thing for about, I don't know, ten seconds and he says, "Young man." And when he straightened up he was

like 6'5" or 6'6". Big guy. He sassy, "Young man," I was 42 by now, you know. And he says, "I remember that just fine."

Well, working actually with Adam Mancini and some others I found out they had gone to him. And he thought it would be a good thing to do. Because his feeling in the early 80s was we weren't – we'd kind of lost that impertinence. And he wanted to make an example of it. So I think it came about more because he thought it would be useful to have a stalking horse than anything else.

*Phil McKinney:* One question I always ask, you know particularly the people who have been around who actually got to spend time with Bill and Dave. Tell us a funny story of both Bill and of Dave. You know what's, if you think about that one story, you know that –

*Chuck House:* Well, I mean there's a hundred. I'll tell ya the one that my wife enjoys. And that is – now these guys were my idols. But I knew them young. And I knew them personally. You know the advantage I had starting when I did is they were very active in the company. And I got a chance to present a lot to them. And I knew them well. So I'll tell two stories in a row. And the first one's quick.

And that is Hewlett came out, actually they all came out for a division review and they brought Louie Alvarez with them. And I drew the short straw to drive Hewlett and Louie and one other guy I can't remember to the Broadmoor for dinner. And we're on our way. And I'd given a pitch. This was 1977. And I'd given a pitch on where the world in the year 2000 would be to the board. And Bill starts arguing with me in the car. And then he starts arguing with Louie about – so this is a Nobel Prize winner, right? In the backseat.

And he says, "You know Louie, I don't know how it's gonna be in the year 2000." But he says, "One thing I know is we're eating the seed corn. Silicon is sucking up all the new Ph.D.'s and they're going into industry not into teaching and I'm just worried about, you know we're eating our seed corn." And Louie said something. I had a flashback that when I was in junior high school I had an assignment, 1955, to write to two scientists to find out what to have, how to become a scientist. Right. My science teacher. So picked Louie Alvarez and Jonas Salk. Because polio vaccine had just

been invented and Louie had just found, whatever Californium or one of the rare earth elements.

And I said, "Hey, I wrote to you, you know back then." And he said, "What'd I say?" And I said, "You never wrote back." I said, "Salk did but you didn't." And Hewlett is just upside down over that laughing. He said, "Rah, rah, rah kind of what I'd expected." And Louie starts his defense of, "Well, you know I was getting a lot of letters and it was really a busy time." And then he says, "But, you know you're doing okay." You know so not to worry.

*Phil McKinney:* You just got an award.

*Chuck House:* Yeah.

*Phil McKinney:* Not quite the same as getting the award from David for being the renegade. But recognizing the work that you did earlier. Talk a little about the IAAA award that you.

*Chuck House:* Well, I just the ACM fellow award, which is actually – so the IAAA award is a good one. It's something like 1 percent of IAAA people get it. The ACM fellow is more like a .1 percent get it. It's a pretty prestigious award. And the reason I never thought I'd get it is because they don't acknowledge that what I did was software. Just like the computer history museum doesn't acknowledge that HP builds computers or built anything that ever mattered. You know because they didn't pioneer the Mark 1. They don't deserve credit, you know. And most of the software I did was microcode or was screen graphics. You know we did motif and view and we did lots of stuff. But it didn't count. I wasn't programming in Fortran or PL1. Crap like that.

So I got this award. And the neat thing was I'm standing beside Alan Kay, who just got the award the same time, you know. And Pat Hanrahan who did all the rendering for Pixar. And then Bill Buxton.

So to have a cohort, you know there were 40 of us inducted, so it wasn't like – it wasn't a singular award. But black tie deal and, you know I felt pretty privileged to be standing there next to Alan. Felt very privileged. I've been lucky. It's been a great life.

*Phil McKinney:* So what are you doing at Stanford now?



*Chuck House:* Well, in some ways this is a capstone. In another way it's like I'm a novice. Twice earlier, once at Stanford in the 80s and once at Santa Barbara in the 90s I felt that a course or a curriculum around information technologies and their impact on society would have value. That there's something to be said for getting communication and computing together. I mentioned that earlier. Or getting psychology and engineering together or whatever.

In this case we've actually turned it into kind of an art form in the sense that we're an industry facing group. And the idea is that what you want to do is understand the implication of the tools that are being built. It's pretty easy for an HP to find Hanrahan. You know what he's done. If you want to do work in 3D rendering today or you want to do work with data visualization toolkits you find it. You know, "Hey, Pat, you know want to work for us?" And everybody at Stanford is funded pretty well. So it's got to be an interest question for them to want to do it.

What's hard for Stanford faculty is to work across departments. So we almost purposely set up things that if it's an edge question, you know how do physical and virtual worlds intersect? Or what does trust have to do with HP halo? You know do people walk in and does this engender productivity or is it off-putting? Those kind of – there's no department of trust at Stanford. There is a trust department, but it's over the financial side looking at how our portfolio melted down.

So try to tease out, and we think we're pretty good at teasing out, getting people to work on this cross equation things. So case in point. Pat got a research grant from us not long ago to look at how to instrument avatars in a virtual world. We funded a French literature guy and a Russian medievalist to put together a Second Life version of the Hotel California. And they go out. They build a great thing. They won awards in Brussels. They get people coming to their site. And the next thing – and what they designed was the kids could have the ending of the movie different. They could move the furniture around.

What happened though was the users that came tore the hotel down. And that was not allowed. And so these guys said, I said, "Go talk to Pat." And they said, "Computer

scientists never listen to humanities department. You know they won't even listen to us." "Try it. We're all part of the same set of seven projects." They walk over there and Pat's immediate answer was, "Well, just put object locking on the walls and you're done." Turned out that didn't do it. Then he says, "Well." He says, "Well, just do configuration management for the set and then you recreate it. You know it's \_\_\_\_\_." Turned out that didn't do it quite either.

About a month later Pat came to us and then and said, "We've studied this around the country. We can't find anybody that understands this problem. It's a cool problem. We're staffing five Ph.D. theses on this project." A year later we can report out that we now have a new open systems virtual world that Stanford's gonna issue to the world called Caracota that'll launch in September. And a spin out company. And media X did it. Just cause we said, "Hey, you know this would be a neat combination."

*Phil McKinney:* It's kind of those – it's back to the old skill set of those strange connections.

*Chuck House:* You got it.

*Phil McKinney:* One of the things I get a lot from listeners of the podcast is a lot of high school students, kids going into college, real passion and real interest to go – they want to be innovators. They want to be inventors. Right. And the question I always get is what college should I go to? What classes should I go to? How do I become kind of that – they've really got that passion to go create. So here's your opportunity. What advice would you give those people who really have a passion to be inventors, to be innovators, to really change the world? What advice would you give them? What should they do to get ready?

*Chuck House:* Well, first of all I believe in experiments. Little experiments. Lots of experiments. Learning by doing is just the panacea. I mean you've got to get your hands dirty. You got to mix it up; whether it's hands or software you're playing with or whatever. But there's kind of a dual and here. If you're not grounded in math and science, I am convinced you're handicap. Because what you learn isn't formulas. What you learn is a way of thinking.

And the way of thinking is a logical ordered structure of cause and effect or of relationships that work. And that ordered structured way of thinking is crucial to being able to work through to a solution. The curiosity and the enthusiasm and the drive and the eclecticism is essential to the creativity side. But unless you can take that creativity and harness it so that you can make traction and get something in a resultant way, you're kind of, you're really handicap.

So I, first of all would urge math and science. And I would urge it these days much more at the statistics and big systems and data visualizations. The kind of things that computers can help you with. I'm less interested in learning how to do calculus, integrals and things like that. You want to know what calculus can do for you and what algebra can do and all that kind of thing. But just being able to think spatially and visually and, you know organizationally is crucial.

Being unafraid to make mistakes is – that sounds odd. But there's an impressive body of people you interview midlife or even late life that I wish I had. You know and I believe I will go to my grave with very few I wish I had done something. There may be a few of I wish I hadn't done something. But it's the if you wished you had done something get doing it. I mean you know that's what I tell people today. And I say, "God, I just lost my brother or I just had somebody, you know a death in the family." "Well, are there things you want to do that you haven't yet done?" And they go, "Oh, I wish I." And you, "Well, hey guess what."

*Phil McKinney:* Go do it.

*Chuck House:* Now's not a bad time to start.

*Phil McKinney:* Right.

*Chuck House:* Cause, you know get going.

*Phil McKinney:* Right.

*Chuck House:* And the world today in terms of – the world is waiting for innovation. And it's waiting for it in a million ways. And you can find out the needs as quickly just looking right around your own, you know – I'd like cleaner water. I'd like my car to get 200 miles to the gallon. I'd like to, you know I mean

think of the Segway that Dean Kamen invented. That was a bold imaginative stunt. You know a wheelchair that treats you like a human being instead of, you know an entrapment device.

*Phil McKinney:* Chuck, thanks for coming in. Really appreciate it.

*Chuck House:* You bet.

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