Q: So would you tell us your name and where you were born, and when?

Hirose: My name is Shigeo Hirose. I was born in 1947 in Tokyo.

Q: And that was right after World War II. What was the time like? Do you remember anything from-- maybe not exactly what <inaudible>.

Hirose: It was already stabilized, but there is still some-- I could see some American soldiers somewhere. But our area was rather peaceful.

Q: And what got you interested in engineering?

Hirose: I was interested in making things when I was very young and-- for example, when my mother asked-- proposed me to go somewhere but I said I would stay home and make something. <laughs> So I was making some things, and when I was high school, I start to make radios. So I decided to go to the engineering field from very young.

Q: And what kinds of things did you make other than radios?

Hirose: Just very simple toys, but sometimes I was in charge of the bathroom-- bath?-- Japanese take a bath, okay? So I have to watch that it's at the right height and stop and start the gas, but it's troublesome, so I made a special device to alarm, by no electrics. I think that was a rather interesting device. But I made also a very small toy of a robot.

Q: So you knew about robots already when you were young?

Hirose: Well, but until when I was graduated from the university, I am not so interested in robotics. I am maybe more interested in space and rocket, that kind of things.

Q: So how did you decide which university to go to?

Hirose: When I was university student, I read a book written by Professor Masahiro Mori. He's a professor of Tokyo Tech, my university, and he wrote that the robot is a new kind of machine which can be very soft. Ordinary machine is very fast or accurate and very heavy, but robot can be very lightweight and just like animals. So I studied mechanical engineering. But I ran-- of course it was very interesting, but most of that is a little bit classical. So I want to do something new, and at that time I found robot can be a very interesting research topics.

Q: Do you remember what the book or paper was?

Hirose: It called Robot, by NHK Publishing Company. It is written by Professor Mori and Schuhe Ida [ph?], Ida Schuhe.

Q: And this was way before he wrote The Buddha in the Robot.

Hirose: Pardon?

Q: So Mori Sensei also wrote The Buddha in the Robot. But this was way before, right? In the '70s?

Hirose: Yes, before, in the '70s. Yeah, yeah. Oh, you know very well.

Q: I studied Japanese robots for a while.

Hirose: And actually I was in Yokohama National University and to go to the graduate school I took the University of Tokyo and Tokyo Tech, but University of Tokyo-- I couldn't-- there is a <inaudible> by order, and top-ranking one can enter as maybe professor <inaudible>, but it was not so. In the case of Tokyo Tech, I passed, and Professor Umetani [ph?], he worked under Professor Mori, is asking the student, so I entered that laboratory.

Q: And what kind of projects did you start working on and find there when you went?

Hirose: Yeah. At first I was asked to study something related to the <inaudible> cognition, but I am not so interested in that subject. So I am-- and Professor Umetani once studied about the snake, but he said he not going to work anymore. But I thought it's very interesting and I start to work on that, and I could derive some basic equations about the snake locomotion. So I proposed again and the professor accepted, so from the master course-- first grade master course-- I just maybe-- in June I go to the snake shop and I bought snake and started to do the experiment using a real snake.

Q: What were some of the interesting questions about the snake? Why were they working on a snake robot to begin with?

Hirose: Well, I thought it was very typical example of the soft machine. It's a very slender body, just a string, but it can move or it can coil around object or it can move from branch to branch. So it's a very versatile machine if we see from the engineering standpoint. And the structure is very simple. So maybe there is some possibility that we can make-- there's possibilities that we will make machine and we will produce lots of functions.

Q: Were there any applications that people were thinking of at the time?

Hirose: Well, not so much work, almost nothing. So I thought at that time-- well, at least for my doctor thesis presentation defense-- I wrote cartoons. I said that we can make snake like Arctic explorer _____ robot or snake like arm which can coil around object automatically or just like a crane, has a snake-like string and it can coil around object. If we miniaturize we will make a gastroscope. And another

one was snake-like active hose. It can approach the site and splash water. And there's high pressure water so we can bend. So that's what I thought when I got the doctor degree

Q: So you worked on snakes for quite a few years, masters and PhD?

Hirose: Yes. I did experimental real snake maybe four years and every springtime I bought the snake after-- they started to work after hibernation. And we did biomechanical studies. It was very interesting. In the world, there's almost nobody works that, so I could derive the equations and try to do the special experiment to verify the motions. And after that, the second grade of master course I started to make my first snake robot. And that works very well. So it was very impressive. So I decided to continue robotics. And in doctor course in five years I work on that topics, and afterward I start to improve that, and the snake-like grippers were <inaudible> snake robot. And at the same time I wanted to do something new for when I attend the conference. Almost all people talk about human, humanoid, or industrial robot. But nobody talks about snake. So people like my presentation very much. But I was a little bit alone, so I want to do something similar, and I was interested in working robot. I saw the spider and the spider motion was very interesting, so I decided to make-- I don't like biped for it's not stable, but quadruped-- a spider has eight legs, but when considering about the number of legs I thought four is optimum number. So I decided to work on a quadruped. And that project is also continuing until now.

Q: And while you were doing your PhD, did you ever have a chance to work with Professor Mori?

Hirose: No. Professor Mori is rather-- he is more-- he is very popular, but he's not so working on research, so under-- laboratory is different, and so we're mainly working with Professor Umetani.

Q: Who were some of the other people who you worked with in the lab?

Hirose: Well, first year I was alone, and the second-- afterward I supervise a younger student, and every year. When I was a doctor course, every year one or two students I worked together.

Q: Are there any that kind of stick in your mind or that you remember working with more closely?

Hirose: You mean the person that I remember? Well, <inaudible>. One of the-- well, in my doctor course or afterward?

Q: Either one. I'll ask you about afterwards too, but if you can remember somebody from doctor-- it's fine. If not, it's okay.

Hirose: Well, one student was in _____ biology, so he's there treating animals. So when we make experiment, so I have to dispose the snake. So he buried the snake and later he buried and took samples of bone. So, I don't like so much the snake, so it was very shocking. That I remember. But other things-- well, Tokyo Tech students are very good, so we discuss together they can do well, but-- of course they are very-- not so specific interesting topics.

Q: Did you have any contact-- I know that now at CMU there are some people who work with snakes and things like that. Do you have contact with people outside?

Hirose: Yes, yes. Howie Choset visited my laboratory and we was contacting him. And one of my student also visited his laboratories. And one of my former student, he is now in the-- it's American university-- did some study related to snake. And when he graduated, he consulted me. So I advise him to do more on the snake robot. So he is working on the snake in China and Japan too. And also Shugen-- Shugen Ma. And Paul [ph?] in Norway-- they are also making anaconda-like robot. And he also came to my university and stayed a few months, and we discussing when we meet.

Q: So how did you decide to stay at Tokyo Institute of Technology? Because you stayed there after your PhD.

Hirose: There was a position of the research associate and I can enjoy-- it's a very good place. The student quality is very good, so I thought it's the best place to work.

Q: Did you consider any other positions?

Hirose: No. I got offer from other university afterward but I thought that Tokyo Tech is the best place.

Q: And so then one of your first projects was the spider robot, or the quadruped?

Hirose: Yeah, after the snake. And I made first one in 1976 and it was not successful. But after that, I found a very interesting design concept and in 1978 I made quadruped with tactile sensors and I succeeded to make it work on the stairs. And at that time Bob McGee of Ohio State University-- I gave a talk on ASME Conference in Los Angeles and Bob McGee attended, and <inaudible>. He is now in Stanford. They attended, and I proposed how to make energy-efficient leg. And so he proposed me to visit OSU. So in 1981 or 1982 I visited OSU. And so that was-- at that time I visited Marc Raibert. He make a hopping machine. So I could meet many interesting researchers. And afterward I keep working, so.

Q: You mentioned that in the beginning when you were designing your spider robot it wasn't very successful. What were some of the problems?

Hirose: I was inspired by spider, so I want to make a much bigger one where the leg length is about three meters-- a very slender one, just like-- I saw a spider with-- English name? I don't know the--

Q: Daddy Long Legs? It has a small body but very long legs.

Hirose: Are you <inaudible>? Okay, okay. <laughs> So that I want to imitate the similar one and scale up. But while I'm making I worried it's too fragile, too weak. So I tried to support, reinforce, and <inaudible> works. But after that, I recognize importance of the scale effect. Well, if the scale is bigger, the weight increase and the force doesn't increase so much. So that one had a very <inaudible> leg. And I notice about the energy efficiency. So I thought about the efficient leg and for the next model I reduced that, and that idea was accepted to the adaptive suspension vehicle of Ohio State.

Q: What were some of the innovations that you brought in with the energy efficiency?

Hirose: I noticed that in one cycle of leg motion, there is negative power consumption phase. Many people believe that if the body moves horizontally in constant speed there is no energy loss. From the physics it's okay, but when we make a working robot and there's the joint and the joint is driven by motors, the motor can degenerate the energy. So if the positive or negative power produces-- summation of the total energy is at zero. But some part is positive and some part is negative. So negative power is regenerative, so there's always big energy loss. So I proposed to use a pantographic mechanism and by that we can decoupling the horizontal direction and the vertical direction and we could decrease energy loss. And now the same-- I no longer use the same mechanism, but the concept itself is very useful so I'm applying this idea to many field.

Q: And you mentioned that your next version also had tactile sensors. Did that also play into the energy efficiency or was that kind of a separate issue?

Hirose: It's a separate issue. It's for terrain adaptive motion, and we use posterior sensors and the tactile sensors. And the second, third, fourth, fifth, sixth-- until sixth model we use a kind of pantographic mechanism. But from seventh I found that by changing the <inaudible>, it's not perfect very good, but we can produce a kind of-- similar function of the pantograph mechanism. And by using that mechanism, the motion range is much bigger. So afterward I change my idea. So it can be energy efficient, also more terrain adaptive.

Q: And did you also look at how the-- were you also kind of studying how the spider moves, with the snake, or were you more focusing on the actual mechanism and the engineering?

Hirose: Yes. So after the study of the snake, I was inspired by the spider, but I no longer start to work on the animals. I am more interested in the design, so I always focus on that kind of topics.

Q: I may be remembering incorrectly, but was the quadruped-- it was though orange? Was it orange? Big? It was used--

Hirose: Orange?

Q: Uh-huh. Was one of the versions kind of an orange, kind of largish orange robot, maybe this big? Was that somebody else's?

Hirose: Well, you mean the bigger one? There was-- <inaudible> was seven ton, and the first prototype was red. But afterward it's painted blue. But there's a picture of orange one, so maybe you saw that one.

Q: So after you did the spider, did you continue kind of working more on quadrupeds or did you look at other types of bio-inspired robots?

Hirose: Well, the study of the quadruped is in nearly 2000. I got the contact from the company, construction company. They wanted to develop the steep slope machine to drill the iron bar, and they want to avoid the contact of the _____ concrete frames. So we decided to make a quadruped, a seven-ton machine. So that was Titan XI. And afterward-- in the Titan VIII, the Professor Inoue [ph?]-- he's over there-- asked me to design some platform for the researcher. Many people wants to study about the quadruped but it's very difficult to design the machine. So I made a machine which is commercialized and distributed to the many researchers. It was 1.5 million yen, and I thought it was very successful.

Q: How many people worked with it?

Hirose: About 80. <inaudible>

Q: And do you know, were they all in Japan?

Hirose: Yeah, most of them were Japanese. But once I attended a conference in the working session. Most of the machine was Titan VIII. But unfortunately the company is bankrupt just recently.

Q: What was the company?

Hirose: <inaudible> Sangyo. That company was unfortunately-- it's not-- it's because of other reasons. So I am looking on to design something new.

Q: With the Titan VIII and some of these other quadrupeds, were you-- I know you were looking at design, but were you also thinking of some other application?

So you mentioned the steep slope machine. Were there other things that you were working on in terms of where they could be applied?

Hirose: Yes. One time I made a wall-climbing robot. I call it the Ninja. I can call it Titan. It's a four-legged one. But Ninja is more interesting, so I named it-- so it's a kind of branch of the quadruped. And at that time we wanted to develop some inspection machine for many big structures, but there's just so many obstacles. The surface is not so clear and we need lots of pump supplies, pressurized airs. So it's only stopped on research level. So walking robot is not so directly connected to their application.

Q: And I think you also worked on landmine robots.

Hirose: Yeah. And that first idea was to use quadruped for demining task, and 1997 I wrote paper about the quadruped which foot is changeable, and if it's walking normal path-- when it's inside a mine field, it change to the sensors, and then changes to the digging machine or something that cut the vegetations. And we made two models. But after 2001 Japanese government decide to support Afghanistan and the reconstruction, and I visited Afghanistan. And I saw the real site and I found that walking machines too science-fiction like and I decided to use a buggy vehicle. So it's more cheap. Or it's commercialized. So the prices are most important factors, so I decided to put arm and I made-- it's called the Gryphon. So of course walking can be very interesting, but I try to make something very practical. The idea is always shifted to other things.

Q: So walking machines in general aren't very practical?

Hirose: At least at present. But computer power is enough. Problem is actuators. We need lots of joints and it's sometimes very complicated and too expensive. But if we can find a very interesting key applications, _____ application, maybe walking can be used. So the construction site machine, when I discussed our thinking about the crawler, a more modified type, but there is a very strong restriction to avoid the frame. And I was thinking about grocery [ph?] and I found walking the final solution. So I decided to make it. So it depends on the application.

Q: And have you worked on other types of-- any other types of robots?

Hirose: Yes. And after that I start to work on the crawler vehicles, for it's much more simple and very practical. So I did working on that, always improving. And once I worked with a company called Takaoka Manufacturing, and we made-- we commercialized a thing called the _____ carrier, or carrier robot they call. But it was too expensive, so only four or five units were sold. So, but I got the license, two licenses, and when the-- there was an accident, a _____ accident; a nuclear facility _____ one and two people died at that time. So after that, the Japanese government decided to develop a robot to go inside the site, and they-- Mitsubishi have industry-- we worked together. So they contacted me and they liked my idea.

So they decided to do my idea of the crawler and they made machine in 2002. But maybe you attended. Professor Nakamura explained. But after that, Japanese government decided to stop the grant. They always say that the nuclear reactor is completely safe. So I was quite shocked. It works very well. It's rather heavy, so that's a problem, but if we improve one or two times, it can be much better. But they decided to stop, so I complained in the <inaudible> Japan journal. It was 2003. But unfortunately they stopped, but this time it happened and the people started to think why Japanese robot didn't appear, and they found that I wrote an article that I was complaining. So they found that the project was stopped. So that was a very regrettable accident but after that, I continued that research. That one has four crawlers, but I always try to make simple-- mechanical systems should be simple. So I reduced the number to two, and instead I attacked a very powerful arm. So it can be a kind of hybrid vehicle with a crawler and a leg. So it works very well. So we are improving that, and that one is a Titan-- no, Helios. It's called Helios. Helios IX. And we are just now designing Helios X. We are expecting-- anticipating that we need a decommissioning. It takes 20 or 30 years. So very good mobile robot is needed. So I want to study for now.

Q: And is there more funding for that kind of work now?

Hirose: Unfortunately, I always try to get big funding, then I can hire lots of engineers, but no. I got a very small amount. So I asked my former student to design some part or-- my student is able but not so experienced, so I combine several people's-- now I am checking the design.

Q: And what kinds of places have you gotten funding from?

Hirose: Most of it is from Ministry of Education. There's a special fund. And I was a leader of Center of Excellence two times, in total 10 years. At that time there's a special funding. So there are so many fundings so I have to make lots of robots, so I was very busy. But now it's stopped, <inaudible> five years ago. Since that time I tried to get separate funding. I get a certain amount of funding from Ministry of Education and I also contact many companies. It's very interesting for private companies come to contact me these days. And every time I know the new program, I want to do something new. So it keeps me very busy.

Q: And how are the contacts in Japan between companies and university created? Does the government help? Is it through students that you've had? How do you do those kinds of things?

Hirose: Well, sometimes my robots is introducing a TV program and so very different field of company contact me directly. And there's a special section of coordination with industries in Tokyo Tech. So once I got the contact, I discuss and it's promising, I start to make some contact.

Q: And some of the companies that you worked with most were then Mitsubishi, Takaoka Manufacturing, <inaudible> Sangyo.

Hirose: Mitsubishi have industry-- that one. At present, we talk Canon [ph?], we studied with Canon. And now we are working with-- it's a small one, Daisho [ph?] Construction. It's a sleep slope climbing robot. And Bastera [ph?] is a company specialize in decommissioning of big tank. So we start work with robot which cut the very big tanks. And, what else? Also work with Toshiba and we are going to start to work with Sony Computer and Entertainment. Maybe several other things.

Q: And usually in those the application comes from the company, and you're kind of more looking into the design?

Hirose: Yeah, so there are two directions. I always think something new and-- for example, I made omni-directional-- chronomic [ph?] omni-directional vehicle. Then I'm interested in the structure but there was a conference in Nice, and MIT group make something interesting. But they did some program. So my way about Japan and flight I thought about that and I think very interesting mechanism. So I designed in my brain and when I arrive in Tokyo, I'm almost finished. So I asked my student. He already had another topic, but I ask him to change topics. "It's very interesting, so design this one." And that one works very well. So now it is commercialized and now a company called Haksang [ph?] start to give <inaudible> machine, or earthquake. We put a chair and then we can feel any types of the vibration. And that was sold to the Tokyo Metropolitan Fire Fighter Bureau. So we had a party one month ago. <laughs> So every time I think something basic, it developed as a _____ applications. But at the same time if I got some consulting, I asked to consult, that is also very interesting. And another one is _____ company. They ask me to develop the high-voltage line inspection robot, and it took five years and finally we made a very good one. Last year I got robot grand prix award. Now startup company is improving and try to commercialize that one. So that is from company. So _____ oriented research and application related research is always done in parallel.

Q: And when you're looking at your career, what are some of the biggest problems that you think you've kind of worked toward solving?

Hirose: Biggest one?

Q: Or most important, or most interesting to you.

Hirose: Ah. Well, the most interesting thing was my first snake robot, for I made everything, and it works very smooth. So of course all the robot was interesting, but a little bit accustomed to the robot. The first one is-- of course I made many toys, but that works very well, so. And even now, it's very old. It was 1972, nearly 40 years ago, but still many people excited. And I just did Computer History Museum this time in San Francisco, and my snake robot is exhibiting. So the snake robot was my epoch-making research.

Q: And you also wrote a whole book about bio-inspired robotics. So how do you see the field has developed through the years?

Hirose: But I am a little bit-- feel cautious about biological-inspired robot. Of course snake robot was very successful, but afterward I give a lecture to my students and every time I ask, "Except snake, what do you recommend to study?" but I cannot find out very good one. So snake was very exceptional. And at the same time we should-- it's not so important now where I am inspired or-- biological-inspired is only one of the way of doing research. I can inspire from everything, ordinary tool or-- everything is source of inspiration. So if we limit our inspiration to the biology, it has a bad effect. So I should say that even biology should be used as a source of inspiration. That's what I want to say.

Q: And what are some of the limitations you've seen in using biology?

Hirose: Well, the component is completely different. For example, muscle produce only reciprocating motion. But motor is infinite rotation. So for example, sometimes if you use a screw-- and waving motion is very gentle and interesting-- but the screw motion is very effective, and very simple rotating moving parts. So if we compare, I want to recommend snake-like motion, but very simple rod and screw maybe much better. And of course we can use metal and the sensor is completely different. But our sensor is completely delicate, but it's very difficult to make such kind of sensors. So part is different. The _____ design should be completely different. But sometimes when we say biological-inspired, we stick to that shape, and that will limit our way of thinking. So we should understand the components and we should be very free to the combinations, then we can make good machine.

Q: And do you think that the way that people in biologically-inspired robotics has changed very much from when you started working with things like snake-like machines until now?

Hirose: Well, I don't think so. Sometimes _____ approach is similar. Reason I say that people always reinventing the wheel. She complains that young researcher don't know the research more than five years ago, always doing the same thing. And I somehow agree with her. The way of thinking is very similar.

Q: What about in terms of walking robots, kind of as the other focus that-- or robotic locomotion, since you've done a lot of different things in that.

Hirose: Yeah. So in the case of the biped-- well, there's lots of argument with Professor Inoue, but-- well, maybe people believe that the human walking is good but human walking comes from the very limited condition. Fish [ph?] goes to the ground and they use fins, four fins, as walking. And they want to use two legs for handling [ph?]. So they are right to use two legs. And muscle is only reciprocating. So it's selection from the very strange restrictions. But we are _____ and we don't need to-- we can be free from such kind of restrictions. So

if we are given some target, we should select more freely. That's more interesting. So if you try to move by biped, it looks like I was asked to swim with leg and hand bundled. It's very difficult. So I feel that many people working on the biped study, but it's okay-- as a science it's okay. But from engineering point of view, we should think more freely and we should accumulate lots of possibilities. Then, if some urgent program appears we can select lots of new very good solutions.

Q: And what are some of the interesting kinds of engineering solutions that you've found? I mean, the snake is definitely one.

Hirose: For example, I made roller walker that is four-legged machine but foot can be just bent and it becomes a roller and it start to make roller-skating. So the function of the walking and the function of the infinite rotation is properly combined. So I like those kind of ideas. And I also made a _____ rover. That one is a planetary rover with many wheels. But what I thought is to make the wheel detachable, and if any detach the wheel has a connecting arm and the arm act as a manipulator, and also some supporting leg and it can individually moving around. So it's a kind of parent and children concept. So I think maybe the combination of different types of locomotion method would produce a very new concept.

Q: So you mentioned in the very beginning you weren't so interested in robots; you were actually interested in space. So you did end up being able to work with robots in space.

Hirose: <inaudible>

Q: You worked with robots in space in the end.

Hirose: Yeah, at present. Yeah, yeah. Yes. And, yes, also our department is named Mechanical Aerospace, but unfortunately there are very limited professors in the field of space. So I should do something in the space-related. Of course I am very interested, so I start to work on that.

Q: I'm just curious, in terms of robotics in Japan, how have kind of the focus of researcher-- what kinds of research directions are encouraged? How do you see that changing through the years?

Hirose: Well, many people very often say that we have cartoon atomic boy [ph?]. So they are very popular. And so people like robot. They have a very familiar feeling. That's why people start to work on humanoid. Honda ASIMO was very successful. So people likes robot. But I feel it's rather science fiction like. It's a little bit different from the real programs. So people in general it's very interesting, robotics. But unfortunately the industry people start to be very skeptical, for always say that robot can do something or explain, but it doesn't happens, always in initial stage. But mass communication people, people in general, believes, but very specialized person don't believe it. So I always complained about that. So we

should be very careful to develop really practical robot. Sometimes it doesn't look like a robot of the normal concept, but that is very important. So in 2003 I complained about stopping of the Jeshio [ph?] accident robot. The title was <inaudible>. Robotics as a popular science-- people like robot. But we should think other way. That's what I want to say at that time, and I still believe. So Japanese people like robot and they simply believe that when nuclear reactor accident happened they wheel this robot up here and do everything. But unfortunately, as President Nakamura says, we do not connect the research to the military activities. So it's always stopped at the research stage. So real things happened, we cannot use it. So that's unfortunate point of the Japanese research.

Q: In the U.S., they have a lot of military funding. So do you think that that, having something like that, where you need immediate practical application <inaudible>?

Hirose: Yes. Of course it's related to Japanese constitution, and we should be very careful. But since after the World War II our Japanese defense military only used for rescue operation. Nothing at all, okay? And in this case, the defense army was very gratitude by the people. So I think we should-- it's very difficult, very delicate program, but we should extract some rescue activities and make it helping rescue-- rescue army or something like that. And always try to-- the relation between university and military is completely cut. So we are very careful do that. But so in the case of when I studying demining robot, I contacted militaries and I found that the technology is very bad, because it's a secret. There's almost no competition. So I thought we should combine and always compete more openly. Then the technology level can be much higher. We have to be very careful about military activities. So that's most important, very delicate, but important point we have to discuss.

Q: In your career, who were some of the people that you-- did you work with any people closely, like collaborators? I mean, in Japan or outside of Japan.

Hirose: Well, no. Of course the research associate professor; research associate helps me a lot. And we have several contact with professors offsite. But I don't have a so close collaborators.

Q: I'm just curious, in Japan is it common-- because there's such a lab culture-- is it common to collaborate closely with others or is it mostly within the labs themselves?

Hirose: Yeah, most of the laboratories are rather independent. Well, of course depending on the character of the researchers. Some of them likes to work together. But I like to think by myself. So when I think something new, I want to-- if I have lots of students, I can ask. So now I just have about 30 projects going on and I like very much that kind of situation. Of course when I worked other professors, I tried to collaborate. But that is not my mainstream.

Q: Before I go to the last question, I also noticed that you were an honorary professor in Shengyang Institute of Technology in China. Could you tell us a little bit about your connections with China?

Hirose: Well, that's not so-- well, my former student-- I talk about Professor Ma-- he helped me a lot, and he contacted China universities and promote. So he give me that _____ title for me.

Q: And you also got-- I know you have a number of awards, but I also noticed you had one from the Ministry of Education and also one as IEEE Pioneers Award. Were those for particular projects, or Pioneers is more of a lifelong--?

Hirose: Yes, and maybe the biggest one is, it's from Emperor, Purple Ribbon Award. But it's also lifelong one. So some of them-- Ministry of Education one is mainly for education.

Q: And we usually-- this is a question we ask kind of towards the end just because we want to have a little education component. But if you were going to give some advice to young robotics researchers or students who are interested, what would be your advice?

Hirose: I always try to stimulate young researchers or children to make kind of hands-on experience. Because mathematics and physics is very important, but the combination of the hands-on experience and some theoretical study, it's very important. Otherwise people always thinking-- and think about some very abstract, not really practical one. And this time-- before I visited Stanford University, I take my high school student. I have a special course for high school and I invite them to Tokyo Tech and we had a special course on Sundays. And the final course was to take them to the foreign research institute. So I also have started Robot Grand Prix in Japanese Society of Mechanical Engineers since 1997. At that time I thought when I was teaching in university some of them has a very good sense, but most of them is very clever but engineering science is very bad. So I have to explain the machines, how to make it. So I hope if the student study, enjoys making things and also studies hard, the combination is very good. So if it's a very young, I hope they do like that. And maybe even university student I propose-- recommend them to try to make something. Maybe that's a good thing.

Q: And where do you robotics going in the next, I don't know, five or ten years?

Hirose: I think the components is getting better and better, so there was a kind of stalled phase for a very long time, but I expecting new machines, new robot. But at the same time, for example, I always say that robot would be emerge from other field, other area. In the case of the automobile, they put GPS and people are very serious about that kind of artificial intelligence, and it can stop, it can follow. So such things will continue and they will be evolved into a robot. So everything will start to be a robot. So I feel-- I wrote article about 2050 and I wrote that if we are at that age, maybe there is no humanoid-like robot, only for entertainment is

appear. But almost all the machines would be evolved in robot-- washing machine or cleaning machine or _____ would be a robot. And even the house itself would be a robot. Yeah. So maybe evolution of robot is not like humanoid robot is walking around the street. That kind of science-fiction-like development would not be appear. But still we would be surrounded by robot in 20-- maybe 10 or 20 years later, such kind of things start. And we already started.

Q: Thank you. Those are all the questions I had. Did we miss anything, or is there anything you wanted to add?

Hirose: It was very good. When in a TV program I have to say something very short, so it's very difficult.

Q: Here the more difficult part is having to talk for a very long time.

Hirose: But it was very interesting.

Q: Thank you very much. That was really fun. Thank you, thank you. #### End of Hirose.MP3 ####