

INTERVIEWER: Today is September 23, 2010. My name is Lawrence Gallagher, and I have the pleasure of interviewing my longtime friend and colleague, professor Richard Larson, as part of the MIT sesquicentennial Infinite History project. Doctor Larson received his PhD from MIT, where he is the Mitsui professor in the engineering systems division, and is currently founding director of the Center for Engineering Systems Fundamentals.

The majority of his career has focused on operations research, as applied to service industries. He is author, co-author, or editor of six books, and author of over 85 scientific articles, primarily in the fields of urban service systems, queuing logistics, disaster management, disease dynamics, dynamic pricing of critical infrastructures, education, and workforce planning. Doctor Larson's research on queues has not only resulted in new computational techniques, but he has also been covered extensively in the national media, earning him the nickname, Doctor Queue.

Doctor Larson served as co-director of the MIT Operations Research Center, over 15 years in that post, and 1995 to mid-2003, served as director of MIT's CAES, Center for Advanced Educational Services. He is founding director of LINC, Learning International Networks Consortium, an MIT-based international project that has held five international symposia, and sponsored a number of initiatives in Africa, China, and the Middle East. He recently started LINC's newest and largest initiative, BLOSSOMS, or Blended Learning Open Source Science or Math Studies. And we look forward to hearing more about that.

Dick, thank you very much for taking the time to talk with us today.

LARSON: Thank you, Larry.

INTERVIEWER: Can you please start by telling us a bit about where you grew up?

LARSON: Well, that's a complicated one. I was born in Bayside, Queens, New York, at the age of five, moved to Sunbury, Pennsylvania, spent six years there, then moved to North Plainfield, New Jersey, and I graduated from a high school not far from MIT, Needham High School, which is a western suburb of Boston.

INTERVIEWER: Please tell me a little bit about your family, and any significant events or influences that stand out from your childhood.

LARSON: Well, there are so many. But I think I would just like to share one of them here, today, as an indication of my parents' support, and that sort of thing. We were in Sunbury, Pennsylvania, which is a rural community, farming community, and I was age five. And there was a day, my parents came to me, it was a Friday, I remember. They said, Dick, you know, in Pennsylvania, going to kindergarten is optional. You can choose to go, or not to go. And you're the age, now, come September, you would go to kindergarten. You choose to go, or not to go. It's your choice. And I thought that was pretty cool. For the parents to ask a five-year old that. So I said, well that's a difficult decision. Can I give you my answer on Monday? So I thought about it for the whole weekend, and then on Monday, I told them. I said, well, thank you for giving me the opportunity to think about this. I think I'd like to be a child for one more year. I will pass kindergarten. And so I did not go to kindergarten. I played in the woods, and the grass, and all those sorts of things, and with friends. And on the first day of first grade, I was the only kid in the class who couldn't count to 10, write his name, or know the alphabet. But I tried to catch up as soon as I could.

INTERVIEWER: It sounds certainly like you did. When did you first develop an interest, or another way of putting it, was there an a-ha moment when you realized you had a special aptitude in the sciences?

LARSON: I found out, I always liked math, and I liked the physical sciences. And I think I understood that from first grade and it just accelerated as I went along. I always liked to figure out how the world worked, and putting math to all that. So that was kind of neat. Then at Needham High School, I think I was in the first class that took MIT's created PSSE physics. And when PSSE physics was introduced, it was born from the Sputnik era of the 1950s. It was really wonderful for me, because it put math into physical world together in ways I'd never seen before. And I kind of fell in love with that approach to learning, and to research, and to science.

INTERVIEWER: Is that when MIT first appeared on your radar screen?

LARSON: Yes, that was when MIT first appeared on the radar screen.

INTERVIEWER: What grade?

LARSON: Well, I was a senior in high school at the time.

INTERVIEWER: So what were the motivating factors that brought you to MIT?

LARSON: Well, candidly, my father thought I would be a commuting student, and it would be less expensive for him to send me to MIT than someplace else that I'd be on campus! I surprised him quickly, though, by moving onto campus. I never thought MIT would admit me. So that was my stretch school, and I applied to a number of other schools. And when I was admitted, like a third of other freshman, I thought they had made a mistake! So when I came here, I was terrified!

INTERVIEWER: Where else had you applied?

LARSON: Well, I don't want to say where else I applied, because that indicates that they were my second choice! But good schools.

INTERVIEWER: So that must have been exciting. What were your first impressions when you came to MIT of the students, the culture, the environment?

LARSON: My first impressions were great. I was overwhelmed by the geographic diversity of the people, including from other countries. My living group, we had people from Argentina, from Austria, from Italy, from Cuba. I had never met folks my age before who came from such other countries, as well as from Iowa, from California. And they were all smart, and they were all motivated to learn. And that was just a fantastic thing to experience.

INTERVIEWER: When you say that you were, you thought they made a mistake, when did you realize that you fit in to MIT?

LARSON: Oh, a few years ago! MIT is a very interesting place. It's very competitive place, and I remember a colleague of mine, when he returned sixty. He said, because he had the same feeling, he said, Dick, now it doesn't matter if they found out they made a mistake! No, I would say, honestly, I'd say, probably by my sophomore year.

INTERVIEWER: Was there any one thing when you realized, wow, this, yeah! OK! This feels OK.

LARSON: Yeah. When you work hard, and you get competitive grades, and your colleagues take you as a supporting colleague.

INTERVIEWER: And so then, what determined or influenced your course of study at MIT?

LARSON: Well, I took Course 6, which is, for those who don't know, Electrical Engineering, at the time. Now it's called Electrical Engineering Computer Science. And my father studied Electrical Engineering, so I saw that was good. But basically, you know, you ask around, and I think it's somewhat the same today. If you don't know what you're going to do, but you want to be an engineer, or you want to apply systematic reasoning, quantitative reasoning, to the world, the default choice here on campus has been, and continues to be, I think, Course 6, Electrical Engineering and now Computer Science. Because it trains your mind to think systematically about complex problems in ways which are very valuable, no matter what you do later. So I chose that field, and my degrees are in Course 6.

INTERVIEWER: And what was the course that led you from undergraduate to graduate studies at MIT?

LARSON: What was the--?

INTERVIEWER: Not the course, what was the path?

LARSON: Well, it's very complicated, and I don't want to bore people with all of the complications. But basically, I was accepted in for a Master's degree, Master of Science degree, because I had a Bell Laboratories fellowship. And then professor Bruce Wedlock said, well, let's transfer them that into a scholarship, so you're not obligated to work for any particular employer. And then physics professor Eric Cosman here, who happened to be a fraternity brother of mine, said Dick, you really should study, spend the last summer after you graduate with the senior year, study for the doctoral qualifying exams. And I said to Eric, I'm not doctoral material. I never thought of myself as getting a PhD. And so he yelled at me every night, and yelled at me every day. He said, Dick, study for the exam, study for the exam. So finally, just to stop the pain, I studied for the exam, and I took it, and I passed it. So I went into the PhD program kind of, not even, without anticipating it ahead of time. And thank goodness.

INTERVIEWER: So as a graduate student, Dick, how did you decide upon your choice of these?

LARSON: OK, well that's an interesting and complex question. But basically, a living group that I felt close to had a theft on a party night. And they knew the physical description of the perpetrators, the two of them, and so I thought, well, maybe I could follow the lead, and be like a detective, and find out who they are, get them arrested, and get the money back to the people whose money were stolen, driver's licenses, and so on. And so I collected police books, police detective books, from the MIT library system. And one day I had like a dozen under my arms, like this, and professor Al Drake, who was my adviser at the time, saw me walking down the hallway with these books, like this. He says, Dick, what are all those books? I told him the story, I said, they were police detective books. I'm going to solve this crime. He said, that's fascinating. You're applying your engineering thinking to this sort of thing. Why don't you bring that on campus? We'll fill out a form, we'll give you 12 units of research credit for this, and you can start that way. So that started my career in policing, studying police from a scientific point of view.

And that led to a Master's thesis, and that led to a doctoral thesis, it led to me being the youngest member of the Science and Technology Task Force of the president's Crime Commission, and my first book, which is called *Urban Police Patrol Analysis*, MIT Press.

INTERVIEWER: Interesting! Could you, we're going to get back to also how that led into your passion for operations research. But could you describe the process and how it felt to transition from student to faculty at MIT?

LARSON: Well, you know that I said that when I was here as a freshman, I figured they made a mistake? I kind of had the same feeling then! Because you're an assistant professor, you know, you're assistant professor here, and you look all around, you see all these Nobel Prize winners, and see these members of the National Academy of Sciences and Engineering, you say, what am I doing here? It's almost a Groucho Marx situation! So it took a while to feel comfortable, to say that I wasn't feeling intimidated for the first year or two would be denying the reality. But then again, you start writing, you start doing research, you start interacting with students, they start doing theses, and you start getting research grants, and all of a sudden you feel like you belong.

INTERVIEWER: That's great. So tell me about your feelings about teaching at MIT. How would you describe teaching at MIT?

LARSON: Well, teaching at MIT is great, because we have the greatest students. You know, the biggest asset of MIT is our students, undergraduates and graduates that come from all over the world. They're eager to learn, they're very, very bright, they're very, very energetic, and you can try different things with them, you can try experiments in teaching, and as long as you challenge them and keep them involved, they always give back much more than you give to them.

INTERVIEWER: Wonderful. So what are the distinctions between teaching undergrads versus graduate students?

LARSON: The difference between teaching undergrads and graduate students. A lot of undergraduate courses are kind of required, basic material, particularly the freshman and sophomore year. So those tend to be large classes. And like one of those that I taught, which was when Al Drake, when he was here, and he was on sabbatical, I taught what we call here 604.1, 643.1, which is Applied Probability. And freshmen take that, seniors take that, grad students take that. But it's a large lecture hall with 350 people, both semesters. And that's OK. I did things to do live probability experiments, to include them, but it's hard to be that interactive.

Graduate student courses tend to be smaller. They can be, 40 or 50 students would be a large graduate class. Some of them are 20. And you have more intimate contact with them, and it's more dialogue and interchange. So it's a little bit like, and the graduate classes also tend to be more researching-oriented, more state-of-the-art, more advanced. But both are fun to teach. Right now, for instance, I'm teaching a freshman seminar. So we have eight 18-year olds, who are just in from high school. And that's a wonderful experience.

INTERVIEWER: And then you also were thesis advisors to graduate students as well, which gives you an opportunity to interact on even more intimate level.

LARSON: Oh, right. Being a thesis advisor is terrific. I've lost count of how many MA and PhD theses I've supervised over the years. And we who do this, I think all the faculty members think of their PhD thesis students as their children, you know, quote unquote, and then when they become assistant professors and associate professors, and they supervise, and you have grandchildren-- well, I'm old enough now, I've got great-great grandchildren out there! I've lost track of them.

INTERVIEWER: And how does teaching impact your research?

LARSON: Teaching and research kind of are meshed like this. Because today's research results go into tomorrow's courses. Here at MIT we don't call them courses, we call them subjects, but I think most the world, they view these things as courses. And so it goes back and forth like this. And sometimes in teaching, you can say, OK, here's the Chinese Postman Problem, or here's this queuing thing. But this result, the following thing, if you generalize this in this way, it's not known. So then you challenge the students. Say, well, if you're really interested in this, maybe you'd like to do research in this. Because this particular thing is an open question. And if you solve it, just think of, this whole class of problems you would help to solve in the real world. So the two of them go hand in hand.

INTERVIEWER: Clearly, clearly from that description, yes. Let's talk about your passions, starting with operations research. What is it about operations research that captured you?

LARSON: Well, first of all, as an undergraduate here, I didn't know what operations research was. And most people today still don't. I view it as the world's most important invisible profession. And if you go to a gathering, a social gathering, and somebody, some stranger comes up and says to you, what do you do? If I say, well, I do operations research, sometimes they say, that's very good. It's nice to have those doctors, have researchers in the operating room, looking at what they're doing. That's operations research.

So operations research is industrial engineering, management science, and these sorts of things. Basically, what I call it, is the physics of the real world that involves people and technology. And so when I entered graduate school, I loved Course 6, electrical engineering, but I didn't want to be an electrical engineer. I wanted to apply that kind of thinking more broadly. And I searched around, searched around, searched around, and I found operations research. And it wasn't well-marketed, it wasn't-- today it is, for the undergraduate, but then it wasn't. And I fell in love with it. Because you can apply the engineering point of view, the physics point of view, to these complex problems involving people and technology.

INTERVIEWER: And you have applied operations research to private and public systems, including transportation and logistics, service industries, queuing theory, location theory, technology-enabled education, disease dynamics and higher education in developing countries. That's quite a scope. Can you talk a bit about how you've applied operations research to, say, two or three of these areas that interest you most?

LARSON: Well, which one would you like me to--

INTERVIEWER: What's queuing theory?

LARSON: OK, queuing theory. Well, you know, my first application of queuing theory was in policing. Because my Master's and PhD thesis here at MIT, decades ago, was in policing, and if you call-- at the time we didn't have 911 in the country, now we have 911. So you'd have to call a seven-digit emergency number. And you enter a cascade of queues. First of all, there's a telephone answering person who takes the thing, and then he or she fills out a form, goes to dispatcher, to the dispatcher queue, blah, blah, blah, and then the police cars may be busy, so there's a queue there. And so my first application of queuing theory was to there. And I've applied it to the post office, to banking, to ATMs, to lots of things.

And I've even developed some work in the psychology of queuing. And I find out now that the psychology of queuing is just as important as the mathematics of queuing. So I've applied it in a lot of different areas. It's a beautiful theory, and in fact, in this year, queuing theory, the mathematics thereof, is celebrating its 100th birthday, because it was born in Denmark, around 1909, 1910.

INTERVIEWER: Could you describe a couple of practical applications, particularly in those instances when you've been actually hired as a consultant to basically put some of these practices into the real situations?

LARSON: The queuing theory?

INTERVIEWER: Exactly, exactly.

LARSON: Well, I think the first one was with the New York City Police Department. The New York City Police Department, in the late 60s, see, I'm dating myself here, but I still remember this, announced with great fanfare that instead of having seven different numbers from the different boroughs to call for police, and you had to have a different number for fire, and a different number for an ambulance, they merged them all with 911. And with great fanfare, the mayor cut a large ribbon, and it was all over the headlines of the New York Times and the Daily News, et cetera. And then, all of a sudden, you saw letters to the editor come in, saying, I called the mayor's 911 number last Saturday night to report this crime in progress. After hearing 30 minutes of a ringing telephone, I hung up and called again. After 29 minutes, somebody answered the phone. Police emergency, may I help you?

And we went down there, and I lived in the Police Department for one month, with two lieutenants from the Police Department. And we collected all the data, we interviewed, we observed. And it turned out to be a very simple application of the queuing that was invented in Denmark 100 years ago. And so I took all the data, and I applied those queuing formulas, and we rescheduled all the call operators in a way which matched the pattern of arrival, by the time of day and day of week. And we attached names to the different tours, of the guy who was in charge of that tour, so there was accountability about those delays. And we posted it on a big bulletin board. Anyway, the delays plummeted, not to zero, but to measurable amounts, without adding any manpower. And it's because we scheduled them differently than the police had done.

INTERVIEWER: And did start a business on the side to provide these services?

LARSON: Yes. A few years later, I started a not-for-profit company called Public Systems Evaluation, and we applied some of these same techniques, initially in police departments. In Wilmington, Delaware, Worcester, Massachusetts, Saint Louis, Missouri, and other places. And that's because we were doing this kind of research at MIT under an NSF grant, and I got calls from all these places-- Professor Larson, you've got to help us here, you have to help us there! And there were no more MIT resources to do that, so that I was encouraged to form an off-campus company. That changed to for-profit when President Reagan became president, and it's had several different names since then, but it still exists today. And we're doing, about half of the work that the company does, is public sector, for government, particularly the Federal government and places like New York City, and the other half is for the private sector.

INTERVIEWER: So this is just another MIT spinoff!

LARSON: This is another MIT spinoff, among the thousands of MIT spinoffs, this is one of them! And interestingly, a lot of my doctoral students have spent some time there before they finish their thesis. So it's very integrated in a compatible way with MIT's objectives.

INTERVIEWER: And a description of operations research as it applies to disease dynamics.

LARSON: A description of operations research as it applies to disease dynamics. Well, operations research applied to disease, particularly we're thinking about pandemic influenza these days. We just had H1N1 last year, and it's going to come back this year, perhaps as part of the seasonal flu this year, 2010 -2011. So operations research can be applied to emergency response and diseases in a number of different ways. The most standard way of thinking about it is, I think of operations research as logistics. Supply chains. So how do you get the supply chain of medicine and vaccines to people? And the queuing for the vaccines? And so those are all very important things, but that's not what we've been doing. Because we view that as too standard. So we've been applying operations research to the progression of disease, as it propagates throughout the population, and trying to discover non-medical interventions, NPIs, non-pharmaceutical interventions, which reduce the prevalence of disease among the population. And we're mathematically modeling that. We've had some publications out, book chapters, and these sorts of things. So that's our focus.

INTERVIEWER: You've done work on everything from the psychology of waiting, to influenza pandemic modeling. What's the uniting thread for all your interests, if there is one?

LARSON: Well, that's an excellent question. I think the uniting thread is, given the education that MIT has given me, and given my students, and the ability to frame problems in a particular way, and then to formulate them in a systematic way, there's no need to just limit those problems to little silos of academia. Some kind of circuit design, or protocol for some piece of software, or something like this. You can take that approach and apply it to very important complex problems. And so I like to attack those kinds of problems. I bring my students in with them. And so sometimes it's education in developing countries, sometimes it's pandemic influenza, often times it's planning and response to what we call low-probability, high-consequence events, disasters of various kinds, these sorts of things. And operations research is a beautiful field, because if you study it in-depth and from a broad perspective, you are armed and equipped to frame and formulate those kinds of problems.

INTERVIEWER: What do you consider to be some of your most important or interesting contributions in those fields?

LARSON: That's an interesting question. It's difficult to figure that out. I mean, in each decade there've been certain things. I guess, from an analytical point of view, my two most important contributions were, in the 1970s I invented something called a hypercube queuing model. Sounds very techno-geeky, hypercube queuing model. But this really was the first model that included spatial aspects of emergency response with the temporal aspects of queuing. And it's been applied and implemented in many cities in the US and some cities overseas, particularly for allocating resources and dispatching resources, police and ambulances. In fact, I've been involved with some of that implementation in Dallas, Texas, Saint Louis, New York City was a major one for ambulances, Boston, we wrote a book chapter about this for ambulances. And that required going through some hoops. And we had to implement this at a computer. And if you have n police cars and n ambulances, the number of state variables is two to the power of n . So it grows exponentially. And we're doing this in the 1970s on 1970s computers. And they were very, very limited. What now you can do on an iPod, or iPad, certainly, it required huge mainframes at the time. So we had to go through some analytical hoops, and so that was a major thing.

And then again in queuing in the 1990s, we developed something called the queue inference engine. Which allows you to infer the queuing behavior of customers that queue, just by the time that they start the transaction, time they end the transaction, with no videotape of the queue itself, or no sensors or monitoring system. It's almost like magic. And when I first figured this out, I thought, I must have made a mistake, because there's too much information here. But we found it, and that's now something as well. But I've done lots of different things in other areas, too, and I don't want to bore the viewers with too much.

INTERVIEWER: Those are two great examples. So you're currently affiliated with the Department of Civil and Environmental Engineering, the Operations Research Center, Leaders for Global Operations, and the Center for Biomedical Innovation. How do you split your time between all of these?

LARSON: Well, I view my primary allegiance to the Engineering Systems Division, where, that's my home. I can't even say department, because it's not a department, it's a division, ESD. And it's kind of an experiment at MIT, where if you think of civil environmental engineering, mechanical engineering, and you can go on, electrical engineering, computer science, these are vertical things, sometimes called academic silos. And ESD sits on top of this horizontally, and draws faculty from each of these engineering departments, and also three other schools at MIT. And it's interdisciplinary.

INTERVIEWER: And so those entities you just mentioned, it depends on what project you're working on, or what students you're supervising. And some of them come and go over time. So you're not really splitting your time between these entities. They're all intertwined.

LARSON: Correct. It's all an organic whole. It's organically kind of like this.

INTERVIEWER: Let's talk a bit more about your administrative contributions to MIT over the years. You were co-director of the MIT Operations Research Center for more than 15 years, and you served as director of MIT CAES, Center for Advanced Educational Services, from 1995 to 2003. How did the CAES opportunity come about?

LARSON: Well, the CAES opportunity, again it's the culture of MIT, in the sense that you're allowed to, and you're encouraged to, follow your passions. You know, what happened? I'm blessed with three children, and at the time my oldest was in middle school. And this was the early 90s. And I came down one Sunday morning, and I noticed Eric, the oldest, who was in middle school, hadn't slept a wink that night, and he was still on our Apple Macintosh Mac Plus or something, black and white, little screen like this, and he was still working away. I said, Eric, what are you doing? He said, well, I'm working on this project with two other students on mammals and birds. And look what I've created overnight. And he had this with music accompaniment, he had birds flying in, and this is 1992 or so, small computer that Apple had made. And I was just awestruck by this. And I said, well, are your friends doing similar things? Oh yeah, we're all, you know, kind of blah, blah, blah.

And all of a sudden it struck me. I said, you know, we professors at MIT who are generations apart from this teenage group that is coming up, are not prepared to handle this cohort of young students. Because we're teaching in an old-fashioned way, and we don't really understand the technology-laden universe in which they live, and what excites them, and how they learn.

And so I started making a pest of myself here at MIT. I happened to be founding, a guy in charge of a couple of committees, on education technology with professor Paul Penfield, he was partnered with me in the first of these, and eventually Joel Moses, who was then, I think he was the dean of the School of Engineering before became provost, said, all right, Dick, let's have an off-campus one-day retreat. So we had a one-day retreat, and I kept on making an annoyance of myself. So finally Joel Moses had been promoted to provost. He said, Dick, here's the keys to CAES. Why did you make CAES a technology-focused educational enterprise. And that's how that all came about.

So it came about, again, from a personal experience. Just like the police thing, when I was a student, was a personal experience I brought onto campus, in this case, it was a personal experience watching one of my own children learn, and I brought that onto campus, and did that for eight years, and it's really changed my career ever since.

INTERVIEWER: So to use your words, you were given the keys to CAES by Joel Moses as a result of your participation and the MIT counsel on educational technology in the mid-90s.

LARSON: That is correct.

INTERVIEWER: This was a very important time for e-learning initiatives at MIT. What were some of those initiatives, and what was the role of CAES in supporting those initiatives?

LARSON: Well, that's very interesting. We had a number of initiatives. We tried, we experimented with distance learning to developing countries, as an example. I remember giving live distance learning to three or four countries in South America, with professor Steve Lerman we gave some live teaching to Sub-Saharan Africa, it was extremely exciting. And the feedback we got from these people, they were so grateful, and so thankful, and they wanted us to do more. But those were kind of a proof of concept courses that we gave. So that was in one dimension.

Another dimension is, later in the decade of the 1990s, MIT was developing a strong relationship to Singapore, and working with you, because you were kind of in charge of modernizing many of the classrooms. We modernized a lot of classrooms here on the MIT campus to give live world class teaching built to the students here on campus, and to an equivalent number of Singaporean students, and I kind of defined the state-of-the-art, and proved that you could teach distance learning very, very well, and pedagogically, in an interactive way, literally on the other side of the earth. Like this, twelve time zones away. So we did that.

And we also got some interesting research grants. The one that I'm most proud of is PIVoT, Physics Interactive Video Tutor, where we took world-famous, he wasn't world-famous at the time, professor Walter Lewin, and you and your team videoed him three live cameras teaching what we call here 8.01, which is Newtonian physics. And I know Walter prepared 40 hours for each one-hour lecture. And we also then took snippets of his homework exercise solutions, and put it into a searchable database. And this was called PIVoT, and I think it was about 15 years ahead of its time. We are now revisiting that as we speak, these sorts of technologies. But it was a wonderful combination of development, let's say, of an R&D frame, the development part, let's say, for Singapore, and research, applied research, which was the PIVoT. So those are three examples that I would say.

INTERVIEWER: And then also during that time, you cofounded MIT World. Could you describe that project, and what was the motivation behind that?

LARSON: Well, MIT World. Yes, we're very proud of that. That exists now, I think there are over 700 public lectures, that are MIT public lectures, including presidents of countries, including our own country, and prime ministers of other countries, and poets and novelists as well as professors, CEOs. It's an amazing collection. I think it's the world's largest free video on demand collection of public seminars and lectures from a research university.

And basically the motivation for that is, we were at CAES at the time, and MIT alumni, I remember, like from Hong Kong, would say, Professor Larson, we're in Hong Kong, but we want to feel tied to MIT somehow. And we can't travel there. So is there somehow we can feel tied to MIT and have the MIT experience? And so we had a little group session and we talked about this, and said, well, one of the nicest things about MIT is every day there are public seminars and lectures here. Every day. I think we averaged about eight per day on campus, throughout the entire school year. So we said, why don't we take the best of these, videotape them, and put them on the web? And that was the birth of MIT World, and MIT World is still going strong today.

INTERVIEWER: So CAES, during those years, was key in supporting some of these major initiatives, like SMA.

LARSON: SMA being the Singapore initiative. Absolutely. Without CAES those things couldn't have happened.

INTERVIEWER: So Dick, moving on from the CAES years. How did your experiences at CAES influence what you decided to do next? For example, where did the idea of LINC come from?

LARSON: Well, that's a very interesting, excellent question. You know, I think faculty members who want to do research and teaching with their students, they're willing to be administrators for a finite amount of time, and then it's time to go back to teaching, and research, and working with students, which is what we all love to do. And so I think it was about seven and a half or eight years I did CAES. And we're very proud, because I think we grew CAES from two business units to about seven, by the way I count.

And one of the last two was LINC. We formed LINC during the last of the CAES years, Learning International Network Consortium. And that was in response to, I think I talked about earlier, delegations from developing countries coming to talk to us, like I mentioned South Africa. And so we thought, wouldn't it be nice to have a loose consortium of people, of leaders, vice chancellors, ministers of education, practitioners, professors from developing countries, come to MIT, or sometimes MIT will go overseas and have it there, to talk about best practice. Leveraging technology to bring education to underserved populations.

And so when I stopped being the head of CAES, and CAES, the seven business units, dispersed to various parts on campus, I'm very proud they're all growing and very healthy today, I decided to bring that with me. So LINC came with me. I wasn't going to let it go, because I was very, very committed to it. And I started traveling overseas, I became a consultant to the World Bank, to the UN, and this was just part of my core at that time. And so that's how that grew. And then also, going back to research and teaching, other things came into my life as well.

INTERVIEWER: What other institutions, countries did you enroll to participate in LINC?

LARSON: Well, we had developed an email list of contacts from our eight CAES years. And some of these people who, some of them were MIT alumni, like Dr. Naveed Malik, who's the vice director of the Virtual University in Pakistan, in Lahore, Pakistan, and others had just communicated with us or visited us. So we sent out email alerts and advisories and invitations, and the response was terrific, and that's what started LINC.

Now the first LINC conference, which was in the early, two thousand aughts, whatever that decade is called, had maybe 80 or 90 people. Our fourth LINC conference, which was bilocated at the Dead Sea in Jordan and in Dubai, had over 600 people, and in fact we've now had five LINC conferences, the fifth one here at MIT this past May. So we reached out, and somehow we knew about the African Virtual University, the Pakistan Virtual University, Monterey Tech in Northern Mexico, and these people are cofounders of LINC with us, and they've been with us this whole period of time.

INTERVIEWER: Where has been the benefit of developing that community?

LARSON: Well, the benefit is a shared benefit. So the idea is, you bring these people together, and if it's a good conference, any good conference, yes, you learn things from the speakers, and you learn about best practices-- unless you learn the worst practices, people may say, we tried this and it failed, and it failed for the following reasons-- but at least half the value of a conference like this, is meeting your colleagues, forming relationships, and establishing programs that wouldn't have occurred otherwise. There's a program now between Mexico and China that would not have existed had these two people hadn't met at a LINC conference. There's a program between Ireland and Saudi Arabia which wouldn't exist if it hadn't been for a LINC conference. So it's those kinds of things.

And I think MIT benefits too, by having the president, the chancellor, the provost write letters welcoming people at LINC. All of a sudden it shows that MIT cares about delivering quality education in developing countries, leveraging technology, and I think that's very good for the Institute.

INTERVIEWER: And more recently, you've developed a practical project which you can basically share with this community, and that's called BLOSSOMS, or Blended Learning Open Source Science or Math Studies.

LARSON: You know, with each of these things, it takes us a day to figure out how to put in a word that people recognize, and then the name of it. So BLOSSOMS, it took us a day to figure out that. LINC, it also took us a day, because we liked link, about linking countries together, but we didn't have the K at the end, we have the C.

INTERVIEWER: So how did BLOSSOMS come about as part of LINC?

LARSON: My last sabbatical, 2004, my research partner, Elizabeth Murray, and I, did some research, particularly in China and in Mexico. We spent serious time in interior parts of China, inner Mongolia, Ningxia Province, and in Northern Mexico, thanks to Monterey Tech, and we were curious to find out how technology-enabled education was delivered to rural, poor communities, to alleviate poverty and to enhance economic development. And we learned a lot. And we thank, fantastically, our hosts in both China and Mexico, and we wrote a paper about this.

But there was an a-ha moment. And the a-ha moment occurred in Ningxia province in China, which is in the center of China, a little bit east of center, and it's one of the poorer provinces in China. And we were in a village where the schools were unheated, because it's against the law to turn on the heat until November 15, so the kids were wearing parkas, because it was like, 38 degrees Fahrenheit outside. There were two incandescent light bulbs hanging from the straw ceiling. And yet, they had a TV set in front of the class, and they were watching a lecture that was done by a superlative teacher in Shanghai. And the teacher would turn on the lecture for a while, and then turn it off, and interact with the class in a very exciting way! You know, just, this exciting! And call them by name, and this and this.

And I said to Elizabeth, I said, that's very fascinating. Because these kids, whose fathers are peasant farmers, their cash crop on an annual basis about \$300 US, they're getting this education, they're getting the same quality lecture that the kids in much richer Shanghai are getting, or Beijing. So that's interesting. But then the thought was, this particular lecture was designed as a 60-minute lecture. It was not designed to be interrupted.

So we thought, what if we designed a video so it went in short segments, three, four, five minute segments, and then it faded to black, and then the teaching baton was pedagogically designed to be handed to the in-class teacher? And that was a-ha moment that gave rise to the primary pedagogy of BLOSSOMS.

INTERVIEWER: And could you tell us, what happened next with BLOSSOMS? How did it get from that a-ha moment to what it's doing today?

LARSON: OK. So then we had to think about how to write this up, and propose a plan that some foundation might want to fund. And that took another two years in negotiation, and talking to all of our LINC colleagues and friends about how this might work. Because our LINC cofounders were really behind this. Because they saw that if they were co-developers in different countries, of the educational content, just like Wikipedia, for instance, or other things that are shared content on the web, that could really add to cultural sensitivity, and people could communicate across boundaries, where maybe because of local concerns they couldn't actually walk across those boundaries. Conflicts, and other things.

And so then, Elizabeth and I wrote this proposal, and we published it, but we also published a paper in a distinguished education journal. And the Hewlett Foundation, which also funded MIT's OpenCourseWare, was sufficiently encouraged by this that they decided to fund it. We've had three or four other foundations also, in a smaller way, fund it.

And basically, we designed an architecture, where, do you want me to describe the architecture of this? Basically, we call it a teaching duet. So in a high school classroom that's math or science or engineering, the idea would be, suppose it's a 60-minute class. Then at most, 30 minutes would be video, in short three to four minute segments. You pass the baton, so it's this teaching duet. The teacher, then, is supposed to interact with the class, and the class meets among themselves, in a very interactive, experiential way, solving a very complex problem that requires development of critical thinking skills, and learning away from any test, and rote memorization is not good. It's also to excite them. It's to excite them about math, science, and engineering. So that's the pedagogy.

The other aspect of it is, we want international partners. So currently we have, as international partners, Pakistan, Jordan, and Lebanon. And we're in discussions with six other countries about becoming partners with us. And the idea is, if a country signs on as a partner, they are also coproducers. So every partner country produces at least 15 new BLOSSOMS videos. And we'll translate them to other languages. We have Arabic, Urdu, and English right now, Urdu being for Pakistan. And so that gets great country pride. Because if another country says, oh, we're partnering with MIT, and we're creating lessons for them, for American students, and MIT is creating lessons for our Jordanian students, or Pakistani students, we all learn from each other.

Example: We have, one of our most popular ones is called Donkey Cart Physics, filmed in the streets and playgrounds of Lahore, Pakistan. And it shows that you can teach Newtonian physics by looking at how a donkey cart is loaded and runs in the streets. It has to stop for stop signs and stuff like this.

So that's basically it. That each country that partners with us will create content. They like that a lot. So everyone is a coproducer and a co-user. So it took us three or four years to design all these different attributes. And proof of the pudding will be maybe two years from now, when we do a formal assessment and see how it's going. But also, currently in the US right now, we're working in the various states to implement it in schools. All these states and the District of Columbia have been winners of this Race to the Top program, which has been recently announced.

INTERVIEWER: And why is it important to target BLOSSOMS to high school students?

LARSON: Here we are at a research university. And LINC initially started as focused on tertiary education only. Tertiary meaning college and university. And then, talking to a lot of the LINC partners, and even talking to a lot of our friends here in the US, and said, wait a minute. Education is a system. It starts at birth. The parents are very, very important throughout the whole process, encouraging. And then you go to kindergarten, unless you're me. I opted out of kindergarten. And then you study math and science. So there's a whole pipeline, it's a whole system. And the inputs to a freshman class here at MIT, or any university, are the outputs of the high school they came from three months earlier. So to ignore the high school and just think of tertiary is not viewing it as a system, in the way that Course 6 here at MIT, or any engineering or math group, would define a system.

And in recent years, in a lot of the developing world, and the developed world, so the US has this as a problem too, and in the developing world it's a problem, fewer and fewer young people are choosing what they call STEM careers. STEM is science, technology, engineering, and math. Fewer and fewer young people are sticking that, and we're figuring out why. Because here in the US, we're having a burst of retirement soon, the post-World War II baby boom, all these boomers are about to retire, and big technology companies are wondering, who's going to replace them if we don't have enough graduates in the STEM programs?

So we thought, hmm. Maybe in middle school and high school, we're seeing little internal dropouts, and we're trying to figure out why. And so we're hoping that BLOSSOMS plays some small role in encouraging young people to stay with STEM careers, and to develop critical thinking skills.

INTERVIEWER: So BLOSSOMS has been online now for a couple of years.

LARSON: Two years.

INTERVIEWER: You've just received another round of funding.

LARSON: Correct.

INTERVIEWER: Could you just give us a status report right now, and just tell me, two years into it, what are some of the concrete rewards from the BLOSSOMS project at this point?

LARSON: Well, that's an excellent question, I could talk forever about that. But the first two years are proof of concept. We've ended up with forty to fifty BLOSSOMS modules, created here at MIT, in Jordan, in Pakistan, and by of NGOs, like Teachers Without Borders. We're very happy about that. The feedback we get by emails from teachers has been very good. We've given eight teacher training workshops, a large one with sixty STEM teachers at the public school system in Washington, D.C. in August, and we did a formal evaluation of that, and the feedback was good. Virtually all the teachers said that they plan to use at least one or two of these in their teaching in this fall term. And however, we're now thinking, OK, we have to go from proof of concept up to a higher level of production quality, and also our website has to be scalable, and so we're doing that.

But the feedback so far, by giving our eight teacher training workshops, and from the Jordanian high school teachers. Four of them actually created BLOSSOMS modules. We went over in March to thank all the 17, the Jordanian teachers, the professors, the high school teachers who made BLOSSOMS modules. They were so thrilled to have us there, and they all dressed up, and we had a big occasion, and the Minister of Education gave out the certificates of appreciation to all of them. And so the teachers like to be involved, the professors like to be involved.

And I think, the high school teachers we're talking to about using this, they love this, because this is an example of technology where their students are not marched off into a computer lab to sit in front of computers. They're still in their in the same seats, and the teachers are still in charge of their class. And they love that application of technology.

INTERVIEWER: And is it true that the teachers are also kind of ambassadors for their own country?

LARSON: Very much so. They're ambassadors for their own country, and they love to have their country be participants in this MIT initiative.

INTERVIEWER: So how is it that an MIT faculty member with a background in electrical engineering and operations research partners with educators in Jordan and Pakistan to create an open source platform for the online delivery of math and science learning modules for high school students? How does the culture of MIT support and encourage this type of work?

LARSON: Well, that's an excellent question. And I have visited some other universities on sabbaticals, and I've seen how other places work. The thing about MIT is, even though we have academic departments, some of which are over 100 years old, of course one is 150 years old, almost, it has always encouraged interdepartmental, interdisciplinary kind of movements. Traditionally MIT has put this in by having interschool and interdepartmental laboratories. So you had the vertical cuts, which are the academics, and then you have these laboratories. But I think MIT encourages people to get out of their silos, out of their, you know, viewing things through a very narrow window here, and looking at opportunities that the world provides for you to give some kind of contribution. So if you get out of your comfort zone, and say, well, I want to, it would be nice, could I apply some operations research or critical thinking skills to this problem or that problem or that problem? And you see these problems evolve. Just read the newspaper, talk to colleagues, talk to students from different countries, different parts of the United States. And you can do that.

So over my career I've actually had appointments in four different academic departments. Electrical Engineering, Computer Science, Department of Urban Studies and Planning, Civil and Environmental Engineering, and now ESD. And I think that's reflected kind of a trajectory of following what I view as very important critical problems that involve both the social aspect, and technology aspects, and system design aspects.

INTERVIEWER: Does this work fit into your job description, if you even have one?

LARSON: I don't know what my job description is! I think a job that, you know, there are about 1000 MIT faculty members, and we're all very blessed and honored to be here, because it's a very, very unique place to be. But they say some places you have to ask permission to step a little bit out of your boundaries, and it might take a year or two to get permission.

And here, there's a certain culture of controlled rebelliousness. And we even have this amongst our students. I think the controlled rebelliousness is what gives rise to their entrepreneurial spirit. Why thousands of startups have happened from MIT, both the students and the faculty. So the faculty also have a controlled rebelliousness, which the students see, and so instead of asking for permission, we ask for forgiveness.

We do something, like when I started LINC, I didn't have to ask for permission and get all kinds of paperwork done. We just announced it. And then, after it existed, the MIT administration, the top three people, said, this is fantastic. Let's write the president or the chancellor will write letters of welcoming. The president's always done that, the chancellor's come, or the provost is welcoming people. So it's that kind of culture. So you're invited to, and encouraged to, step out of your comfort zone, and use the skills that you develop, and apply them in interesting and important areas.

INTERVIEWER: And how does this overlap, or map against, MIT's overall mission?

LARSON: Mind and hand. So you do research, but you apply it to the real world. And that's, in a general way, what an engineering research university should be, and is. So MIT has always been attached to the real world, and views itself as helping to frame, formulate, and solve very important problems. Increasingly more complex systems, social problems, yes, they involve technology, but in a very broad sense, not in a narrow sense. And I take MIT's involvement with countries in Asia, in the Middle East right now, and in other parts of the world, in Europe, indicate that we want to be involved with those problems, that we want to contribute to some of their solutions.

INTERVIEWER: The application of science and technology for the betterment of humankind.

LARSON: Absolutely. I couldn't have said it better.

INTERVIEWER: So of all the projects that you've been involved with during your time at MIT, is there one that stands out in your mind as a favorite?

LARSON: Well, the favorite is always one of the current ones! The favorite is always one of the current ones. But of all the projects I'm involved in, which are my favorites? You know, each decade I have a favorite. But I have to say right now, in terms of BLOSSOMS, see, there were so many issues. For instance, in developing countries. In rural Pakistan right now, Pakistan is one of our partners, less than 5 percent of the women are literate. Education is a really important thing. So we have the issues of developing countries, which are different.

But here, even in this country, we have the issue, it's a national security crisis, in my view. If we don't have enough STEM-oriented young people, who choose these STEM careers, the very technological and scientific engine which brought us all of prosperity and goodness of the 20th century will not be there to bring us through the 21st century. And so to me, it's a National security issue.

And so right now, I as I said, your favorite project is one of your current ones. And it's not just BLOSSOMS. I think it's all these efforts. The national Race to the Top program, the Gates Foundation has allocated tens of millions of dollars to this issue, private companies are allocating to it. So we really need to encourage, in the United States, our young people to get excited about it, see the relevance of science and technology to their real lives. You know, sometimes these math books are written by mathematicians, who have never applied it to the real world, and the teachers don't have that much experience. So we have to bring that experience to them, in various ways, like through BLOSSOMS, to show them the applicability.

And so I have to say, in terms of STEM careers, both helping in the US and in developing countries, that's the thing I'm most excited about.

INTERVIEWER: So I'm going to shift gears here just a bit. So you've consulted to the World Bank, United Nations, Rand Corporation, Hibernia College in Ireland, Hong Kong University, the US Department of Justice, American Airlines, and various other corporations. Can you talk about the value of this kind of consulting work to MIT?

LARSON: That's an excellent question. Again, MIT is mind and hands, and so we always like to have our feet solidly on the ground, and know what's going on in the real world. Now, there are some universities and colleges whose administration views faculty consulting as an annoyance and a provocation and a distraction. Here at MIT, it's just the reverse. Especially in the School of Engineering, and I'd say other schools as well, the idea is, a day a week. So if it's Monday through Friday, maybe, for me personally, typically Fridays I'm off-campus, involved in real-world things. Through my company, through private consulting, or whatever.

And the neat thing about this, is you go out and see what's really happening in practice. You think you know what the state of the art is in queuing, or manpower deployment scheduling, or something like this. And you see what's going on in the US Postal Service, or at Citibank, or the St. Louis Police Department, and you realize, here in academia, we're only scratching the surface. And they really have these problems, they're much more complex than we're thinking.

So you bring them back on campus. And I would say at least half of the doctoral theses that I've supervised are of problems that we've identified off-campus, in this practical kind of, what they call consulting, situation. And probably at least 40 percent of my published, refereed papers have come from problems derived off-campus that way.

So to me it's an integrated system. It's not a competition, it's an integrated system. Consulting, teaching, and research.

INTERVIEWER: Now let's talk a little bit about publications. You've authored six books, and written more than 85 articles. Is publishing something you like to do, or is it more like a necessary evil?

LARSON: I love to write. I love to write, whether it's a book chapter, or a journal article. If you can put down some framing and formulation of a problem which is a contribution to our collective knowledge, that's a very exciting thing to do. And if it goes through peer review, and the top peers in the profession say yes, that's a contribution, and it goes into the literature, that's very exciting. And also, just getting those words right. Sometimes when I write a paper, I like to put in a new vocabulary word that I didn't know before, and say, OK, now I own this word, because it's in that. So I've always viewed it as one of the best ways to spend time as a professor, is to sit down and write. I really enjoy that.

And I also enjoy co-writing things with students. If it's my Master's or doctoral students, we coauthor papers, and that's a great thing for them, because if we go to a professional society meeting, I'll let them present the paper, and that lets them grow and emerge into their career. So there's lots of synergy there.

INTERVIEWER: You've been recognized by many awards, honors, et cetera. What do these awards mean to you? One or two of them meant something very special to you?

LARSON: Well, it's always nice when your professional colleagues give you awards. I don't have any of them on the walls of my office. I have other interesting things, to entertain people. But it's nice to be acknowledged in that way, and it's a very profound thing when you get one of these awards.

I think the one that's most valuable to me is being inducted into the National Academy of Engineering in 1994, because my career has not been in the traditional engineering way. I've had an eclectic combination of things I've worked on, and to have your colleagues around the country say, yes, you belong in this organization, which has less than 2000 people in it, that, to me, was the highest honor that I've received.

INTERVIEWER: So significant recognition, given the fact that you haven't done it the traditional way.

LARSON: I haven't stayed in one little zone. So I've gone to different zones. Kind of every 10 years, my career has been reinvented, by accident or personal experience or something like this, yes.

INTERVIEWER: Going back to the beginning. Your first book, *Urban Police Patrol Analysis*, won the Lanchester Prize for Best English-language Contribution to the World of Operations Research and Management Science. How did that impact your career back then?

LARSON: You should ask my Tenure Committee! Yeah, that was my first book. It was MIT Press. I was just learning to write at the time. I remember MIT press had a very nice editor who showed me how put coherent sentences and paragraphs together, so we went through a few iterations. And I think that was kind of the first major application of operations research to urban policing. And it was a huge honor that the Operations Research Society of America honored the book in that way. Maybe that was one of the events when, as an assistant professor, that I thought, hmm, maybe I really do belong to this group called the MIT Faculty! Because until then, you know, it's pretty intimidating being an untenured assistant professor in a place like at MIT. So maybe it was a little bit of confidence that got there as a result.

INTERVIEWER: And it certainly didn't hurt the tenure process, either!

LARSON: I don't think it hurt the promotion and tenure process.

INTERVIEWER: Over the years you've served as president of ORSA and INFORMS, and the Institute for Operations Research and Management Sciences. How have these roles been valuable to your work?

LARSON: Well, it's always an honor when the people in your profession, and these are the largest operations research professional societies in the world, first of all there was ORSA, so I was president of that, and then ORSA and TIMS got together and got married, TIMS was The Institute of Management Sciences, and formed INFORMS, and I guess they were looking for a president of that, too, so I was also president of that.

And the nice thing is, when you're elected to that office, or a high office like that in these professions, you're actually on the council for at least three years. So you're president-elect for one year, then president, and then past president, and you sit in these council meetings. So you have three years, really, to effect some change and to show some leadership there. And it's an awesome responsibility to sit at that table, and to make strategic decisions about the future of the profession to the extent that organization can foster directions and changes in directions and allocations of resources. So it's a leadership opportunity that I wish everyone had that kind of leadership opportunity. Because you come back from it more mature, and with a broader perspective about your profession and your role in it.

INTERVIEWER: So in terms of balancing all of this, what is the difference between being an administrator at MIT, and a faculty member, and what motivated you to accept these administrative positions, when it meant more work, more responsibility?

LARSON: Well, I think by administrative positions you mean like codirecting the Operations Research Center, or being the founding director of CAES, these sorts of things. Well, you know, I never thought of these positions as administration. To me, the word administration means keeping the status quo, and keeping the ship afloat in the same direction. And I don't know if I would've been too excited to do that.

But particularly, let's do the CAES one. That was, I think, an example of creating something new-- of leadership, and the idea that technology and education, both on-campus and reaching overseas was a huge opportunity. It was just happening in the mid-90s. So I never viewed it as administration. I viewed it as creating something new, and going from, let's say, two business units to seven. And MIT World is an example, PIVoT is an example, helping the MIT-Singapore project get going.

So that was exciting. I think if it had gone to routine administration, I think I would have submitted my resignation letter that said, somebody else should be in charge. But the thing about a place like MIT, with only a thousand faculty members, there are lots of leadership positions. And I think anyone here who becomes a full professor should assume that they have a responsibility, at some time in their career, to take these leadership things. I call them leadership. Maybe in a few cases it is administration. But MIT's a very dynamic place. So we're not sitting, we're not sitting down and just treading water for 20 years. We're always changing. So I think even most of those things that we might call administration, really are, you can act as a change agent in those as well.

INTERVIEWER: It seems like some faculty are very happy to accept those positions, and then they're equally as happy to go back to just to plain faculty member when the term is over.

LARSON: Well, yes. When I stepped down from CAES, I had more time then to do research, and interact with students, and do more teaching. I think that's what faculty members really thrive on. They love to work with the students, you have the best students in the world here at MIT, and we have great colleagues. So it's a balance. Part of your career you do this, part of your career you do that, and it ebbs and flows over the course of one's career.

INTERVIEWER: So I'm going to shift gears here again, and talk about your remarkable relationship with MIT. MIT history and numerology buffs will be interested in the fact that you entered MIT as a freshman in 1961, when MIT was celebrating its centennial. And next year, you'll be marking 50 years at MIT while MIT is celebrating its 150th anniversary. You have shared in one third of MIT's history, as an undergraduate, graduate student, faculty member, administrator, and even as a parent of an MIT student. To what degree do you feel part of MIT's history?

LARSON: Well, I feel that MIT is a huge fraction of my life. I can't separate my life from MIT. Of course I have my family, too, which is extremely important. But I have visited other places on sabbatical, and many conferences and other things, and I have to say, the grass is not greener anyplace else. This is a unique place. They encourage you to do different things. Follow your passions, step out of your comfort zone. And that makes MIT a unique place. Now, obviously since I've been here for 50 years, you didn't mention that I came in at age six. We don't want to divulge my age! Yes. But I came in as a freshman at age 18, I'm still here, and as my mother used to say, it's life imprisonment at the same institution, haven't figured out how to escape. But I'm not trying to escape, so that's great.

But there are many different attributes of MIT that make it a very attractive place to be. As I said, number one is the students. Number two is the culture here, which allows you to pursue what you think is important to pursue.

INTERVIEWER: When you came in 1961, how did MIT's celebration of its centennial manifest itself? What do you remember about it?

LARSON: Well, let's see. I was a freshman thinking that they had made a mistake admitting me, so I didn't really focus that much on the centennial. I did notice it was occurring. Kresge Auditorium was a new thing people were very proud of at the time. We had maybe half the buildings that we have now.

The student body, undergraduate body, was about the same, about 1000 students per class. Interestingly, though, the fraction of the undergraduate class which was female was less than 5 percent. So, like you'd say to one of your friends, oh! I saw a co-ed today! Oh! Where did you spot her? It was like a sighting of a rare bird or something, or a rare animal. And right now, I think we're very proud of the fact that almost 50 percent of the undergraduates at MIT are female. I think it's just lower than 50 percent. And that is a dramatic change, compared to when I entered as a freshman.

INTERVIEWER: What other changes have you noticed in the student body over that 50-year span?

LARSON: What other changes. I think the students who come to MIT now, the freshmen, have a much richer background in terms of extracurricular activities, giving back to society, forming little NGOs in high school. I mean, I read their resumes, when did these people sleep? And some of them have taken 12 AP tests, and gotten credits for that, jumped right into sophomore year, and I'm thinking, my God, thank goodness I'm not 18 now and applying, because they'd never let me in! So there's that aspect. The graduate student side, I would say there are many more international students, particularly from Asia, Far East and South Asia, and South America, and that's very interesting. The graduate enrollment has increased, as our research volume has increased, and our number of buildings and laboratory-supported research has increased. So I think those are some of the major changes.

The culture of MIT, though, has more or less been nicely constant-- about pursuing your passions, stepping out of your comfort zone, and always viewing students as number one. One very interesting thing about MIT is that all the faculty agree and acknowledge that undergraduate teaching is very important. We don't farm that out to outside contractors. There's a lot of energy into our undergraduate teaching. And if you look at OpenCourseWare, MIT's OpenCourseWare, and see, for instance, some of the videos of some of the lectures-- Walter Lewin, Gil Strang and others, you see the quality of the teaching that goes to our undergraduates. And that has remained constant throughout these 50 years.

INTERVIEWER: And some of them are Nobel laureates that are still teaching.

LARSON: Some of them are Nobel laureates that are still teaching, it's remarkable.

INTERVIEWER: So in terms of MIT's uniqueness, what is the significance of MIT's interdisciplinary and collaborative approach to problem solving?

LARSON: I think I mentioned before that MIT gets around the silos of the traditional academic departments by traditionally inventing cross-disciplinary laboratories like CSAIL in computer science, the RLE, Research Laboratory of Electronics and others, now in the biological areas. So you bring people together, not only from different departments, but from different schools.

INTERVIEWER: Was that true back when you first started?

LARSON: RLE, I believe, started in 1952 or so. So it was true then. And so you have this matrix organization, where you've got the vertical silos-- the academic departments, which are very traditional-- and you have the ability to create, and un-create, these cross-disciplinary things. And so that has allowed that kind of flexibility, which fosters it. And it's led to my current academic department, which is a division, Engineering Systems Division, which just celebrated its 10th birthday, and that really is a permanent tenure track position organization, which draws people from maybe a dozen different departments in three or four different schools.

INTERVIEWER: On a larger scale, what do you see as MIT's role, both nationally and globally?

LARSON: That's a tough one! You know, MIT's a small place. We have 4000 plus undergraduates, we have 5000 to 6000, depending on how you count, graduates, and on the scale of size, if you look at other universities, there are many, many universities that are much larger than ours. And yet there's a lot of pressure, and a lot of opportunities, for MIT to make major contributions overseas. And we do have major involvement now, particularly in the Middle East, and the Far East, and faculty members love to get involved with all kinds of areas. BLOSSOMS is involved with Pakistan, Jordan, Lebanon, we're in discussion with six other countries. Right now, as we speak, there's great concern about Haiti. And can MIT help with the educational processes in Haiti? We're involved with that, to some extent, with about twelve other faculty members.

We have to be careful, though, not to stretch too far. Because there are only 1000 faculty members, only, you know, 9000 students. We're not massive, we're small. So I think MIT is going to have to be very careful, and carefully select, and do a really good job in a few places, rather than stretch too thin, and then all of a sudden we find ourselves in a situation where we do a bad job because we're overstretched.

The same thing, the same kind of culture occurs with our undergraduates, here on campus. The story is that MIT is a candy store. There's a lot of candy in the store. There's a lot of things, and as an undergraduate, you don't want to eat so much candy you get a stomachache. And so the idea is to know when to be selective, how to be selective, and just to concentrate your efforts on that area that you select.

INTERVIEWER: Can you talk a little bit about when MIT Faculty have been leveraged, to or have applied themselves to creating MIT-like universities in other places in the world?

LARSON: Well, before my time, I know that MIT was very much involved with creating one of the IIT's in India. I think this started in the 50s and went into the 60s. And you look at this, and it takes generations to create a world-class university. But I think MIT's very proud of that. I believe that MIT played a major role in creating Sharif University in Tehran, Iran. And even today, with the problematic government of Iran, that remains a world-class university. Their students often beat MIT students at international robot and other kind of competitions. And MIT is now creating a new university in Singapore, and some of my best friends are spending six months a year in Singapore, creating that engineering design university. And we are currently involved in some countries in the Middle East, doing some university creation there, as well, or close interaction, for instance with the mechanical engineering department. So I think a lot of countries look at MIT and say, how can we get some of the culture of MIT? How can we get some of that excellence, the commitment to excellence? How can we get it here in our country? And that gives us many opportunities to do that, and we have to be very selective and do it in a small number of places so we do it well.

INTERVIEWER: Dick, you stated earlier that today's MIT student body is broader than, than certainly your classmates were when you were an undergraduate. Have the core requirements changed at all, or are they somewhat similar to where they were back then?

LARSON: Well, that's an excellent question. The core requirements of being really solid and strong in math and science are just as rigorous today as they were in 1961, when I entered. And so there's no letup in that. In fact, the other guy from my high school who got in had memorized pi to 100 places, and that was kind of the stereotype of the incoming MIT engineer. And I thought, well, maybe with the breadth requirements we have right now, because it seems like everyone has started their own social service organization, NGO in high school, and they've been the star of a football or tennis team or something, and I'm thinking, you know, where did they get time for this, but is the MIT stereotype totally dead? No, one of the freshmen I'm currently teaching has memorized pi to 278 places! And probably has tested out of first three math courses. So people who enter MIT are just as strong as ever in math and science. But they have all these other things on their resume, that I'm exhausted when I read the resumes. My goodness, how they done this in 18 years of life!

INTERVIEWER: And how has the faculty changed over the years?

LARSON: How has the faculty changed over the years. Well, I have to say, I think the faculty, in terms of commitment to excellence, is unchanged. It's been a constant over the time. The faculty has grown in numbers to 1000, but it's been more or less 1000 for a long time. There are different departments. Some departments which existed when I came no longer exist, and there are some new departments now, particularly strength in the biological sciences and biological engineering. The Sloan School of Management has gotten larger, and is offering an MIT undergraduate option, which I don't think was available when I was there, and it's very popular. But the faculty's commitment to excellence, commitment to MIT, commitment to teaching its students, has been unwavering during the whole 50 years.

INTERVIEWER: What are some of the key institutional turning points you have witnessed during your 50 years here?

LARSON: Key institutional turning points. Well, there are particular things which changed a lot. I think MIT OpenCourseWare is a recent one, where president Charles M. Vest was president, and he agreed with an a-ha moment, why don't we post, free of charge, on the internet, the content of all of MIT's 2000 courses? People thought MIT was insane to do this. And now we've done it, and I think the worldwide reputation of MIT has just advanced orders of magnitude as a result. Not that their reputation wasn't excellent before. But the fact that MIT would do this has it's been an exemplar to the rest of the world. Now other countries, universities in other countries, are doing this. And other places are translating MIT content. So the OpenCourseWare would be one.

I think creation of new entities, like the media lab, which spun out of the School of Architecture and Planning. The media lab is now a world-class, well-recognized thing, and it fills a domain involving technology, and science and engineering and education, and kind of off-the-wall, off-beat things, some of which fail, but many of which become transformational. That's another example of MIT going out of its comfort zone, going out of the tradition of the research university, inventing something new.

So things like that have happened during my life here, and it's just been fascinating to watch, and then to interact with new colleagues who would be affiliated with, for instance, the media lab.

INTERVIEWER: So looking forward, what would you like to see MIT accomplish, and how should it change in the future? What can MIT do better?

LARSON: Well, MIT should continue to go out of its own comfort zone, and to continue to strive to define what state-of-the-art research is, in a research university that has minds and hands as its philosophy, that you interact with the real world, you want to learn real important problems in the real world, help to frame, formulate, and solve them, and then impact the real world in a positive way. I think MIT's become increasingly international. It's going to have more impact internationally.

And hopefully, MIT can lead the research universities and colleges in cutting the escalating cost of education. Right now, to send a son or daughter to an MIT or a Princeton or a Stanford for a year of education here, costs more than a sports car. So you can buy four sports cars in four years, and save money, compared to sending your son or daughter, assuming there's no scholarship or fellowship. And MIT probably admits on a basis which doesn't consider the financial resources of the parents, so if somebody comes here that, they need scholarship support, or work support, or this sort of thing, they get it. And MIT's very proud of that.

But somehow, if you look at the past 20 or 30 years, the cost of on-campus education has gone up about three times that of inflation, and that has to stop. And so a big challenge for MIT would be, how can we leverage technology, technology that's from the other services industries? And education is the second largest service industry in the United States, after healthcare. And can we bring this technology into play, and somehow reduce the cost of education, and keep the excellence, and maybe even increase it. And I think that can be done. And if MIT's not going to do it, somebody else will. So that is one of the key challenges that, in my remaining years here, I'd like to have some impact on.

INTERVIEWER: That's a great segueway into the next question, and that was, what is the next chapter for Dick Larson at MIT?

LARSON: Well, the immediate chapter is a sabbatical next year! And I don't know. I've been here for 50 years, I don't think I'll be here for another 50 years. I love this place. People say, well, why aren't you retired? I say, well, if I were retired, and I wake up in the morning, what would I want to do? I want to do exactly what I'm doing now. So I'm just having too much fun, right now. And I've got a lot of energy and passion for BLOSSOMS, and this flu work we're doing right now, and other stuff, the MIT-Portugal program, and working with the students. Working with the students gives me lots of energy.

But, you know, there will be a time to say, OK, that's enough of that, and maybe I'll then retire and write a book about all this whole experience or whatever. But I think right now, my midterm goal is to get this STEM initiative in high schools, whether it's BLOSSOMS or something like that, and nationally and internationally, up to a level of sustainability and having some positive impact. I think if I could get it to that point, I think I would be very happy if that could be a capstone in my career here.

INTERVIEWER: So let's turn very briefly to one of the motivating reasons why we're sitting down today, and that is in recognition of MIT's upcoming 150th anniversary. In your mind, why is it important for MIT to be celebrating its 150th anniversary, and what should MIT be most proud of celebrating?

LARSON: Boy, that's a really interesting question. I think MIT has made so many contributions. Thousands of startups and spinoffs which have helped our economy prosper, and give jobs, not only to MIT graduates, but to many others from other places. Not necessarily even college graduates, high school graduates, et cetera. So on the one hand, on the economy, we've spun off, I think, more companies than any other university on the planet. So we can be very happy about that.

If you look at the foreign students who have come here and then gone back to their countries, many of them are leaders in their countries. Government leaders, ministers of education, rectors of universities, these sorts of things. MIT, for its size, has had a huge impact, both nationally and internationally. And you think about it, you might think of a stereotype of here's a computer company, or there's another high tech company. But no, we've sent people to Washington, we have people at work in the World Bank. So increasingly now, and in the biological sciences, we're having a huge impact. So there's a time to celebrate. Just like when we have birthdays, we say, we would like to celebrate our birthday. Well, this is a major birthday. So if you have a... I had a major birthday a few years ago, we won't say what it was! And it's time to reflect, and look back. And then also, it gives you a time to look for the future. So I would hope, as MIT is looking back, very proudly, over the past 150 years, it should look to the next 50 years, and come out with a set of objectives, to say, what are its objectives, in terms of size, location, interactivity with other countries, the cost of education, very, very important. All these things. I have full confidence that the next 50 years will be even better than the last 50 years.