PROFESSOR: Welcome to STS.050, History of MIT. I'm Professor Mindell. This is Professor Smith. And before we introduce ourselves or say anything about the class, I just want to do a little exercise about what do you know about the history of MIT, either big picture stuff or even random facts. Yep.

AUDIENCE: Used to be in Boston.

PROFESSOR: Sorry. Used to be in Boston. OK. That is correct.

PROFESSOR: Used to be called [INAUDIBLE] Boston. As sort of a nickname.

AUDIENCE: Don't remember.

AUDIENCE: Boston Tech.

PROFESSOR: Boston Tech. Yep.

AUDIENCE: I think it was founded in 1861.

PROFESSOR: That's correct.

PROFESSOR: Jeez. You don't need this class.

PROFESSOR: Yep.

AUDIENCE: I think because of the Civil War, it had to wait to open.

PROFESSOR: OK. That's correct, too. The American Civil War started right after the founding. And there weren't any classes taught for about four years.

AUDIENCE: It was founded by William Barton Rogers.

PROFESSOR: OK. That's also good.

PROFESSOR: What was his nickname?

AUDIENCE: Barty?

[LAUGHTER]

AUDIENCE: William Rogers.

PROFESSOR: I don't think he had a nickname.

AUDIENCE: William Bart Rogers.

PROFESSOR: Cool. Bart.

PROFESSOR: What was it? Do you know?

PROFESSOR: No.

PROFESSOR: Billy?

PROFESSOR: We had a house master over at Burton Conner. We had a reunion the other day, and they had a big picture William Barton Rogers. And one of the students came up and put a ID clip on and it said Billy. So maybe it's Billy.

PROFESSOR: Somebody sent me-- there is one sentence in all of his papers and letters and records which shows any amount of cheerfulness or playfulness, which is, I think it was after his brother died, he wrote to someone about six months later said, I'm finally starting to feel brisk again. He was a serious guy. What else do we know about MIT?

AUDIENCE: They got one of the federal land grants.

PROFESSOR: OK. Good. We'll certainly talk about what that means. Yep.

AUDIENCE: Me?

PROFESSOR: Yep.

AUDIENCE: I think at least when it started out, there weren't any female students.

PROFESSOR: OK. That's true. No women at first, but later on. We'll also talk a lot about that. Yep.

AUDIENCE: At some point there was discussion about wanting to merge with Harvard.

PROFESSOR: Oh, OK. Many points as it turns out.

PROFESSOR: Yeah. Five or six. We don't have to just talk about the founding in the early years. There's a lot of time in between. So. Yep.

AUDIENCE: It got a lot of money from Polaroid to build a new campus.

PROFESSOR: OK.

MERRITT ROE SMITH: Polaroid?

PROFESSOR: Polaroid?

AUDIENCE: It was one of the guys who started Kodak.

PROFESSOR: Eastman Kodak.

PROFESSOR: Kodak. Eastman Kodak. See, I knew he was gonna jump on you because he's from Rochester, New York, home of Eastman Kodak.

PROFESSOR: That's right. Yeah. Polaroid is a Boston company with ties to MIT, although not specifically an MIT spin-off, starting in the 1930s, really getting going in the '50s and '60s. Whereas Eastman Kodak started around the turn of the 20th century. Anybody know the year that MIT moved across the river from Boston to Cambridge?

AUDIENCE: 1916.

PROFESSOR: 1916. Right. So that's also a pretty important date. Nobody's mentioned anything that was invented here. Maybe nothing was.

AUDIENCE: Radar.

PROFESSOR: Sorry.

AUDIENCE: There was a lot of development for the radar--

PROFESSOR: OK. Radar, certainly. Anybody know where the radar development took place physically?

AUDIENCE: W 20. Or not W 20, Building 20.

PROFESSOR: Yeah.

PROFESSOR: Anybody know where that was?

AUDIENCE: Where Stata is right now.

PROFESSOR: Yeah. Right there.

PROFESSOR: To give you an idea how long I've been here, my first office was in Building 20. And, the offices in that building, it was like a WWII barracks. It was all made of wood, basically. It's a wonder it didn't burn down, all this stuff that went on in there.

But my office was huge. But the problem was that by the time I got there, it was pretty well run down. And there was a hole in the wall and squirrels used to run around inside and then dash out. Our colleague, Leo Marks, you'll hear about today, had an even bigger-- his office was like a one bedroom apartment over there. It's really cool. A lot of stuff went on there.

AUDIENCE: Which building is better, 20 or Stata?

PROFESSOR: I haven't had enough experience in Stata to tell you. Stata visually, of course, is far more interesting, but I hear it leaks. Building 20 didn't leak.

AUDIENCE: Except for the squirrels.

PROFESSOR: Pardon?

AUDIENCE: Except for the squirrels.

PROFESSOR: I still didn't hear.

AUDIENCE: Except for the squirrels.

PROFESSOR: Except for the squirrels. Yes.

PROFESSOR: Building 20 was built in, I think, under six months in 1940, 1941.

PROFESSOR: Yeah.

PROFESSOR: And it lasted for 50 years.

PROFESSOR: Well, it was torn down what? 10 years ago, maybe?

PROFESSOR: Yeah, not that long ago.

PROFESSOR: Not so long ago. Long ago in your lifetimes. But in mine, a mere drop.

PROFESSOR: Anything else?

AUDIENCE: The departments here have gone through a lot of changes.

PROFESSOR: OK. The departments certainly have. Although a lot of them are also quite similar. Yep.

AUDIENCE: During the 1960s, the basement of Building 10 was excavated for a super laser that was designed to bounce off a orbiting satellite out to the Soviet Union. That was one of our weapons in the Cold War that no one ever knew of.

PROFESSOR: Oh. That's news to me. I didn't know about that. Ah.

AUDIENCE: That's awesome.

PROFESSOR: Is it still there?

AUDIENCE: Yeah. It's a secret sub-basement.

[LAUGHTER]

PROFESSOR: You got to take us on a tour. Does anybody know how much secret research goes on on this campus? Military secret research?

AUDIENCE: None anymore?

PROFESSOR: That's right, none. Does MIT do any secret research?

PROFESSOR: Yeah.

AUDIENCE: Not that we know of.

PROFESSOR: Well.

[LAUGHTER]

PROFESSOR: No?

PROFESSOR: No?

PROFESSOR: Actually, MIT does a lot of secret research. It's just not--

PROFESSOR: Here.

PROFESSOR: Here. Where is it?

AUDIENCE: Lincoln Labs.

PROFESSOR: Lincoln Labs out in the suburbs. Yeah. So that's certainly a thing we'll come across, too, is Cold War and generally the relationships with the military. Anybody know what MIT's budget is roughly? $100 billion? $100 million?

AUDIENCE: Endowment's like $8 billion.

PROFESSOR: Yeah. Endowment's between $8 billion and $10 billion, depending on how you count. What do we spend every year? About $1 billion.

PROFESSOR: Really? My god. I didn't know it was that much.

PROFESSOR: A big part of that is actually at Lincoln Labs. I forget exactly. 10% or 20%.

AUDIENCE: I wonder how many people--

PROFESSOR: Work. Including students? How many students are there, first of all? Anybody know how many undergrads?

AUDIENCE: 4,000?

PROFESSOR: What is it? It's like 4,100 today or--

PROFESSOR: Is it? Really.

PROFESSOR: Around. It's about to grow a little bit to about 4,500. How many grad students?

AUDIENCE: 6,000.

PROFESSOR: About the same, 5,000 to 6,000. Then another 5,000 or so faculty and staff people and other kinds of researchers. Anybody know how many faculty there are? Roughly about 1,000. About 960 maybe.

PROFESSOR: Does that include adjuncts?

PROFESSOR: No.

AUDIENCE: Just straight regular faculty.

PROFESSOR: There aren't very many adjunct faculty, actually. So, about 1,000 faculty. Interestingly, that number has not grown more than 10% in the last 20 years. Whereas the budget and the general size of MIT has about tripled in that time frame. So, if you ever wonder why the professor seem overworked, that's why. Anything else about the history of MIT? Big accomplishments.

AUDIENCE: Nobel Prize winners.

PROFESSOR: Lots of Nobel Prize winners for sure.

AUDIENCE: Instrumentations Lab during the Apollo program. And apparently like a third of

NASA's astronauts have been MIT educated at some point.

PROFESSOR: OK. Big connection to NASA. MIT built the computers that landed on the Moon. I think about a third of the people who walked on the Moon were MIT graduates. And about a third of the total American astronauts had been MIT graduates, which I think is more than anywhere else. And I think that also I read a statistic where--

AUDIENCE: Other than military academies.

PROFESSOR: Sorry.

AUDIENCE: Other than military--

PROFESSOR: Other than the military academy. A third of all US human space flights have had MIT graduates on them. We're gonna have a big astronaut reunion this spring, actually, which you'll all be invited to as part of the class. Not all of them but quite a good number of them are coming back. So a lot of connections to the space program. What else?

PROFESSOR: Do you know who's chairing the 150th anniversary?

[LAUGHTER]

PROFESSOR: So we'll talk a little bit about that. Other facts about MIT?

AUDIENCE: Was high-speed photography developed by an MIT Professor?

PROFESSOR: Not exactly high-speed photography, but close. Anybody know what the actual technical part of that is?

AUDIENCE: He did the strobes.

PROFESSOR: Electronic strobes. So up until not that long ago, certainly in my lifetime, if you bought a camera, it came with flashbulbs which were like in a little cube. Anybody ever seen a flash cube? And they go pshh. And that was it. One picture and then they'd turn around. And you'd get four per cube. And Edgerton invented what is now on not only on your cameras but maybe even on your phones, the actual electronic

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strobe. Which means that you could fire it with a battery and it was basically usable hundreds of thousands of times, which had made possible high-speed photography. We'll talk about that a little bit. Other interesting facts about MIT? Anybody name a company that was started by MIT graduates?

AUDIENCE: Analog Devices.

PROFESSOR: Analog Devices is one. Sorry.

AUDIENCE: Bose.

PROFESSOR: Bose is one.

AUDIENCE: iRobot?

PROFESSOR: Sorry.

AUDIENCE: iRobot.

PROFESSOR: IRobot.

AUDIENCE: A123 Systems.

PROFESSOR: A123.

AUDIENCE: Harmonics.

PROFESSOR: Harmonics.

AUDIENCE: TerraFusion.

PROFESSOR: Sorry.

AUDIENCE: TerraFusion.

PROFESSOR: TerraFusion.

AUDIENCE: Dropbox.

PROFESSOR: Dropbox. That's right. I use Dropbox all the time. Not actually Polaroid. Raytheon was started partly by MIT folks.

MERRITT ROE SMITH: Miter.

PROFESSOR: The Miter Corporation. I'm just trying to think a little bit further back into time. Anybody ever hear of the Digital Equipment Corporation? That's kind of before this generation a little bit.

So obviously, nobody said anything too much about computers. Lot of the work in computing was done here, software, artificial intelligence, robotics. Human Genome Project. Anybody ever hear of that? Significant fraction of that was here. We'll come across 1,000 things that you didn't even think of were here. OK.

PROFESSOR: I think one of the great inventors is still living here-- I mean of the fairly distant past-- and that's Jay Forrester. Have you ever heard of him? What do you recollect, Eric? Pardon.

AUDIENCE: The Whirlwind computer.

PROFESSOR: Whirlwind, yes. And why was that a significant development? Do you remember? Well, you got the Whirlwind all right. It's the first core memory. One of the first random-access core memories, as I recollect. So it had great significance to the building of the type of computers that you're using and the desktops and all of that. It was very, very basic.

It's said that IBM really made its money off the use of that development. And I was in conversations many years ago in which President Wiesner expressed some discontent about the fact that IBM had not ponied up enough support money for MIT because it had gotten so much from MIT in terms of it's technical. I don't know how true that is. But Jerry Wiesner sure was not happy about that, I know that much.

PROFESSOR: Also, Whirlwind was sort of the first real-time interactive--

PROFESSOR: Yeah.

PROFESSOR: --computer, which was--

PROFESSOR: Where did the money come from it? Who supported that?

AUDIENCE: Navy?

PROFESSOR: Pardon.

AUDIENCE: The navy?

PROFESSOR: Well, partly navy, partly air force. Yeah. A lot of military contracting down here after World War II. We'll see that. I mean that's a big part of the system.

PROFESSOR: Anybody know where the Whirlwind computer was back in the days when computers had entire buildings themselves? It was on Mass Ave. in the Barta Building, which is now where IS&T is. Anybody know where that is?

PROFESSOR: Some people are shaking their heads almost in disgust. [LAUGHTER].

PROFESSOR: OK. So I just want to start with a little brainstorming about some of the things that are gonna come up over the course of the term. Maybe we'll introduce ourselves first. I'll ask Professor Smith to introduce himself, say a little bit about his research and stuff.

PROFESSOR: OK. Hi. My name full name is Merritt Roe Smith, but I go by my middle name, Roe. And I'm a member of two faculties here, the STS faculty that David chairs and also the history faculty. And I've been here since 1979. So I've been here quite a while.

And my research interests are primarily in 19th century industrial history and technology. And as I've said to many friends, my expertise falls off rapidly after World War I. But the good news is that his picks up rapidly in that period. And so David is the expert on the modern era of MIT's history. So we make a fairly good team. I will give the earlier lectures on William Barton Rogers and things like that.

I guess my main my main research has been about machine tools and the

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development of interchangeable parts manufacturing. And I'm particularly interested in that subject because that, too, was a military-sponsored technology that had a tremendous spin-off effect that once these new techniques were developed for making guns, the machine tools and gauging methods and things like that, were disseminated into all sorts of manufacturing, one of the first being sewing machines.

So it was primarily a technology used by women in which this gun making technology found it's earliest applications. And then you can see it spreading further out until you see the earliest automobiles in the United States being made with very similar methods that come right out of this old gun-making industry. So those are the sorts of things that I'm interested in basically is how new technologies develop and how they get disseminated.

PROFESSOR: So I'm David Mindell. As Roe mentioned, I'm in the program in Science, Technology, and Society as an historian of technology, which I'm the director of, and also in aeronautics and astronautics. I'm actually an electrical engineer interested in electronics and control systems. But these days a lot of my work in that area happens in the aerospace world so I'm dual in AeroAstro.

Most of my research is focused, as Roe mentioned, on 20th century, some of it military technology, particularly control systems and feedback control and digital computers. And I wrote a book about the Apollo program and the computers that we mentioned before that were used to land on the moon. And I'm generally interested in human machine interaction and the ways the evolving technology changes the rules of the users and of the people who are operating systems. And that's still something that I study today.

Done a lot of work in the undersea world doing exploration of the deep ocean with robots. Anybody here ever participate in the JASON project? In junior high? No. Did a lot of work with deep-sea robots exploring shipwrecks around the world. And that still interests me. And now I work a lot on space flight in aviation, too, and what roles people have in technological systems and how those roles change as technologies evolve and how the engineers who build those technologies think about people.

There's really sort of two or three things that led us to begin teaching this class. This is the second time we've taught it. We taught it last spring as well. And one of them is obvious, which is that, as you probably all know, this semester is MIT's 150th anniversary celebrations. And I've been chairing the planning committee for those celebrations for the last few years.

And when I started doing that, I didn't know anything about MIT. And in grand tradition, when you don't know anything about a subject, you get a bunch of students in a room and start teaching about it and you all sort of learn together. And so that was part of the idea for the class.

And then another part of the idea for the class was there's actually been only in the last few years enough really professionally written history about MIT. So that we won't spend the whole term talking about just the fraternities and sororities and the great inventions and the sort of great man history of MIT. We'll do some of that. But there's also been enough professional history where you can really talk about what is the history of science and technology? How does it evolve? How do technologies and knowledge evolve-- which is really what both Roe and I study in our different contexts-- and use MIT as a lens through which to look at that issue over the last 150 years.

So we will be looking at some of those larger questions. What counts as knowledge? How do engineers work? How do scientists work? How do they interact with the larger society, both the politics and the culture and the social questions? And how do they actually carry on their work day to day? And what does it mean to invent something or create a new idea? And fortunately, there's enough material out there on MIT that we can examine those questions through the history of MIT.

And then it happened that because Roe is a 19th-century expert and I work more on the 20th century, we kind of got together and roughly split the material. We'll go back and forth quite a bit as well, especially this term.

This term is a little bit special, more than a little bit. It's a lot special and a little bit different from last term in that the actual 150th celebrations are going on as we're

taking the class and teaching the class. And so you'll see a little bit about that as we pass out the syllabus.

So that's just sort of a rough introduction to the class. I also wanted to ask Michaela Thompson to introduce herself as our teaching assistant.

MICHAELA THOMPSON: Hi. I'm Michaela Thompson. I'm a third-year PhD student in the HASS program. And I study, basically, the history of biology and environmental history.

PROFESSOR: And among many other cool facts about Michaela is that if you go to the Boston Aquarium and see the penguins swimming around--

MICHAELA THOMPSON: I'm down in there with them.

PROFESSOR: She's the lady in the wetsuit feeding the penguins and swimming around with them. Maybe we'll take a field trip and come see her when she's working one day.

MICHAELA THOMPSON: I will be there and I will wave at all of you.

PROFESSOR: So maybe we should pass out the syllabus and we can sort of walk through. Any questions on what we've talked about so far?

MICHAELA THOMPSON: Is anybody missing a syllabus?

PROFESSOR: Oh, we already passed out. OK, good. I don't have one yet.

So just to go through the top, we really talked about this description. Again, there are a number of themes that are in this sort of first paragraph that will keep coming up again and again. The relationship of MIT to the surrounding city and the region and the country. Stories about MIT students and professors. The student body and who is an MIT student and how does that person-- there is no typical profile, or really at any time, but the student body changes quite a bit over the course of these 150 years. That's something we'll be looking at. The physical development of the

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campus. We talked about the move a little bit across the river.

MIT's relationship with industry. That's a big one, which is kind of a pendulum that swings every 10 years or so. Too much industrial involvement, not enough relevance to industry, too much industrial involvement, not enough-- practically see-- maybe somebody can calculate the period of that pendulum for us. It's pretty predictable, actually.

And then, also, MIT's relationship to the government, which you might guess moves almost exactly the same as the relationship to industry but in the opposite direction. Where are we now in that swing? Does anybody want to have a guess on that? I would say that we're probably at the point of just beginning the swing beginning away from government back toward industry for a while.

Because the stimulus package that Obama passed in 2008 was very, very supportive of MIT. And that's about to run out. And generally the government is about to run out of money altogether. And that's gonna be a big issue for MIT in the coming five years or so. And naturally that swings back toward industry.

A little bit about requirements. We do want you to come to class every week. We do want you to participate in the discussions. We will ask for you to close your laptops when we're having a class discussion, which is generally gonna be the second half of the class. You can use them for the notes and things in the first half of the class.

And then there's a series of reflection papers, which is a significant amount of the work over the course the term. We want you to submit them online to the TA. And, let's see what's the actual number. There are 11 class sessions where there is actually reading that's assigned. And so we're gonna ask you to submit eight reflection papers. So you can opt out of any three weeks over the course of the term.

And when you do submit the papers, we would like them to have them the night before by 5 o'clock. And there's a reason for that, which is then we'll compile all the questions and the thoughts the people have from those reflection papers and use

them as the starting point for the discussion the following day. So we need to have those then. We're not gonna grade them A, B, C, or D, but we do want to see people thinking through what's on the reflections. One to two pages is all that is required.

Then of those eight reflection papers-- you'll notice when we come to the syllabus that a number of the days that we meet in class are concurrent with the MIT 150th Symposia. And so if you like, you can write reflection paper on the symposia instead of on the readings for that week, with basically the same requirements.

And then they're going to be two writing assignments, basically two papers, which we'll send out the assignments for as the time goes closer. And one of the really nice things about teaching it this term, even as opposed to a year ago, is-- I'll show you in a few minutes. There's a vast amount of material, just raw material, on the web that's been made available from which we can use as research materials for these papers.

So there's the breakdown of the grading, 20% on the papers, big band on the writing assignment, and then class participation. Although, somehow that doesn't add up to 100. We must have missed a line from last year.

[LAUGHTER]

PROFESSOR: We'll get back to you on that one. Somehow we must have edited something. Oh no, sorry, there's two writing assignments, 70 and then 30.

There's the absence policy. There's really only one required book. I see one person's picked it up already, which is the book that David Kaiser-- our colleague-- edited called *Moments of Decision,* which they had no intention of this when they put this book together. But it really comes out almost perfectly as a textbook for the course. Do you want to say anything more about the book, Roe?

PROFESSOR: Well, the essays in it are not long. I'll tell you that. Each essay's around 15 printed pages, 17, somewhere in there. So they're easily read.

I've read the entire book twice now. And I contributed an essay to it. But quite apart from my essay, I actually think these essays are pretty damn good.

And it's the sort of book that you can use in this class. And then you could turn around and give it to your parents or somebody like that because it does a good encapsulated history of MIT at certain-- it's not a complete history of MIT. But it looks at the critical moments. And I think it's a good little book. I'll say that much.

PROFESSOR: Good, I agree. I should say also next Tuesday, February 15, from 4:00 to 6:00 we're having an event as part of the 150th that is more or less the authors from these books getting together to talk about the history of MIT. And so you'd be welcome to join us for that.

And then there are going to be additional readings, a fairly significant amount of them, available on the MIT site. I'm sure you've all taken humanities classes at MIT before. There's a lot of reading in the humanities. That's sort of the equivalent of the problem sets is reading through a fairly large amount of material and absorbing it and then fitting it into the rest of the material. So that's a very important part of the class. And we do expect you to spend sort of the equivalent amount of time that you would spend on a problem set in a science class on the reading.

So just to go through a little bit week by week, what we'll do today, when we're done going through the syllabus, I want to show you a little video about the founding of MIT and then a little bit about web resources. And then we'll take a break, which we'll always do about halfway through the three hour period because it is a long time period.

And during the break, we'll give you extra time to read an article that we'll pass out which is about the birth and the idea of technology, which turns out is not a very old idea and is almost exactly the same age as MIT. The t in MIT was one of the very significant first uses of the word technology. And then we'll come back for a little discussion of the ideas in that article.

And then toward the end of the class, Karen Arenson will come in. And she actually

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is past president of the MIT Alumni Association and Brass member of the Corporation. But also is a journalist who conducted 100 or so oral history interviews with people about the last 40 years of MIT. And she'll talk a little bit about that process.

Then next week, we go way back before even the founding. Do you want to say anything about that week, Roe?

PROFESSOR: Well yeah, the second week is basically trying to put MIT in a larger context. So I'm going to give a lecture about the United States circa 1850, 1860, the years that William Barton Rogers was beginning to formulate this plan for what he called a "polytechnic institute." And so the readings here, there are two readings.

One of them is from a textbook that I was one of the co-authors of. It's the one that's listed under Pauline Maier's name. Actually, the pages you'll be reading there are pages that I've written in the text on the 1850's basically. So you'll get my take on that period from the textbook, basically.

And then the other reading is, I would say, a broader cultural, political look at the United States between 1820 and 1860 that looks very broadly at society. So that's even a bigger picture of the United States during this period. And the idea here is just to kind of immerse you in that period to get you thinking about why was a technical institute necessary at this point in time? Why 1861 and not 1900 or sometime like that?

It turns out that MIT's founding, it occurs at a very important moment in history. And one of the things I want to talk about in my lecture is why 1861 basically. Why is this the right moment to found an institute of technology?

There's none other like it prior to the Civil War. There were other engineering schools, but not like MIT. MIT was different.

And I'll say one thing too about this place. The more I learn about MIT, the more I'm amazed by it. It's really an interesting place. And I didn't know much about MIT's history until about two years ago when I started preparing for this essay on William

Barton Rogers. But the more I learn about it, the more captivated I've become by the history of this place and all the things that it's done.

I don't think there's another educational institution, or surely a higher educational institution, in the United States that has had a more interesting history than this place has. We're sure to get arguments from people up the street. But that's just my own personal perspective. It's quite a remarkable institution.

And it takes root in the middle of the American Civil War of all times, one of the worst possible moments to try to found a college. How did that happen? So that's what that second week is basically about is how did this place get started? And why?

PROFESSOR: Because we'll come across this then, too. The actual date of the signing of the charter for MIT is April 10, 1861. April 12, 1861 is the firing on Fort Sumter, which is the first combat of the Civil War. So you'll see this next week.

Poor William Barton Rogers spends 30 years pursuing his dream and finally achieves it. And then the whole country blows up in his face basically.

PROFESSOR: Not a good time.

PROFESSOR: So the next week too then we also focus on the founding and the early years. You want to just walk through this part of the syllabus?

PROFESSOR: Yeah, the third week will be mainly about William Barton Rogers and his vision for the institute and how this place gets started. And in the essay you'll read in this little book here, you'll see that I have some things to say about the role the government played in giving MIT the wherewithal to get started. The state of Massachusetts grants it land over in Boston. And then it subvents it to the tune of-- I don't know how many current dollars. But I think it's around $300,000, a lot of money in those days.

But without that money, initial seed money basically, MIT would have had an almost impossible time. Because once the government of Massachusetts signed on to this

place and said, we'll give you a charter. We'll give you some land. And we'll give you some money. That gave a signal to private donors that this place had a future. And that it was worth investing in. And then, of course, there were private donations that were very important too.

But it's that sort of story I want to talk about is how did Rogers get the place started? And then who were the early faculty that he recruited? Because it takes off in an extremely interesting way and in a way that really comports nicely with what MIT is all about today. The original ideals of MIT in 1865 and those today are not that different in my opinion.

There are differences. But the Mens et Manus theme in the seal is a very interesting and revealing way to think about this place. It hasn't changed. Well, it's changed, but-- so that's the third week.

And then the fourth week is basically-- well, it's about two things. One of you mentioned earlier about Harvard trying to take over MIT. And that's a fascinating story. Harvard makes that attempt at least five times, if not six, starting in 1872 and continuing up until World War I or thereabouts. And each time-- well, it comes very close once in the early 1900's.

There was actually a time when you could get a joint degree from Harvard and MIT. And it was looking very much like the two places might merge. But it never happened. But that's an interesting story that all MIT alums like to talk about and students I suppose.

And then the other part of it is how this new campus, the so-called campus, that we're on today, how did that come about? And of course, it wouldn't have happened without George Eastman first of all. George Eastman put up an amazing number of dollars to build the main part of the campus here. The big dome buildings and all that were all built with Eastman money.

And it's an interesting story because I forget exactly how much he granted MIT initially. But President Maclaurin, who was the president of MIT at that time, kept

going back to him. George, could you put a little more on the till here? And each time he'd write a check, very, very generous.

And he wasn't a MIT graduate. I don't think he had any MIT affiliation. But he employed some MIT graduates. And I think that was what-- he thought, they produce a good product down there. I'm going to support that school. And so that's basically why he put up so much money to build a campus.

But we'll have Mark Jarzombek come in. He's written a book about the physical facility or the campus itself, the building of the campus. And he'll be the guest speaker that day. And he has really interesting things to say. He's written a book about that topic. But they'll be some good visuals that you'll be able to see in this too.

PROFESSOR: And that's really kind of the end of the beginning for MIT.

PROFESSOR: Yep.

PROFESSOR: In that. And people at the time, you'll see them say, up until that point there was always money trouble. We never knew if we were going to be around in five years. But once they move over to this side of the campus and they build the buildings, which puts them in a bit of a hole for a while financially, but really is the time that MIT arrived. And they feel like that it's really become something that's going to be lasting, only 50 years after the founding.

Then the next week we move into what people sometimes call the progressive era, the age of big business also. And actually our guest speaker is Ross Bassett, who was a colleague of ours, not from here. He's written a very interesting piece, which we'll read, about students from India coming to MIT in the 1930's. And there were only about 20 or 30 students from India coming to MIT during that whole 10 year period. But they were all from the 20 or 30 most prominent families in India and went back and did amazing things in their own countries as well. And that's the sort of jumping off point for our conversation about MIT's relationships with the rest of the world and the positioning of MIT as a global university, which is obviously a very

big thing today.

And again, there's a lot of issues there during that period about industry and the appropriate role of industry. And people are feeling at the time that MIT has gotten much too close to industry. And professors are behaving more like consultants than they are like scientists. And that all sort of turns around in 1930.

We'll talk about that in week six, both the relationships with the military during World War I and the hiring of Karl Compton in 1930, who was the first scientist-- I think he's the first scientist or the first physical scientist who leads MIT and really brings the institute back toward a basic science foundation, which is still something that you'll see in your own educations, and sets it up for the second World War in a way. So that's the middle of March.

Then in week seven there's one of the symposia for the 150th. There are six symposia over the course of the semester about the 150th anniversary. And two or three of them are meeting on a time that happens to be a Monday. And I have to be there all day anyway because I'm introducing it and sort of put it together.

And what we'll do is we'll have class time just be attend the symposium. Now, you don't have to actually attend the three hours 1:00 to 4:00. We happen to know that's free in your schedule. So that's a good time to go. But any three hours over the course of those two days will be fine.

And that one is about women in science and engineering at MIT, which is a pretty major part of the history in the last 10 years here starting just about 10 years ago with a very famous report that came out, which was, in a sense, nothing short of revolutionary. And actually, Lotte Bailyn, who wrote the article in this book-- the Kaiser book-- about that moment also was one of the key authors of that women in science report and is one of the organizers of that symposium.

PROFESSOR: One other point is to note now week six, we're dealing with the '20s and '30s. And now in week seven, we're kind of jumping chronological a little bit to more current events. We have to do that because the symposia is scheduled at this time. So

there's going to be some jumping around here that we can't avoid. But the themes are sufficiently important that we think that going to that symposia would be extremely interesting and educational.

PROFESSOR: Yeah, on the one hand, we're roughly moving chronologically over the course of the term. But inevitably, even as we've been doing already today, we're going to jump around throughout the 150 year history because things will come up that are relevant today or things that were past. So the class is not organized around the idea of suspense where wait and see what happens in the 1980s that you'll only learn in the last week. You're going to incorporate that over the course of the term.

Then on week eight, we're going to actually meet at the MIT Museum where they have a special exhibition about MIT. Has anybody been to the exhibition so far? So they put that together for the 150th anniversary. It almost reads like a syllabus for the class in some ways and also does a really good job of tying these larger themes together about different kinds of innovation and education and how those two things tie together. And Debbie Douglas, who was the curator who put that together, will give us our personal tour through that exhibit.

It's not actually part of class time. But then I just put on the syllabus April 10 is the convocation, which is the ceremonial center of the 150th anniversary. It's open to all faculty, staff, and students and alums and happens down at the Boston convention center. So I certainly encourage you all to go.

The governor of Massachusetts will be there. Quite a number of other high profile speakers will be there. And I'll show you a little bit later about the mid-century convocation, which happened in 1949, which it's roughly modeled on.

Then that very week, actually it's the day after, is a symposium on computation and the transformation of practically everything. Again, that one happens to meet on a Monday. So class will just be attending the symposium that day. Excuse me.

Then we kind of pick up our historical thread again with World War II, also really quite a critical turning point for the institute. One that I've done a lot of work on that

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really begins to see where we are today.

Then we'll go into the Cold War. Again, one could teach an entire class on MIT in the Cold War as one of our colleagues, David Kaiser, actually teaches a class on science and the Cold War.

And then week 12, we sort of bring it up to the last 40 years or so. And in a way, that's been the hardest part of the class to teach because it's not yet history as much as the rest of it is. And yet, it's still in the making.

And actually, the final writing assignment really is partly to ask you guys to help make that history of the last 40 years or so. Because there's a lot of things that haven't been written about that we don't really know that some research into the archives will really help us with. Although this year, we have the oral histories that we didn't have last year. And I'll show you those in a moment.

So it's actually going to be a pretty packed semester. There's a lot going on. It's a big history. There's a lot that happened. But we'll hope you'll get some sense both for where the place that you're going to school at came from, why you are expected to take the classes that you're expected to take-- the GIRs in particular-- what is the philosophy behind the education that you're getting, no matter what major you're in.

How many people are undergrads here by the way? Any grad students? Couple of grad students.

And those are two things-- we'll talk about how those two things, the undergrad and the grad experience, relate to each other. And hopefully at the end of the term it will all make perfect sense to all of you. Any questions about the syllabus or assignments or any of those things?

One of the really interesting things about the 150th and about teaching the class and writing this book and a lot of the other things we're doing is that there isn't really a fixed history of MIT. And as any historian will tell you, what constitutes the history of any subject changes in each generation and in a sense is constantly rewritten. We like to think we don't write too much of it according to today's values and points

of view. And at the same time, we always know that we see things from our point of view.

And so you look back. And you see things that are important in one generation that were less important in another generation and vice versa. And what's been really interesting about the last couple years and the next few months is that we are again rewriting the history of MIT. This book is one attempt to do that.

And one of the things that came out of that was this little video that I want to show you which, in a way, really will anticipate a lot of the themes for the reading for next week. It really gets us started on how we think about these things. And over the course of the 150 you'll see we put together about five or six 12 minute videos on different aspects of the institute.

Some of them are more historical. Some of them are more current day. One of them focuses on students and student life. One of them focuses on entrepreneurship. And this one focuses on the founding of MIT. And you'll see, maybe, a familiar name or face in there.

[VIDEO PLAYBACK]

-Today's Massachusetts Institute of Technology is a world class center for teaching and research. Faculty, students, and researchers are united in their goal to advance the frontiers of knowledge and solve contemporary real world problems, following the vision laid out for MIT 150 years ago. But the place itself has certainly evolved and flourished since those early days. It's hard to imagine how much the scientific landscape has changed from when founder William Barton Rogers first started thinking about a new kind of polytechnic institute.

-William Barton Rogers was born at the beginning of the 19th century. And that marks the beginning of an extraordinary time in US history. It's really the transition that we're going to witness over a century from an agrarian, rural country into an urban and industrial country.

-We're beginning to see the emergence of large cities, factories, railroads, canals,

all the early instruments of big time industry in the United States.

-There's surveying involved. There's mechanical engineering. There's geology. There's all kinds of civil engineering.

-The sense of possibility of what this new technology would mean for the country was very much on Rogers' mind.

-William Barton Rogers had a lifelong interest in education. And by 1835, he's a professor at the University of Virginia. He soon signs on to lead a geological survey for the state. Though he loves the project, he has a big problem finding qualified workers.

-Rogers' inability to hire workers for his survey, that combined scientific knowledge and the ability to use technical apparatus, was a great problem to his way of thinking. He wasn't the only person that needed an individual with that skill. The world was filled with new industries. And they all needed people that combined smarts and skill.

-Eventually, Rogers decides to leave behind the frustrations and political turmoil he's encountered in Virginia's slave society and moved north to the vibrant city of Boston.

-Boston was one of the leading commercial centers of the country. And the area surrounding Boston was without question the most developed industrially of any state in the union.

-There probably was not an American city that had more of a need for engineers than Boston. The city itself was being transformed by one of the greatest engineering projects of the 19th century, the filling in of the back bay.

-And then you had these reform movements, temperance movements, pacifist movements, and of course the famous anti-slavery abolitionist movement. This was the place. Boston was so radical in its reform spirit.

-The wealth generated by all of this industry Bostonians put into various philanthropic enterprises, endowing schools, hospitals, libraries, museums, various institutions which benefit the broader community.

-Rogers writes in his memoirs how much he likes the so-called enterprising spirit and even uses the word knowledge seeking spirit of this area.

-For decades, Rogers had been talking with his brother Henry about a new kind of polytechnic institution.

-At the time, the ideals of science really focused on fundamental principles somewhat disconnected from the real problems of industry and the people who worked in industry.

-They began thinking about how to incorporate science into what they referred to as the useful arts. Today we would call that technology.

-It's a revolutionary idea that someone will go to school to get training to become an architect, an engineer, a scientist. These are typically occupations that people would learn by doing.

-This was experimental from the get go. Even the word technology was new at that time.

-He wanted students who had a grasp of human nature, of basic sciences, of mathematics far beyond the requirements for making this or that machine work. He wanted to train students who would be able to kind of guide the nation through industrialization, not just build the widgets.

-Different players are coming together, trying to bring a bunch of different scientific and practical institutions together. And Rogers proves very skilled at taking that set of people and orienting their ideas toward his proposal.

-They knew it was going to be in Boston, and the land in Back Bay was the place to put it. So they were going to have to convince the Massachusetts state legislature that not only was the school worth establishing, but that it was worth designating a

piece of land for.

-The proposal was brought to the state of Massachusetts. And the first step is to essentially incorporate it as a state corporation. And that's what we celebrate on the founding day of April 10, 1861, when the governor finally signs the MIT charter.

-Just two days after MIT's founding on April 10 in 1861, the first shots are fired on Fort Sumter in South Carolina. And with the start of the Civil War, it meant that classes at MIT could not start right away. This proved fortuitous for MIT, because it allowed them the opportunity to raise additional funds-- to acquire the land, to start construction, to hire faculty.

-One can imagine that when Rogers tried to raise money-- it's wartime, and energies are being devoted to other things. Yet on the other hand, if we have optimism about the outcome of the war, we can see the necessity for young men and women to become engineers and scientists, to be able to solve these other problems.

-When the Morrill Act is passed in Washington in 1862, it grants every state some land that then they can either use or sell to found an agricultural or mechanical institution.

-Rogers and his colleagues won support from the state legislature that a portion of the funds from the Land Grant Act would be dedicated to this new school, assuming that they could raise the other funds successfully. And then they had to go out, house by house, factory to factory, and convince people one at a time to donate funds to support this enterprise.

-As the war is ending in 1865, the Massachusetts Institute of Technology holds its first classes in rented space in downtown Boston's Mercantile Building while constructing its own buildings near Copley Square. Rogers' vision for a new kind of education, with its emphasis on hands on learning, made it crucial to establish cutting edge laboratories.

-Rogers had a very strong reaction against what he considered rote learning. And so from the beginning, MIT was a great innovator in getting laboratory work right down to the earliest levels of the curriculum. Entry undergraduate students would be entitled to do a lot of work in the laboratories with their own hands, not just seeing someone else demonstrate some effect.

-Rogers needed faculty who were going to be willing to invent a new kind of curriculum. That they were going to have to cobble together for the first time ever laboratory exercises.

-He allowed his professors to basically experiment with it, tinker with it, adjust it, and build the program. I think of Pickering in physics, for example. Professor Storer, who was one of the early chemists at MIT. And both of them become very famous. And they're producing textbooks to accompany the lab oriented educational process.

-You look at the curriculum offered in that very first set of classes at MIT in 1865-- it looks a lot like what we call the GIRs today, the General Institute Requirements, that still every freshman has to take. Mathematics, chemistry, physics-- those are all required at MIT from day one.

-There was an emphasis on combining basic science with applied things in the field. Students took field trips to all kinds of working places, where the technological world was being built. And Barton Rogers wanted all that right in the curriculum for his undergraduates, right from the start.

-As a young startup, MIT had its share of hurdles-- ongoing money troubles, takeover attempts by neighboring Harvard. But with every passing year, with every successful student who went on to make his or her mark in the world, MIT's reputation grew, and the school's standing became more and more secure. By 1894, President Francis Amasa Walker was able to declare in his annual report that the battle of the new education is won, proclaiming that the influence of MIT and its innovative ways are now recognized far and wide.

-In the early years, the MIT way of doing business, with a great deal of emphasis on

hands on and doing things in reality, contrasted very substantially with the more classically oriented education. But today, even for those institutions which are more classically oriented liberal arts, they have moved, actually, towards MIT.

-By the time operations moved across the Charles to the brand new Cambridge campus in 1916, MIT's ongoing future seemed assured. Over the decades, the roadmap Rogers laid out for his school has proved flexible enough to stay true to his founding ideals while incorporating new fields as they emerge.

-There have been a lot of continuities in the history of MIT, especially around the type of curriculum that students are required to follow. There's surely a greater range choice today, but the emphasis on combining science with practice is still an important dimension of what is happening around the Institute today.

-That idea of mind and hands-- mens et manus-- that goes right back to the beginnings of MIT. And it's coincident with the idea that learning takes place by doing, as well just by seeing.

-MIT today shows remarkable commitment to the original vision articulated by William Barton Rogers of a place that solves great problems, that educates students who have the capacity to be independent in their thinking. Those commitments are timeless, and stretch across 150 years.

[MUSIC PLAYING]

[END VIDEO PLAYBACK]

AUDIENCE: Is this part of a bigger series, or is this just one?

PROFESSOR: So as I mentioned, there's five or six of these coming out. But it's not like the class. They're not going chronologically. One is on entrepreneurship. One is on the student body. They'll each have a little history in them, but it's not a consecutive series.

When they first wanted to do this, they said, well, we'll do one from 1861 to 1916. And we really pushed them to go back into that earlier period, and the background

AUDIENCE: I feel like there were three people who kept talking, and two of them were you two. Who was the third one?

PROFESSOR: The third one-- the woman was Debbie Douglas, who is the curator at the museum, who we'll meet when we go over there. And we'll also read a chapter of hers, I think, in the book.

AUDIENCE: How recently did this come out?

PROFESSOR: Two months ago. It was just released. It was released on the day that 150th opened, which was January 7. So it's brand new, basically. Yeah, Michelle?

AUDIENCE: Who produced it?

PROFESSOR: Who produced it? Larry Gallagher, who heads AV, produced it. And then it was directed by a woman named--

PROFESSOR: Maggie Villiger.

PROFESSOR: Maggie Villiger. Actually, one of the interesting things that we're doing is for each of five of these videos, they're directed by a different person. So it's not going to be a consistent style across them. They're all going to have a slightly different style, which should make it kind of interesting.

AUDIENCE: At the beginning, I saw a lot of pictures with women in, for instance, classrooms. Is that--

PROFESSOR: Good question. That's a good question. MIT actually admitted women as special students quite early. Ellen Swallow Richards, who was the first actual graduate, also graduated quite early. I think 1878 was the year she graduated.

PROFESSOR: Somewhere around there. Somewhere in there.

PROFESSOR: My alma mater, which is Yale-- they started admitting students in 1969. But MIT was

way ahead of that curve.

Now, actually, it's a good question to ask Karen about when she comes here in a little while. Because she was a student here in the early '70s, I think. And it was very different from what it is today. It's not like there were-- and I think even-- I got here in 1991, and I believe at the undergraduate level, it was still only about 30% women. And now it's more like 50% or 55% women, I think. So it's come up a lot even in that period. So there have always been women here, but the proportions that you know of today are fairly recent.

But again, if you look at the Ivy League schools, they were in the Stone Age compared to MIT with how they handled and treated women.

AUDIENCE: So you guys in that video are saying that MIT sort of grew out of and contributed to the Boston area at the beginning, mostly. When did it sort of hit international and national prominence and become like a huge international technology institution?

PROFESSOR: That's a really good question, actually, and one of the things we'll look at again and again all semester. I think as the video talks about, New England was really attractive to William Barton Rogers. There's every reason that we could be celebrating the Virginia Institute of Technology's 150th anniversary, but we're not. He felt Virginia was not the place for this. That New England, for reasons that Roe will talk about next week, was much more suited to it.

I would guess that already by the late 19th century, a lot of the MIT graduates are going out west, and doing the surveys and engineering on the railroads and dams and water supplies. Fremont, one of the great surveyor engineers of the west, was an MIT graduate. He was maybe even a faculty member here, wasn't he?

PROFESSOR: John Fremont?

PROFESSOR: John Fremont.

PROFESSOR: No, I don't think so. But I'm trying to remember who-- there is someone in that guise, but it's not Fremont.

I think, with reference to your question about when does MIT start to achieve an international reputation, probably the real reputation comes during and after World War II. I mean, that's when MIT is really recognized as being a big time place internationally. There were surely hints of recognition in the late 19th century, the 1890s. When Francis Amasa Walker, after whom the Walker building is named, makes his annual report-- I think it's in 1894 or thereabouts-- in which he says the battle of the new education is won, clearly he was making a reference to the fact that MIT was being recognized not only by American higher educational institutions, but by that time, there were foreign students beginning to come. It's very small numbers, but still. So it's increasing, but it really doesn't hit the big center spot until-- I was going to say centerfold. That's not quite the right word.

[LAUGHTER]

PROFESSOR: But until, I would say, World War II, after World War II. So much was happening here, and it really became famous.

PROFESSOR: If you look in the sciences, well into the 1930s, if you're a bright young physicist, you're basically sent to Germany to get your PhD. And that changes, obviously, during the course of the second World War, not least because the Germans kicked out a lot of the good physicists and they all came here.

And also in 1940, when Vannevar Bush goes to Washington-- we'll talk about this-- and really founds the whole wartime research establishment, which includes the Manhattan Project, includes the radiation lab, includes the whole modern way that the federal government supports research, that's when you see MIT people really literally at the right hand of the president. I don't know that there would be any senior MIT person in a national political role before about then. We'll see over the course of the term, but I don't think of one.

Whereas after that, the first presidential science adviser ever appointed is James Killian, president of MIT. The second one, under John F Kennedy, is Jerry Wiesner, who later becomes president of MIT. On and on and on. And for the period of the

'50s and '60s, the place really acquires that national-- but also during the '50s, MIT faculty, much like they're doing today, are off abroad founding engineering schools in the MIT model all over the world.

I once went to a conference where I was seated at dinner-- it was an oil industry conference-- the guy I was next to was the associate oil minister for Iran, which is not the sort of person that Americans meet very often at conferences, because there aren't too many conferences where--

PROFESSOR: --you have the Iranians.

PROFESSOR: And I was sort of like, gee, what is this going to conversation. And he said, oh, MIT. My technical institute in Tehran that I went to was founded by MIT faculty on the MIT model. He had an enormous respect for what MIT represented in that country. And that's true in a lot of places in the Middle East, a lot of so-called developing nations during that period. The Indian Institutes of Technology-- it's not a coincidence, IIT is what they're called. There are many of them. And so that's one of the ways. And it's of course happening today in Singapore and other places in Asia, particularly, that new institutes are being founded with MIT's influence there.

AUDIENCE: So did we do Caltech?

PROFESSOR: Well, Caltech-- anybody know what it was called before it was the California Institute of Technology, which has some resonance to the name of this institution? It was called Throop College. And in the '20s or in the '30s-- I'm forgetting exactly when-- they changed the name to it California Institute of Technology. For many years, just the word "tech" meant MIT. And then gradually, all these other institutes formed, where they became Georgia Tech or Caltech or other places like that. And then the word, the "tech" term, became generic.

Most of you probably don't refer to this place as "Tech," do you? When you're home on break, you say, I've got to go back to Tech for this. But for many years, that's what people referred to it. Or they referred to it as "Technology" in the 19th century.

So yes, Caltech and Stanford, very much so. The father of Silicon Valley was a guy

named Frederick Terman, who got his PhD here in Vannevar Bush's lab in the late '20s and early '30s, and then moved out west. And Stanford, again, had been founded-- he didn't found Stanford-- but he really built up the model of a university as the center of a kind of industrial region, with Hewlett and Packard and many of those other early entrepreneurs. And so there's a lot of that kind of influence there.

You'll see this a lot in the reading in the next couple weeks-- useful arts. That's a phrase that Leo talked about that comes up all the time. It's in the MIT charter, I believe. And a useful way to think of that is not art as in fine art, like you'd go to the Museum of Fine Arts to see today, but art as in artisanal, artisans-- you know, a brick layer, a tile layer, a carpenter. Those were sort of more what people referred to when they used the term the "useful arts" then.

The steam engine and the locomotive is a machine. But a locomotive is only a very small part of what it takes to make a railroad. There's all this civil engineering that goes involved in laying the tracks, and maybe some surveying, and thinking about it as a system.

And then railroads and telegraphs came up really very much together. All the early telegraphs went along the railroad routes in this country. And so you almost can't even think about the railroad without thinking about a telegraph. There was even a book out recently called *The Victorian Internet,* a kind of early information network that ran around.

There's a famous book by a guy named Alfred Chandler at Harvard Business School. He talks about-- modern management arose as actually between the Worcester to Albany railroad. It was one of the first long railroads in the world, in Western Massachusetts and New York state. When that railroad was built, it was longer than 60 miles. And they started running into each other, the trains. And he said when you started building railroads that were bigger than 60 miles, all of a sudden-- hi, Karen. This is our speaker for our next hour. But we're talking a little bit about the idea of technology. When the railroad became longer than 60 miles, it needed a whole new organization just to coordinate who was on the tracks when

and keep the trains from running into each other.

And that's exactly the same kind of period about which Leo Marx is talking about, where suddenly you have these people called managers. There's nobody in the world called a "manager" before about 1840. And even then, they rise only gradually over the course of the 19th century.

You have these people called "managers." You have this whole organization. Yes, you have machines. But a machine is not a great way to describe it. And sure enough, right about then, if you look, you have this word-- it's not actually coined in 1829 by Jacob Bigelow, but it is sort of brought into a modern usage-- this word "technology."

And Leo really writes about why was it at this point in history you needed a new word for this, and what did this new word come to stand for. And even after 1829, the word wasn't used very much until the T in MIT. It was really one of the first significant uses of the word. And even then, you wouldn't see people using the word technology like they use it today until after World War II, really.

So you'd see a student today in a lab might say, I made a new technology for handling micropayments on the internet, or something like that. You'd never see that in 1940. They would say, I built an apparatus. They used that phrase a lot, even though they were working at MIT.

Technology is an abstraction. [INAUDIBLE] sort of [INAUDIBLE] these different things. And then when people start using it as a noun that actually has active agency in the world, what is that? It's a very strange way to talk. And we won't talk about it this way in the class.

Technology doesn't force people to do things. People build technologies. People like you build technologies. People do things with machines. People are influenced by certain kinds of forces. But technology itself is this sort of invisible thing that exists out there, that doesn't think, it doesn't have a mind, it doesn't have an address, doesn't pay taxes. It doesn't order anybody around.

Now, interestingly, in his conception when he wrote this paper, he had this idea that technology conjures up an idea of white men in lab coats sort of sitting at lab benches. More and more, personal technologies-- PCs and cellphones and things-- if you look in the technology section of either the bookstore or the newspaper, they don't even talk about airplanes and railroads and ships and submarines. They talk about basically personal information technology almost exclusively. So that word has come. And if you talk about the tech sector, they almost always mean the companies in Silicon Valley and a few companies around here who do this kind of stuff.

I once had an experience-- it was about 10 years ago already-- where Microsoft gave a whole bunch of money to MIT-- I think they still do it, it was what became what is now called iCampus-- to do research projects in technology and education. And the guy from Microsoft came and said, OK, we'll give $25 million to MIT for experiments in technology in education, technology in education, technology in education-- he kept repeating that phrase.

I said, oh, that's interesting. And I raised my hand and I said, what do you mean by technology? Do you mean like helicopters and submarines and ships? And the guy said, oh, no, no, I should clarify that. What we mean is personal computers running Microsoft software. Oh, OK. As long as we're clear on what we mean by technology in education. That's helpful. That was sort of an extreme case, but you see that around a lot.

But even then, it's still worth-- I happen to be reading a book by my colleague Sherry Turkle, which you may have seen. It's been in the news a lot. She was on Stephen Colbert a couple weeks ago talking about cellphone use, and particularly teenagers and technology. It says, "Why do we expect more from technology and less from each other?" She's a close colleague of mine and of Leo Marx's, but she's constantly using the word technology makes us do this, technology makes us do that, when actually, it's how we relate to our machines in a slightly different way.

So we sort of start out the class with this piece. And if you haven't finished it, please

do read the rest of it between now and next week, to give a little bit of historical perspective on what is the thing. We're at this Institute of Technology-- what do we really mean by that?

And the word can become so big that it can kind of encompass anything and everything. You can ask the same, by the way, about the word engineering. How many people are here engineering majors of one kind or another? So almost everybody. Science majors? Any? One, two?

And actually, the profession of engineering has almost the exact same kind of chronology as both the word technology and the history of MIT. Does anybody know what the first engineering school in the United States was?

AUDIENCE: West Point.

PROFESSOR: Yeah, West Point. 1804. It was not MIT. Second one was Rensselaer Polytechnic, RPI. And MIT was pretty much the third one, but almost 50 years later-- almost 60 years later from West Point.

So engineering as we know it today has its origins in what today we call civil engineering, but actually was really called military engineering. And all engineering was basically-- up until the beginning of the 19th century, all engineering was civil engineering, which meant roads, bridges, fortifications, a little bit of artillery work. And it's only in the course of the mid 19th century that you get-- in fact, the profession, the discipline of mechanical engineering, is a post Civil War thing, organized around steam engines and steam engineering.

In fact, the MIT department of mechanical engineering, as like many other departments of mechanical engineering, is formed by Navy steam engineers who come out of the Civil War Navy. Electrical engineering is even later. And all the other kinds of engineering are even later after that.

So you're all familiar with the course number story at MIT, right? That the course numbers are basically the chronology on which they were added. So course one is what?

AUDIENCE: Civil.

PROFESSOR: Civil. The environmental is added later. Actually pretty recently, I think within the last 10 or 15 years. Course two, Mechanical Engineering, comes next. Course three, Material Science, anybody know when the phrase "material science" comes from? That's a 1960s, '70s, '80s phrase. What was it before that?

AUDIENCE: Didn't it used to be mining?

PROFESSOR: Mining and Metallurgy. So that's a much more traditional way of thinking about that kind of engineering, very, very old way of kind of engineering, straight of alchemy, really. What's four?

AUDIENCE: Architecture.

PROFESSOR: Architecture, also very early. Five is Chemistry, also very early. Electrical Engineering, getting to be a little bit later. That's an effect of the 1880s. And then, on up from there.

AUDIENCE: Did course six used to be something different?

PROFESSOR: I think course six was always Electrical Engineering. I'm not exactly sure when the department itself was founded. It was probably around the turn of the century. But certainly, mechanical engineering is much older.

And mechanical engineering exists more or less prior to the science that supports it. In fact, most of the fundamental science in thermodynamics is done because of problems raised by steam engines. So it's not like the physicists worked out the thermo and then they built the steam engines. It's exactly the other way around.

Engineers built steam engines. And then, that raised problems of thermo that people needed to solve. Whereas, electrical engineering is much more-- you almost can't have it without the physics. And it's much more intimately tied with science, from its very foundings.

So it's quite, in a way, a much more different kind of engineering. Then you have AeroAstro as Course 16, much later on.

AUDIENCE: How can Electrical Engineering come before Biology?

PROFESSOR: Sorry?

AUDIENCE: Or Physics?

AUDIENCE: Yeah, why would Electrical Engineering come before Biology?

PROFESSOR: That's a good question. And I think, A, there were things that were taught at MIT that weren't necessarily departments, so various things at work. And we'll see, as we look in the next few weeks, the early MIT is a teaching school. It doesn't really become a research institution until rather later, in a fundamental way.

And so biology was the sort of thing-- and we'll see this-- that they did at Harvard because it had very little practical application, compared to other things. And Louis Agassiz, who was the great Harvard biologist, got into a very public a war with Charles Elliott, who was the president of MIT, over the issue of evolution.

And Physics-- you would think-- would be an earlier department. And I'm not exactly sure why that one was founded a little bit later. That's a good question. Yeah.

AUDIENCE: What about those that do not have numbers?

PROFESSOR: Those are mostly added later. Like my course, STS, comes from the '70s. And I think also, in general, you probably can find that around the 15s, 16s, the numbering system starts to break down. And it doesn't follow as much of a rational pattern.

Like, Course 21 is Humanities. Humanities have been around for a long time at MIT. But they weren't incorporated into a particular course, until after World War II.

And again, then, some of the earlier ones, like Mining and Metallurgy, is transformed into Material Science and stuff. So past the first 15 or so, I think the

chronology is a little more complicated.

AUDIENCE: Isn't course nine fairly new, Brain and Cognitive Science?

PROFESSOR: It is, but it was Psychology before. So psychology has a kind of older pedigree. And then, there were other courses that were cancelled, like Applied Biology, famously so, not that long ago. Another interesting way to look at the history.

So now, I would like to introduce my friend and colleague, Karen Arenson. And maybe, as I do, I'll call up the page of the oral history. So people get a sense for what the actual accomplishment looks like.

And as I did mention before, Karen is a former member of the MIT Corporation, an alum, from I'm not quite sure which year.

KAREN ARENSON: '70.

PROFESSOR: '70. So she has a lot of interesting perspective on women at MIT, which we talked about a little bit before, as well as a former higher education journalist for *The New York Times.* So she's seen what MIT looks like in the context of a larger picture, as well as a member the Council of the Arts, here at MIT.

And in all of those sort of capacities, we did this oral history project. And she conducted not all but a large fraction of these oral histories. So she's, at the moment, probably heard more about the last 40 years of MIT's history than almost anybody and maybe will incorporate all those things in what she has to say.

But while she's starting to talk, let me call up the oral history page because it's worth having a look. And it's this incredibly rich thing.

KAREN ARENSON: Have any of you looked at the oral history thing? I've just begun to. Hi, I was in your seat, not in this room, many years ago. And when I was walking here and passed near 26-100, I thought, 801, 802. They existed back when I was a student.

I've been asked to talk today a little about who I am and where I came from, a little

about the Oral History Project, specifically, and then a little about what I learned from it. And that's been the challenging part.

I fell in love with MIT when I first visited it as an admitted freshman, back in 1966 and discovered that other people talked my language. They thought quantitatively and analytically. And they liked to solve problems. And I think that's still true today.

And although many of them were brilliant, they also turned out to be nice people and friendly and unpretentious-- I think a distinction from another place in Cambridge-- and helpful. And I've never fallen out of love with the Institute. And the Oral History Project gave me a chance to explore areas that I was familiar with, like economics and the Alumni Association, and also areas that I knew nothing about, like STS, which didn't exist when I was here; Biotechnology, which didn't exist anywhere; Engineering Systems.

I applied to MIT because I liked math. And I wanted to focus on social problems. I didn't come here thinking I would major in math. I thought Economics. And this place had the best Economics Department then. It still does.

And I majored in Economics and in student government and in the newspaper. And lived at *The Tech* an awful lot. I was one of 50 women in a class to 900.

They had built McCormick Hall a few years before. And all of a sudden, the numbers shot up to 50 per class, that had been less than 20 before that. And by the time I graduated, after all the Vietnam turmoil and society turning inside out, they decided to make the other dorms co-ed.

And all of a sudden, there was more room for women. The number of women shot up, gradually, into the 30%. You're about mid 40s now, in terms of undergraduate population.

I went from the Economics Department here to the Public Policy School at Harvard and did a master's degree. And the one thing I learned was that I didn't want to sit behind a desk, and maybe I should be a journalist. I had lived at *The Tech* all those years and at my student newspaper in the high school.

And it took me about a year to land a job. But I landed it at *Business Week*. I was lucky.

I spent five years there and then moved to *The New York Times.* Business journalism was becoming more important. I love numbers. And it was a wonderful career for me.

Along the way, I remained involved with MIT because I like the people. And as Professor Mindell said, I served on the corporation and the executive committee and discovered that businessmen, who made up most of the corporation, are actually pretty interesting people. And they had other lives. And they weren't the kind of bad people we thought in the 1960s, when all business was bad. And nobody wanted to go to business school.

Because of my involvement with MIT, *The Times*, at some point, they asked me to start writing about higher education. That was an interesting topic. The only trouble was I had to cut my ties with MIT. Because it would have been perceived as a conflict of interest or might have been a conflict of interest.

And so I had a period of about 13 years, when I pulled back. And I took a buy-out from *The Times* in 2008 and began to reengage. And one day, I got a phone call from out of the blue, from a guy named Paul Gray. Maybe some of you have encountered him, a former president of MIT.

And he asked if I would conduct some interviews for this project they had, oral history. And I didn't know what oral history was. But it sounded interesting. And I'm not good at saying "no." And I said, sure.

I hung up. And I started googling. And I discovered that Columbia University was the center of oral history. They had this big archive of world figures. A history professor in the 1940s had started to do this thing that hadn't existed before.

So I visited Colombia and talked with them and discovered that what we were doing wasn't really oral history, which tends to be much more open ended. These things

go one for 40, 50, 100 hours. It's sort of sit back and dump everything, in a very relaxed fashion.

The MIT ones were about two hours each, tied to the sesquicentennial. There had been a planning committee that started about five years ago, to say, 150th anniversary is coming up. What should we do?

And one of the things they came up with was to gather some interviews with people who had been important in the development of the Institute, over the last 50 years. And they put together a list of about 75 people and had hired a guy named John Hockenberry, who has been on ABC, I think, and National Public Radio. But he was a visiting professor in the Media Lab.

And he was the main person who was going to do the interviews. They had a couple of other people helping him. And at some point, he got a new program. And he said, so long, can't do both. And that's when I got the phone call.

So I came in part way through. He had already done a handful of interviews, probably six or eight or 10, including the former presidents who were still living. They had laid out a sort of rough template of seven broad topic areas. They wanted to make sure we asked people where they were born and how they grew up; how they got to MIT, whether it was as a student or a faculty member; whatever their impressions of MIT; their role in the world of MIT; how it had changed; and how it had affected their lives.

So if you sign on to these things. And there are, I think, about 102. I did 40 of them, over about 2 and 1/2 years, including your professor and your other professor. He isn't here today.

PROFESSOR: He had to run out for--

KAREN ARENSON: OK. Anyway, I did both of them. Unfortunately, my thesis adviser, Bob Solow, one of the Nobel Prize winners, subsequently had already been done. Samuelson had been done.

I did Jim Poterba, Lester Thurow. It was a sort of hit or miss. It depended on their scheduling and mine.

So I got to do some people I knew and got thrown into some. I said, I don't know anything about that. So I learned. And that actually was the fun of it.

As a journalist, I was very used to interviewing people. I've been doing it professionally for 35 years. But it was very different. I never had to do it in front of a camera. And these interviews were videotaped.

I never had to worry about a beginning, a middle, and an end. I could sort of start somewhere and sort of go and come back to it, say thank you. And if I forgot something, I call up again or email and say, oops, what about this.

These were two-hour sound bytes that were pretty much as they were recorded. They weren't edited. Except for maybe, they took out some "ums" and "you knows." But other than that, they're pretty much as recorded.

I was pretty compulsive about preparing for them. I tried to learn as much as possible about the people I was going to interview. And I usually drew up about 12 to 14 pages of questions. Because I didn't want to get to an hour and a half and have half an hour to fill and think, oh, my goodness. What am I going to ask?

It's not that I've ever had a problem thinking of questions. But when you're on camera, you can't just sort of sit there and think, hm. What do I do next?

Some of the interviewees answered questions at length, two, three, five paragraphs. Sometimes, people answered in two or three words. And the trouble was I didn't know which it was going to be because I didn't know them.

When I prepared to interview Noam Chomsky, the famous linguist and the highly-visible political activist, there was more material than you could absorb in a lifetime. He'd written so many books. There were several biographies about him, including his life at MIT and what he thought about it. I think he's the most interviewed man on earth, literally.

I mean, there are days when he'll schedule three or four interviews, five, six, seven days a week. If you google Noam Chomsky, there's a whole website where lots of them are available. So if you're into that, he's a fascinating man.

But there was a lot more than I could digest. I dipped into some of it. I ordered some of his books. I had some of them on my shelf. I read about him. But there was no way I was going to understand it all.

And then, at the other end of the spectrum, there were people where you could find almost nothing, like your provost Rafael Reif. I had a short biographical sketch of him. I had a news release, announcing that he was going to be provost. And then, there was this blank. Where did he come from? What did he do?

It turned out, he was a pretty interesting fellow, whose parents had fled Nazi Europe and moved around Latin America. He grew up in Venezuela. He was a chess expert, all this stuff. But you couldn't find it anywhere. So I began to learn about it by calling some of the people he worked with, and little by little.

I could've gone into the interviews without knowing all this and just sort of said, so tell me where you were born and where you grew up and what you liked to do as a kid. And did you tinker? But I liked to know as much as I could. Because maybe he wouldn't think something was interesting or important that I would. And if I knew about it, I could say, but what about this.

So I did as much learning as possible before each interview. And then, the two biggest challenges were to figure out what was important and how to pace the interview. There were all these topics I was supposed to cover. And you didn't know if they were going to talk fast or talk slowly.

At the end of 40 interviews, I still couldn't tell you how. I used to sit there very tense. The first hour was OK because you figured whatever we covered. But then, it began to be, do I have enough. Are we going to have way too much? And how do I get everything in?

So that's the process. What did I learn? I didn't have any of these interviews to look at until January 7, when they all went up on the website. And then, I said, I have to do this panel on February 15. And it would be really helpful if I could look at the interviews and have the transcripts.

Because the videos are interesting, but it's hard. It's slow. They take two hours. If you read them, it's faster. And if you go to the little unlock feature, it turns out you can disengage from the voice. And you can even turn it off, by just lowering your voice.

It's a little hard to read down. I called the people who are running them and said, can people download the voice and listen on an iPod, while they're on treadmill? And they said, hm, good idea, no. This is MIT.

So anyway, I've begun to go through them. They all meld together, in a funny way. They were all my favorite because pretty much all of them were fascinating in different ways.

So lessons I learned, and I'm going to tell you some stories and maybe too many. Probably the most important lesson was that MIT is indeed filled with amazing, brilliant, creative people. For me, it was a dream to be able to talk with so many of them.

But it's actually important because MIT is a special and important institution. Because somehow, it manages to attract them and hold them. It includes the students. Faculty say over and over again that they stay here because they get students like you, who are just really bright and really interested and really driven.

But the staff, the alumni, the trustees. And when you begin to put people like this in some kind of environment, innovation happens. And that's what MIT is known for. And it's not a coincidence. And you need an environment where they can mix with each other and create. And many of the interviewees talk about that, during their two hours.

One example is Bob Langer, the chemical engineer and biotechnologist. When they

called me and said, he's this biotechnologist. I said, ew. I don't know anything about that subject. But I fell in love with him. He's just amazing.

He has more than 750 patents. He runs the biggest lab at MIT. And he's one of the guys who said that what holds him here-- and I'm sure he's had offers from anywhere and everywhere. He said, "It's the best place. It has exceptional students, exceptional colleagues. I feel I can have the greatest impact because of all those people."

Or Donald Sadoway, I don't know if any of you took his 3.091, which satisfies the chemistry requirement. He talked about arriving here as a post-doc from Toronto. He said, "I remember when I first arrived. And I walked up the stairs, the steps from that crosswalk at 77, and looked up at those pillars and thought, well, you've really done it. This is high stakes, no more big fish in a small pond." He'd been up in Toronto.

"This is the real deal." So here's this big guy and telling us what went through his mind. "And the early days were very heady. I mean to be surrounded with super bright people. I was postdocing with Julian. And the kinds of people would come to visit him was just a different world from the University of Toronto."

So it's not only the people who are here, but the people who came to see them, who added to that whole, what makes MIT special. There were other common themes. Many of the people at MIT started from really modest backgrounds. Many of them were immigrants or children of immigrants, Joel Moses, the former provost, Rafael Reif, the current provost, Claude Canizares, the vice president for research and associate provost.

Many of them pointed to serendipity, in the shaping of their lives and their careers. That's a wonderful word, one that the sociologist, Merton, who's the father of the Merton here, did a whole book about. I think he called it *Serendipity.*

It would be easy to think that all these brilliant people knew what they wanted to do from the age of three and that they followed a smooth, predictable path. When

you're trying to figure out should I do this or that, you think everyone else knows what they're doing except for me. It ain't so.

If you watch these videos, over and over again, people talk about well, I was going along. And then this happened. And suddenly, I was going along. And this happened. It really is striking.

Most of them said they had no grand plan and that luck played a large role. One example was Bob Horvitz, the MIT professor who won a Nobel Prize for his research on worms. He was actually one of my news editors at *The Tech*. He was two years ahead of me.

He double majored in Math and Economics. And he was ready to graduate after three years anyway. But he got elected president of the student government. So he stayed for another year. So he had to fill out a fourth year of classes.

He didn't know what to take. And one of his fraternity brothers said, why don't you try a biology class, course seven. So he took a bio course. And he fell in love with it.

And six weeks into the term, he thought, this is what I want to do, not math, not economics. I want to do biology.

But he was kind of embarrassed. Here he was a senior. And he was taking his first class. And he wanted to go to grad school.

So we went up to his professor. And he was sort of apologetic. And he said, I want to go to grad school, but you know.

And the professor, whose name was Cy Leventhal, told him not to worry. He had been a physics major. And he had gone to graduate school in physics and gotten his PhD in Physics.

And here he was teaching biology at MIT. He said, so you're starting early. So it really isn't too late to figure out what you like to do and try things and keep exploring.

Woodie Flowers, the mechanical engineering professor who started the big contest, where you get a bag of stuff. And you have to build a gadget that does something. And then, they have a big contest at the end. And the different little robotic machines compete with each other. That was Woodie Flowers.

He didn't even plan to go to college. I think he grew up in Alabama or Arkansas, in a poor family. His family couldn't afford it. But his senior year in high school, one of his teachers noticed that his arm wasn't set right. He had broken it when he fell out of a tree in second grade. And it had never been fixed properly.

And some teacher took an interested in him and got it set right, I guess. They had to re-break it or something. I don't know.

But then, the orthopedic surgeon looked at the elbow and said, you really need some rehab. You can't just walk out of here. And he wrote some kind of letter to the state. And the state gave Woodie Flowers what he called a rehabilitation scholarship to college. And so we went to college.

And at the end of college, he was doing well. And his professor said, you really ought to think about grad school. And you really ought to think about MIT. I mean, this isn't all Woodie doing lots of homework. It's some chance meeting with people who took an interest in him. Now undoubtedly, he worked hard. He was smart. He was creative. And so I don't think it's a coincidence that people were taking an interest in him. But it wasn't his planning out his life. Rafael Reif, the provost I was telling you about, had several other older brothers and one of them had come to study in the states.

This is way before the internet. How do you learn about colleges in the states? You go to the American embassy. They have a bunch of college catalogs. And the one thing he knew was that he didn't think he wanted to experience winter. Venezuela's not a place of winters. So he looked at California schools, ended up at Stanford, didn't know a lot of English when he came, translated hard for lots of hours the first two semesters, did pretty well. And he was going to go home to Venezuela to be a teacher.

Only, he had a brother at MIT and he thought he'd come visit him before he went back to Venezuela. And one of his former colleagues said, I thought you were going home? And he said, yeah, but I'm going to go visit MIT. And the guy said, there's a spot open there. So he said, well, maybe I'll look at it. Of course, he got the offer, told his wife, I think we're going to stay here. Somebody told him you put on lots of layers and you deal with winter, so he's dealt with winter ever since.

But again, sort of a chance meeting with a former colleague who said, I know about a spot. But for that, he'd probably be back in Venezuela teaching. He summed it up by saying, "I had to change all the plans at the last minute. It was just one of those accidents of history that helped me a great deal." But you get this over and over again in these videos. And it's really kind of stunning.

Other lessons from the interviews-- I learned a lot about MIT's history. You know, I'd heard of William Barton Rogers, but it wasn't until I started reading the *Decisions* book, which is really a good read, and talked to Professor Smith, for example, that I understood a lot more about MIT's early years, the emphasis that William Barton Rogers put on real scientific research, the people he drew to support him, the efforts to merge Harvard and MIT, several times. Luckily, it didn't happen.

There was an interesting chapter on MIT's Center for International Studies, which had links to the CIA for a while. The CIA essentially got it off the ground. By the end of World War II, MIT was used to collaborating with the government. It had provided lots of help on things like radar. And so, when the CIA asked for help in learning more about communications and propaganda-- because it was the Cold War, late '40s-- MIT said, sure, why worry about it?

So two of the interviews are with people who were involved with the center-- Donald Blackmer and Jean Shkolnikov. And they talk about the center, and the protests against the center. There was a bombing in the Herman building, and the eventual break with the CIA. And they talk about the development of political science at MIT. You were talking about how different courses evolve, so course 14, 15, and 17 all used to be glommed together-- economics, political science, and management. At

some point they were separated, economics and management, first, political science later. Probably would make a good project for somebody to explore the different courses and how they came along.

Another historical chapter that some interviewees talked about was the huge disruption during Vietnam. The anti-war protests that tore the campus apart in the late 1960s. So Noam Chomsky talked about it from the perspective of an activist professor. Larry Bacow and I, I got interviewed too, talked about it from the perspective of the students who were there. Howard Johnson talks about that period from the perspective of a president.

And then there was a guy named Bill Pounds, who was dean of the Sloan School at that point, who had followed Howard Johnson as Dean of Sloan, who suddenly found himself appointed by the president to head a committee to study the role of MIT's two defense labs. He said that Howard Johnson went out of his way to ensure that the membership of this committee, which was sort of meant to placate everybody as much as to figure out what to do, that the president had gone out of his way to make sure there were radicals and conservatives, that the whole spectrum was represented. He said it was kind of like a Noah's Ark, two by two, a radical, a conservative, a radical, a conservative.

And Bill stood up during a raucous faculty meeting and announced that the committee would start meeting the following day-- a Saturday. I think he'd been given two or three days notice. And this wasn't an area he knew anything about. They would meet every day from 9:00 to 5:00 until they reached a conclusion. He said that one step that cleared the way for the commission to even begin to talk to each other was to give them as much time as they needed at the front end, just to go around the room and let everybody talk about their views on war and peace, universities and truth, and all the other kinds of profundities, as he put it. And then they got down to work, because they'd all sort of cleared their throats. He said it took about a week or a week and a half.

He also made observation about being made dean of the Sloan School just a few

years after he'd arrived at MIT. And he said he hadn't really understood the place. We all look up to deans as these are all-knowing creatures who have put in lots of time and get promoted. He said, here he was dean, and he didn't really have much of a clue. And he said he thought that becoming dean, quote, "might pull back the curtain on MIT." Instead, he said, he discovered that quote, "there was neither a curtain nor anyone behind it." Kind of like the Wizard of Oz.

He was an interesting guy because he also headed the Rockefeller Brothers office for a decade but was attached enough to MIT so he commuted between Boston and New York the whole time, running the Rockefeller's business and still remaining here. Anyway, he's very articulate. It's another fun one to look at, even if you've never heard of him before today.

Another theme that came up repeatedly was MIT's unusual openness and flexibility. It seemed to be better than many universities at accepting people whose work didn't fit into neat boxes. And it was better than most universities and allowing people to cut across boundaries. I think when you're here, you take it for granted that it doesn't matter what school you're in. On other campuses, it matters a lot you never see the other people.

Again and again, these were cited as really important factors in allowing people to do innovative work. And I'm sure MIT isn't perfect on this score, but it does appear to really be different from other institutions. Chomsky, for example, recalled his early efforts to have his ground breaking work in linguistics published, only to be told that there was no such field. I mean, he was the father of modern linguistics.

But MIT provided a home from for him. His first teaching job was to help graduate students cram for the language exams they had to pass to get their PhDs. I don't know if PhDs are still required to pass one or two languages, but they were back in the '50s. He said, "in your early 20s, you're thinking about what you are doing. You don't really care what the world thinks." Gradually, of course, his work drew attention and respect and got published.

Bob Langer, the biotech guy I was talking to you about, had a similar story. He was

a doctoral student here in chemical engineering. And most of his classmates went from chemical engineering to the petroleum industry. This is what you did. So he flew to Louisiana to interview with Exxon. And the executives there explained that if they could increase the yield of some petrochemicals by one one hundredth of a percent, they would make billions of dollars.

On his flight home he was thinking of that. And he realized he had no interest in doing any of that. But what would he do? Well, he kind of wanted to change the shape of chemical engineering and chemistry. So he started applying for jobs to look like they would do that. But they didn't want him. Exxon would have taken him, but-- so he kept looking and looking, and eventually someone suggested that he go talk to this cancer researcher at Harvard named Judah Folkman.

Hiring a chemical engineer in a cancer lab doesn't sound like an obvious thing to do, especially back when he was coming out. But Folkman was a risk taker, and Langer made a stunning breakthrough in finding a new approach to controlled drug delivery. That was his post-doc.

He came back to MIT. He got hired, but his path was still bumpy. He actually didn't get hired into chemical engineering. They didn't think he was doing chemical engineering type work, like petrochemicals. He went into this applied biology, course 20 at the time. And they didn't love him either. But somehow he kept on. He said, "the path I wanted to follow didn't exist," but he was hired. And there was enough room for him to run and to start publishing and earn tenure. And today he's one of the most venerated figures in the field.

You are another example of crossing boundaries. I mean, I don't know if he's told you about his background. He studied literature. He double majored in literature and electrical engineering at Yale. That's a pretty unusual set of double majors. And even after he got here, he's been a bridge between the humanities department and the engineering school. I think he's the only professor with full appointments in both schools. So you'll have to get him to talk during the semester about being this kind of bridge.

But during the interview, you said STS is not a discipline for people trying to escape science and engineering. It's really about pulling them together. People talked about their backgrounds. Lots of them were tinkerers. There are lots of good stories about that. A lot of them did ham radio. Even the women who came-- as a young girl, Brit d'Arbeloff, who holds a master's degree in mechanical engineering from MIT and is a life member of the MIT Corporation, her late husband was chairman of MIT's Corporation, founded a big company called Teradyne.

But when she was a little girl, her father was an engineer at this appliance company in Chicago. And he brought home the machines that he invented, things like the mix master. He worked on the hair dryer and the toaster. So she used to play with them. She got out to Stanford. She said I was looking to get as far from my parents as I could. And the engineering professors there said, you don't want to major in engineering. They didn't want a girl.

But one of my favorite tales that she told, she had to take welding, and foundry, and machine shop-- only girls at Stanford had to wear dresses and skirts. There was a dress code. So she knew she didn't want to do welding in a skirt. So she used to put on her jeans, and roll them up, and put a trenchcoat over them, so nobody could see, even if it was 90 degrees out, and go to class. They didn't give her trouble there. Of course, she graduated number one in her class.

PROFESSOR: I walked by the glass lab on Saturday afternoon and she was in there.

KAREN ARENSON: She was there. She's now chair of the Arts Council at MIT. Let me get one or two others and then-- there were some incredible personal stories in these interviews. And I think the one that move me the most was Wesley Harris, who's a professor of Aero and Astro. He's now associate provost for faculty equity, as in diversity.

He's the descendant of slaves in the South. He grew up in segregated Richmond, Virginia in the '50s. He was a good student. And in the '50s, the University of Virginia simply didn't take blacks. They said go to one of the historically black colleges. One exception was engineering because there was no separate but equal. So his physics teacher in high school said, you've got to go to UVA and study

engineering because they've got to see that blacks can excel.

So even though he wanted to study physics, he went to UVA and studied engineering to make the point. Some of this professors, I don't know if they were the ones he had teaching, but some of the professors there threw cigarette butts at him. They spit on him. I mean, just an incredible tale.

But he had mentors. And they helped him get through. They pushed him on to Princeton. He had an offer to come to MIT, but his good old physics teacher from high school said, you've got to go back to UVA and make a point that you can be a professor and do it well. So here he was, sort of, pushing his life in directions he probably didn't really want to take and suffering because-- to make a point. It's a kind of civil rights battle. And he talks about this during the interview.

It made me go back and look-- there's a big told by a guy named Clarence Williams who did a lot of interviews with blacks at MIT. I'd never read them before I started reading them. It's amazing. Anyway, actually, the chairman of the board, John Reed, who I also interviewed, who was also the former chairman of Citicorp, is an interesting set of personal tales.

His parents were American but his father was in the meat business. They lived in Latin America most of his childhood. He grew up in Brazil and Argentina. His father had gone to MIT. But to ease the transition back to the states, he enrolled in MIT's 3-2 program, started at a small liberal arts college and then came here. And he describes his years at MIT as being invisible. He said I would go to classes and go back to my apartment. This is the guy who later became head of Citicorp, head of MIT.

He loved physical chemistry but was too awed by the formidable professor to even talk to him. He worked at Goodyear Tire for a year on the assembly line. He had a rubber workers union card. Amazing stories. When he was in the army, he did something wrong and was assigned to clean garbage pails for three days. He said, I assure you that no one has ever washed them as well as I did. I was always enthusiastic about whatever I was doing. It's a great skill. So these tales are buried

through these interviews.

Anyway, I'd better wind down. There are more than 200 hours of video. They're fascinating in different ways. They humanize this place in a way it doesn't do for itself. I don't think there are any plans to do a book or to keep going. I think it would be a shame to stop the chronicling process. But I know that we'll be doing some of your own probing, maybe the oral histories will help a little. I just came from a meeting of the council of the arts, which is having its 40th anniversary next year. I'm doing a one line commercial, if I may.

Part of that, we were thinking about doing a history of the council and the arts at MIT. There are lots of documents there are living people. As you all go about figuring out what you're going to delve into for your projects later, if any of you like the arts, this would be a fun topic. And we'd love to have one or more of you do a history of the council for the arts. And we'd feature it next year.

I don't know if there's any time left for questions, but if there are.

PROFESSOR: I want to take a little time for questions but I also want to play this little farm video they made.

KAREN   Oh, that's a wonderful--
ARENSON:

PROFESSOR: I'll show you, you can look yourself at the interface because you can actually search through-- you can do text searches of all the interviews altogether. And you can search on a particular keyword or topic. And then it'll also take you right to that point in the video, of any video. And the video guys just searched on the word farm. And from that little search, they made this a little video.

KAREN   The first guy is Bill Pounds, who I was telling you about, the former dean of the
ARENSON: Sloan school and Rockefeller. They don't identify him.

[VIDEO PLAYBACK]

-I grew up in Pennsylvania. And I have the distinction of having been born on a farm.

-I grew up on a farm.

-So I was born on a farm, if you will.

-I grew up in Montana. I'm a cowboy at heart.

-Father was a farmer.

-We were in Sunbury, PA, which is a rural community, farming community.

-When my parents were about 20 years old, they decided to live a simpler life. And they basically moved to rural West Virginia as a way of going back to the land.

-I rode and trained horses as a child.

-Well, I was brought up in farm country of Pennsylvania. And I had my share of work picking tomatoes and doing farm work.

-So I grew up in the bush, very much. I come from a fifth generation Australian family and always very much in the bush.

-Between the time I was 17 months old and five or six years old, I spent on a farm.

-So we went to Idaho when I was nine years old. And we settled in a little farming village.

-We lived on a mini farm.

-Well, I was born on a cattle ranch, spent my youth on a cattle ranch.

-I think it had an influence in the sense that farmers are entrepreneurs. And they are their own boss. And so I think that's sort of settled into my psyche.

-Hard work. You learn how to focus on a farm.

-People in the cities romanticize the bush in the same way that Americans

romanticize the west. It's not to be romanticized, actually, it's a pretty tough and rough place.

-It is kind of strange for someone to grow up in a house with not a lot of technology to become a faculty member at MIT. But I became an engineer, in part, because I was good at math, and I liked problem solving. But I think the childhood has influenced me in terms of how I bias technologies. That is, I give value to technologies that are maybe simpler or local. And I think that does come out of my research and my work.

[END VIDEO PLAYBACK]

KAREN ARENSON: So, if you go on the MIT 150 website, there's something called Infinite History, which has the 100 oral histories. There's a separate little category called Multimedia, which is where this is tucked away, way at the bottom of the right hand column. It's a bunch of videos that include some oral history snippets, which this was, and other stuff.

PROFESSOR: If we have the right interface, and I talked to the company to do that, I would love to have, if you wanted, for an assignment, to make little videos like that snipping from these oral histories. But at the moment, we don't quite have the interface to it.

KAREN ARENSON: That would be fabulous.

PROFESSOR: But let's have a few minutes for questions before we're all done or comments.

KAREN ARENSON: Three hours. Yeah.

AUDIENCE: You said you did 40 of the interviews, and there are 100 or so.

KAREN ARENSON: I did 40.

AUDIENCE: So who did the other 60?

KAREN ARENSON:	There were actually four other people, a graduate of MIT, he had been an undergraduate in engineering and STS, did the first dozen or so as a kind of feasibility study. And then John Hockenberry, the NPR guy, got pulled in to do the project. And he probably did 8 or 10 before he went out the door. He came back and did one or two more. They had hired a local journalist, Toby Smith, and she did, I think, 40, 45 of them. And them one of the guys in the video lab, Larry Gallagher, did a handful.
	And the styles are different. Nobody was looking at them. My lead-ins are way too slow. I never saw one of them before. I kept thinking, these are going into the archive. I need an intro to say, why are we talking to this person. So I have pretty substantial intros, and I talk way too slowly. But I had no idea until January 7, which is a real shame. I'd love to rerecord them.
	But Hockenberry's are more like radio interviews. Toby pretty much starts with where were you born? How did you grow up? So anyway, there are several different styles-- probably good. Any other?
AUDIENCE:	You said you did economics when you were here? So for people like yourself, probably the majority of graduates, who do something completely different than what they studied, like, is there sort of a general thing that you still retain from your undergraduate education? I mean, obviously, you don't really use economics day-to-day. What are the basic things that people who go on to do different things keep from MIT?
KAREN ARENSON:	You mean just in general?
AUDIENCE:	Yeah, was it a complete wast of time?
KAREN ARENSON:	Lots of people go into law, medicine, business, a few people go into journalism, not very many. I did economics and finance journalism for 35 years before I did higher ed, so I was using my economics background. I actually went back to school and took finance, and accounting, and financial institutions because I realized there was

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a certain amount I just didn't know.

But I did use my economics background. And as a journalist, a lot of journalists come from being English majors. Some of them are journalism majors. There aren't very many economics majors, but I was very analytical. So they all learned how to write. I learned how to look at numbers, and we sort of came together in the middle. I had to learn how to write on the job. Some of them learned to use numbers. Some of them never did.

When I was editing, I can remember the first couple weeks I ran the Sunday business section for the *New York Times*. And I got a big story in, and one of the editors under me had worked it. And it came to me. And the story wasn't bad. And at the last minute, the graphic arrived. And the story said this, and the graphic looked like this. And I said, they don't agree. I killed it at that point.

People, a lot of journalists, at least back when I was starting just were number-phobic. But I like to look at stories as puzzles. In other words, how did this happen? How did the pieces come together? Kind of like an MIT education trains you to look at the world. And that's how I looked at it, even higher ed. So it was fun.

PROFESSOR:	Let's leave it at that for today. Please join me in thanking Karen.
KAREN ARENSON:	Good luck.
	[APPLAUSE]
KAREN ARENSON:	Thank you.