If were 17, what vocation should I follow? How should I prepare for the career I choose? For the answers to these essential questions our children ask, let's join moderator Glenn Smith and today's guest from the engineering profession, Dr. John D Ryder. [Glenn Smith] Welcome, ladies and gentlemen, to "If I were 17," a half hour of interesting and informative discussion about occupational opportunities in the fields of engineering. We hope to answer for our youth panel and for our viewers some questions about you and your future. In addition to our guest consultant, we have four seniors from high schools, all of whom are interested in the occupation of engineering. I should like to introduce them to you: Alan Houghton, John Robson, Jack Schenk, and Mark Stapleton. Our guest consultant is Dr. John B. Ryder, Dean of the College of Engineering at Michigan State University. Dean Ryder, would you open our discussion by giving us a little information about some of the basic interest and activities in the field of engineering? [Dean Ryder] Well, I would like to ask you boys, if you could imagine a different kind of world, a world you've never lived in. But it would be a world without electric lights. We'd be back to candles. A world without mechanical refrigeration of any kind. We'd be back to the spring house on the farm, and of course that would mean practically no fresh meat. Very few fresh vegetables except in the summertime. There'd be no oil furnaces, not even coal furnaces. You would have spent your afternoon out on the wood pile, and you'd now be burning the wood in front of— in the fireplace. There'd be no running water. You would have carried the evening's water supply in in a bucket. There'd be no television, of course. No radio. No telephone, no telegraph. None of our plastic devices. And, of course, we wouldn't have that essential: the automobile. No airplanes, no railroads. Would any of you want to hazard a guess as to how far back in history we would have to go to reach that condition? [Student] I would guess about 1825, 1826. [Dean Ryder] Well, you wouldn't be far wrong. I would place civilization in this country in about that condition without those conveniences in the general time of 1800 to 1830. And, by a rather curious coincidence, that is also considered the time that we began to have a few engineers for our civilization. Our first engineering school actually was founded in 1802. West Point on the Hudson is given credit as being the first school to train engineers. Of course, they trained military engineers, but still they are the first. So that engineering education has gone right along and the presence of the engineer has also gone along our advances in our civilization that give us the things I just asked you to take out. Now of course we've mentioned some of the things there that the engineer has done for us, but perhaps first we ought to ask: "what is an engineer?" An engineer is the man across the street or the man who works in the next office. He is inquisitive, he's curious, and he's ingenious. It's interesting that the word engineer comes from the Latin word for ingenuity. The engineer is creative. He is the man responsible for new materials, new methods, new equipment in the home, in industry, and I wish to emphasize that he is not a mere operator of that equipment. He is the man who designs it, who creates it, leaving to the technician the operation of this equipment. Now, it's difficult to really say what an engineer is. It's a few words, and I have here some booklets which help to explain just that. I have one entitled "Can I Be an Engineer?" And this is published by the Department of Public Relations of the General Motors Corporation, Detroit. And it tells very well some of the requirements you should have to be an engineer, and you might pass those out to the boys. I have another booklet entitled "Your Future in Engineering," and this is published by Michigan State University, and describes some of the features of engineering work, some of the things you might do if you were an engineer, and ... and describes also some of the work that you would undertake in college. And I have also another booklet entitled "Time for Decision." This also is intended to help students understand what an engineer is and what they might be working with if they were to take

engineering. This is public... published by Jack and Heinz, incorporated in Cleveland. Perhaps those will help. I think, Mr. Moderator, that that ... those booklets should help materially. [Glenn Smith] Thank you very much, Dean. I think that gets us off to a good start. We have plenty to talk about, I'm sure. I see John has a question now. [John] Dr. Ryder, just what should a prospective engineering student look for in selecting a college or technical school? [Dean Ryder]: Well, I think that there is one criterion that you can always use and be very sure of your ground. You can look first for a school that is said to be accredited. Now that really means that its courses, its staff, its curricula have been examined by one of the large engineering organizations and have been given approval. There are other schools, which have not been given approval, sometimes not because their work is not good, but they may not have been established very long. But the first thing you can look at is, "is it accredited?" If it is, and that includes most of our large state universities, most of our big eastern universities, why, you can be pretty sure that you have the first requirement. [Glenn Smith] Fine, thank you. Mark, you have a question? [Mark] Yes, Mr. Smith. Is it necessary for a student in engineering to decide during his first or second year of college which field he wishes to specialize in? [Dean Ryder] Well, Mark, it is very common that we do not ask a student to decide in his first year, because you do not know of all the different fields available to an engineer. And we try in the first year of an engineering curriculum to give you an opportunity to become acquainted with these various fields, so that most engineering schools will have the first year the same for all branches. A few schools may even have the second year the same, and in almost all schools, the second year is very nearly the same for all curricula. So that you have practically, from one to two years, to find the exact field of specialization. [Glenn Smith]: Alan you have a question? [Alan]: Yes, I do. This goes back a little farther a little earlier than college. What subjects would you recommend in high school for a prospective engineer to take? [Dean Ryder]: Well, in high school we would hope that the prospective engineer first would take some science courses. They will help him in his college work. They will also allow him to find out whether he likes work in science. And then, secondly, we would hope that he would take all the mathematics that his high school gives. That he would take algebra, trigonometry, geometry. Whatever the high school has available, because he will never find that he can have too much mathematics. [Glenn Smith] I'll find that in any case you have a question? Yeah. [Jack] I would like to know, Dr. Ryder, if a person who has had little or no science and math in high school has a chance to study engineering in college. [Dean Ryder]: Well, such a person can take engineering. Of course, he has to be really sure that he wants it. And then he definitely faces a slightly longer period in the university to make up those deficiencies that he did not get in high school. But there is no bar against that at all. [Glenn Smith] If you'll hold your question a minute, Jack, we'll take one from Alan. [Alan] Would you recommend, let's say, a person, to go to a regular college and take general education, and then transfer to a technical school, or would you recommend they go directly to a technical school and study all the way through until he graduates? [Dean Ryder] Well, you always face one fundamental that we think in university. Whenever you transfer, you almost lose some time, almost always. You may not lose very much, but you lose a little. So that, in general, I think it's better to go directly to the engineering school of your choice and go through. There may be, of course, financial factors in which you may be able to stay near home for the first year or two that enter in. [Glenn Smith] Now, Jack if your question... [Jack]: Well, Dr. Ryder, I want to know what some required courses are for students and engineering courses in colleges. [Dean Ryder]: Well the engineer in colleges, he will continue some of the things I just mentioned in high school. He'll continue first, very definitely, with mathematics. He'll take some more chemistry. He'll take some

more physics. Then, having laid those foundations, he'll go into the consideration of what it is the engineer works with. The engineer works with the forces ... energy. And with processes in which he uses the energy, such as heat energy in the boiler furnace, or electricity, or he may work with metals. So he will take courses in those various area until he has laid a solid foundation, a very broad foundation for his future engineering work. [Glenn Smith]: Okay, John, your question. [John] I know some colleges which offer an engineering degree in 27 months instead of the usual four years. Does their Bachelor of Science degree count just as much with their employers as one from a four-year college of engineering? [Dean Ryder]: As a rule, a degree from a school with a shortened curriculum may be questioned. As a rule, those schools who offer a degree in 27 months are not among the accredited schools. There are some very good ones, however, but still they will ... you will wind up with a more specialized, a slightly narrower curriculum, because you simply have crammed more work into a given time. And so that unless economics forces you to go to a shorter curriculum, it's much better to take the full four years to it. [Glenn Smith] John, if that answers your question, we take yours, Mark. [Mark] Yes, what particular advantage is there in having a master's degree in engineering? [Dean Ryder] Well, I think in our modern civilization that one can never be too well educated. It's becoming now a very common situation to have a bachelor's degree. Everybody can get that. And if you want to stand out from the common run and to be considered for the better jobs, you want to take an advanced degree. So you have the master's degree representing one year of additional work. And then you may, if you wish, you may take two more years and receive a doctor of philosophy degree. So that you never ... you never can have too much in education. [Glenn Smith] Fine. Thank you. That question came up before we came into the studio. I've heard several times and I'm glad you answered it as fully as you did. I believe Alan had a question [Alan]: I'd like your opinion on this question: if I entered the armed forces before going to college, would they be able to train me in anything that would be helpful in college as far as engineering is concerned? [Dean Ryder] You will find that their training is helpful. It allows you to work with some of the equipment that later on you will study the why of. You will learn why it works. The armed forces are largely concerned with how you operate. And of course at the same time you're getting a little older. You'll be a little better able to appreciate the college work when you do take it. [Glenn Smith] If you'll hold the others, we have one from Mark. [Mark]: Can a student with a C average in college succeed, really succeed, in engineering? [Dean Ryder]: Well, that's... that's quite a question, because we have many boys who succeed as engineers who had just C averages. A college education doesn't discover everything about a boy. He may be a star salesman and I think an engineering education that doesn't do very much to help him that and we don't measure it. He may be a very good administrator. But on the whole we find that the boys with the higher levels of intelligence or the higher IQs are most likely to be successful, and there is a very strong correlation in general between high scholarship in college and final success later on. [Glenn Smith]: John seems pretty anxious. Maybe he has one along the same line. [John]: Yes. Just what are the main characteristics of a successful engineering student? [Dean Ryder]: Well, a successful engineer must first lay a very sound, very broad foundation in basic engineering. We speak of certain areas as representing the engineering sciences; they are the fundamental knowledge of engineering. Then the engineer must be able to express himself; after all he's not going to be put in a corner and work by himself, he's going to be working with other people, so he has to develop habits of good speech, he has to be able to write, and he has to be able to read, to understand. So that it goes much beyond the mere technical courses. We expect for his proficiency in the technical courses, then we hope for the proficiency in these other areas as well. And a man that has them all is very certain to

be a success. [Glenn Smith]: Are you saying, Dean, that the engineer is maybe a citizen, too? I mean, that's a pretty important ... [Dean Ryder]: Very definitely. He's also ... he must have the qualifications that lead to good citizenship. He must be able to take part in his community life. In fact, an engineer must be a very well -rounded person. [Glenn Smith]: Alan, you had a question?. [Alan]: Yes. There's a person who does not have an engineering degree but has learned through on-the -job experience. Would he be able to obtain a engineering degree status and professional status as well? [Dean Ryder]: Well, that's very very difficult. As the man who's gone to college, he spent four years and a good many nights besides learning to be an engineer he, uh, he was rounded, he was polished somewhat. The man who gets it on the job, in, say, the 1880s or the 1890s could become an engineer. Now, too much of this has to come out of books and while a man can say, "well I can study the books and learn," but somehow there is not the compulsion there that there is of having the teacher stand up in front of class and ask the questions about the things you should have studied last night. So it is a very difficult thing to do it on the job. It isn't impossible. [Glenn Smith] I wonder if the general complexity of engineering, as is true, perhaps, in other professions, don't contribute a great deal to that. [Dean Ryder]: Oh, very definitely. There's in, let's say prior to 1900, we had a rather narrow field for an engineer: a civil engineer was about the only major branch. He could build roads, railroads, dams, bridges, water systems ... But now we have a civil ... we have all the other branches of engineering. [Glenn Smith]: Fine. Mark, we'll take your ... [Mark]: Yes, Dean Ryder. What jobs are held mostly by the engineers with graduate training or graduate degrees? [Dean Ryder]: Well, that ... the graduate degree, the graduate training which I mentioned a few minutes ago, is usually considered as leading to work in research or in development. In other words, into creating new things that have not existed before. For that sort of work, you need the highest possible level of fundamental engineering training. And so that is where the man with the advanced degree usually goes. He goes into the research and development laboratories. [Glenn Smith]: John you had a question? [John]: Yes, what are some of the advantages as engineering as one's life's work? [Dean Ryder]: Well I've always found it possible to eat rather well. At least people say that I show that. I, actually, I believe that engineering leads to one of the most satisfying lives possible. I have never yet found a man who took engineering training who was unhappy that he took that training, regardless of what he may have been doing in afterlife. It teaches one to think, to determine the facts behind a question, and to reason from those facts to an answer. And very frequently, when you can find the facts, the answer is obvious. So engineering teaches you how to get at the facts and how to reason. [Glenn Smith]: I think a statement of that kind coming from you being that ... ought to ... increase the enthusiasm of these boys for engineering. [Dean Ryder]: Well, I rather thought that was the idea. [Glenn Smith]: Jack had a question. [Jack]: Is it true, Dean Ryder, that many engineers spend their lives chained in drafting work? [Dean Ryder]: That is very definitely not true. It used to be. It's happened. And there are some engineers that are still chained there. But I think that the day is gone. The engineer now is doing the creative work. If it is a repetitive job, it's necessary to find someone else to do it. Someone who is not trained to the level the engineer is, so that the drafting board these days in fact is almost a symbol of obsolescence, if nothing else is. [Glenn Smith]: John, your question? [John]: Yes, how can I tell whether I have a special aptitude for engineering? [Dean Ryder]: Well, when you were three, did you take apart the clock, and did the cuckoo ever cuckoo after that? In other words, have you had a curiosity about how things work? For instance, have you got an automobile that's always torn down? Or is the family radio all apart? In other words do you like to know how things work? That is is one indication. Or do you like mathematics? You do

well in mathematics, that's another indication. In other words, an analytical mind and a good curiosity are really the passwords. [Glenn Smith]: I'm thinking you ... Mark, you had a question? [Mark]: What factors should be considered in choosing a specific branch of engineering, Dean? [Dean Ryder]: Well, there are a great number of factors. Of course, you can say, well, :I saw such a ... such an engineer work. I like what he was doing." Or, "my father was a particular kind of engineer and like I'd like to be one." But, you really, you should get at the more fundamental things. And there are so many factors, that we have collected here, a group of booklets Which can help. For instance, here is one entitled, "Planning a Career," issued by the Corps of Engineers of the Department of the Army. Of course, there might be inferences about that, the kind of engineer they'd like to have you ... or kind of career they'd like to have you take. But it is intended to help you decide on what branch of engineering you might take. Because it describes the work in the different branches. And then here is another one: "Atoms at Work," published by the General Electric Company, and it covers some of the peacetime applications of atomic energy. And that, of course, is a field that the engineer is not only largely responsible for in the peacetime applications, but he's going to develop very greatly. Another one, "The Aircraft Industry: A Career for You at Douglas," issued by the Douglas Aircraft Company in Santa Monica, California. And they would like to have you consider the aeronautical engineering field, or mechanical engineering, or electrical engineering, because those are also associated in the aircraft. In fact, the modern airplane would not fly very long without some electrical equipment aboard. And then the Allied Chemical and Dye Corporation, quite logically, would say they would like to have you choose your career in the chemical industry. And of course we don't want to overlook chemical engineering, because they are responsible for the plants that process our plastics, many of our industrial chemicals that make possible the manufacture of much of our equipment, such as the airplane. And then we have another one entitled "Power Goes to Work," and this is a General Motors Corporation booklet on the automobile and other forms of devices that use power, metallurgy, and wheels, also put out by the General Motors Corporation. And, giving a strong boost to the metallurgical engineer, a field that you don't realize frequently exists, but who is behind the choice of the steel, the manufacturer of the steel that will do the job best in your automobile and in other devices. And then finally, the General Motors Corporation puts out a booklet, "Electricity and Wheels," associating the elect ... the electrical engineer with the automobile as well. The Agricultural Engineering department here at Michigan State would also urge you to consider agricultural engineering. And that, too, is well worth your thought. [Glenn Smith]: Thank you, Dean, you have given some very good ideas about some further reading which I'm sure they'll want to do. I believe Alan had a question. [Alan]: We are supposed to choose our own careers. What experience would you say would be helpful in selecting a particular field of engineering? [Dean Ryder]: Well, I think one of the best things you might do would be to visit your local industries. Try to visit as broad a cross section as you can. And most of these industries will be very happy to arrange tours for you or for your high school classes so that you can see engineers at work. You can see their products, both in the products of the industry and in the machines and processes that the industry uses. I think that's one of the best. If you are not in a location which has much industry, then I think if you can find a local engineer or two and talk with him. [Glenn Smith]: Jack you had a question? [Jack]: Yes, in what sections of the country can an engineer find the greatest opportunities? [Dean Ryder]: Well, I think that in these United States in 1956 engineering knows no bounds. The east coast is now looked upon as possibly the center of much of the engineering research. The west coast would argue the point, and the middle west is certainly the center of production. So we can look almost

anywhere. [Glenn Smith]: Well, fine, Dean, our time is growing short. I wonder if you'd take just a moment now to bring us up just briefly on why we need engineers right now. We have the greatest need ever. [Dean Ryder: Well, we certainly do. It's been estimated that we have current needs for as many as seventy five thousand engineers the colleges are turning out very much less than our demands. This past year, they graduated only 22,000. Estimated that this coming year we may do 29,000. But the estimates of demand are 35- even 40,000 a year. If we are going to carry on with the kind of scientific civilization we're building, we're going to go into the jet age, the atomic age, or the rocket age, we need engineers. [Glenn Smith]: Thank you very much. I'd like to summarize just very quickly. I made four or five notes here, which I think might cover some more. First, it seems to me the engineer is a broadly trained person who is not only technically skilled, but who, as we said a moment ago, was trained for citizenship. Second, the high school student who wants to enter the field of engineering can and should take a liberal sprinkling of mathematics and science particularly. Third, in engineering as in many fields, the greater amount of training an engineer has, the more opportunities there are open to it. Therefore we might say graduate training is desirable for a great many. Fourth, there is a great demand currently for engineers and there's considerable evidence that that is likely to continue. And finally, there are a great many sources, some of them shown both to our panel and to our viewers, through which additional information about engineering may be obtained. So that I think we have done a pretty adequate job of telling this story to this youth panel about the opportunities in engineering. Thank you for inviting us, "If I were 17," into your home, and thanks to you Alan Houghton, Jack ... John Robson, Jack Schenk, and Mark Stapleton for participating in the discussion. I'm sure I speak for the panel and for the viewers, Dean Ryder, when I say we thank you very much for your participation. This is your moderator, Glenn Smith, inviting all of you to be with us next week when we have a program on nursing, and our expert will be Florence Kemp, Director of Nurse Education at Michigan State University. [Narrator]: "If I Were 17" has just presented another program of vocational guidance. Next Monday evening, you're invited to review the nursing profession with Professor Florence Kemp. If I Were 17's moderator is Glenn Smith. Produced and directed by Charles Ruffing.