

00:00:00:00 - 00:00:34:05

Ned Gagic

Gentlemen, Today's third Elizabeth Bagshaw Memorial Lectureship will be delivered by Dr. Roberta Bondar. Dr. Bondar was born in Sault Ste. Marie Ontario sometime after World War Two and is one of the six original astronauts selected in December of 1983 out of more than 4300 applicants. She has demonstrated here without any doubts that if a woman has the ability and opportunity, she can make it to the top.

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Ned Gagic

As it was stated in the newspaper at that time. Dr. Bondar received a Bachelor of Science degree in 1968 and a master of science degree in experimental pathology in 1971. Doctorate in Neuro-biology from University of Toronto, 1974. She made the right choice and came to Hamilton, where she finished medicine in 1977.

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Ned Gagic

Lost my page. After 1977, Dr. Bondar went to London, where she finished the spec- specialized in the neurology and got a fellowship in 1981. Since 1982, she has been in Hamilton as the initially assistant professor in medicine here at McMaster University, as well as a member of many associations. Dr. Bondar has got a curriculum vitae, which is about 15 to 20 pages and to summarize, would probably take me about 50 minutes.

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Ned Gagic

There is no doubt that number of degrees that she has and published papers and achievement and members of our society that she belongs to are really credit to her. Looking through her curriculum vitae. There was one thing that caught my eye, and I think that's the greatest achievement. As beautiful as she is, she's still single. Would you please welcome Dr. Roberta Bondar as a guest speaker.

00:02:22:17 - 00:02:46:09

Roberta Bondar

Thank you very much, Dr. Gagic. I would like to thank the section of women physicians of the Hamilton Academy of Medicine, the Hamilton Academy Medicine itself for having me come here to speak to you all as the Elizabeth Bagshaw lecturer. I saw some new people at lunch today to try to find out what you are all learning about today. And I was told that the talks are really good because they're really down to earth.

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Roberta Bondar

So I don't know what you are going to think about this because there's nothing down to earth about any of it. I've got a number of slides to show you and also you sort of learn after a while giving a bunch of these talks that you have to sort of save your throat for the end. So I have a movie to show you, and the movie is about 28 minutes long.

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Roberta Bondar

I'd like you to know what's ahead. And it's sound. No cartoons, no popcorn. And it's just a- I think it's a very nice movie. And I'll tell you about that in a few minutes. When I was asked to give a title for this talk, I sort of thought, well, it might be nice to talk about future issues in health care for women.

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Roberta Bondar

And given the type of program i'm in right now, it's sort of really on my mind. The kinds of things that women are going to be facing, especially when we go into space. So I'd like to start off with showing you some slides and talking to you about some of the problems, some of the medical problems right now envisaged in the program.

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Roberta Bondar

And then we'll go on to the movie and I'll come back to talk about some of the real future future issues. So if we could start out by having the first slide and some of the slides are very dark, so if all the lights go off, I wanted to start out in case any of you have not seen a picture of Elizabeth Bagshaw from the autobiography.

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Roberta Bondar

This is the biography that was published. There's a copy of this, I understand going to be the registration desk and people kindly send it to me because I'm afraid that I did not have a wealth of knowledge about Dr. Bagshaw and I really wanted to learn more. I find at this stage of my career I like looking back at other people who serve as role models and especially from communities that I go around and speak to.

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Roberta Bondar

I think Dr. Bagshaw, seen here packing her medical bag, is an absolutely primary pioneer in this country, not just in medicine, but actually in dealing with people. And I think she's a very it's been underrated up to now, and hopefully I'll be able to carry the message of Elizabeth Bagshaw with me around our country and make more Canadians aware of the very great pioneering work that she has done.

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Roberta Bondar

We have the next slide, please. I've got like I could drive on. This is a Dr. Bagshaw on her way to do her rounds. I must say that when I heard that she had packed her bags up after 70 years, I thought to myself, Well, I would really love to be in that position because maybe there'll be a picture of me coming out of the space station with my little black bag.

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Roberta Bondar

These are all know that I'm part of the Canadian astronaut program. There are a number of women in the astronaut program in the world. There have been two Russian women who have gone up and one Russian woman has gone up twice, including the first spacewalk by a woman and woman in the States. Of course, we have had at least we've had four women who have gone up, one of whom has performed a spacewalk.

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Roberta Bondar

And this was done on Marc Garneau as mission. I must say that it's it's very exciting time for men and women in the in this particular age and for our young people. But I think that we have to realize that there are limitations to what we understand about how our body is going to react to this relatively very hostile environment.

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Roberta Bondar

The shuttle program. Really, the flights are about 8 to 10 days long. They can be as short as three or as short as one, I guess, if you had some problems. But the future is going to be in longer term life in space in terms of space stations it's going to be about a 90 day turnaround for each crew member.

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Roberta Bondar

And we're talking about going to Mars at the moment will probably take about two years. And that's really the only planet we can get to and hopefully land on without flying ourselves to death or freezing. So I was really interested in how I was going to react to spaceflight. I have not been up there yet. A lot of people think I've been there, but I haven't been there yet.

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Roberta Bondar

And I'm trying to understand more about space physiology and about the problems that women will be

facing. Because, you see, although I was born after World War- the end of World War Two, it's getting pretty close to the end of reproductive lifestyle here. And I along with other women, are going to be looking at going into space in the future.

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Roberta Bondar

Hopefully it'll be my second or third flight, but it will be at a stage when you're now a post-menopausal. And so there are problems that we face here on Earth that I'm going to share with you how they are even worse in space. The women that have pioneered some of this work here in the United States are there are a couple of doctors amongst this crew.

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Roberta Bondar

We have. Let's see if we can find her here. Dr. Ray Shedden right here is the is a surgeon who is going to be going on a flight. In fact, she's supposed to be on the one that is having having so much difficulty with with the senator, the first physician in space, the first female position space is right here.

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Roberta Bondar

Dr. Anna Fisher. They unfortunately, however, are not doing life science experiments. Once they get into the NASA program, they're called mission specialists and they perform other duties on the orbiter. Kathy Sullivan is a fantastic lady. She has a Ph.D. in engineering, at least in geology, from Dalhousie University. She was on the flight with Mark and made the first spacewalk for an American woman.

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Roberta Bondar

She's very interested in life sciences, very interested in Canada. We need more people like Kathy to go up and make very accurate record, accurate records of sort of observations on oneself in space, because unless you have formal experiments, you have to realize how your body's reacting. And there's so many of us in the room and each one of us would react in a very different way.

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Roberta Bondar

So it's very important to have very good observers up in space. People are really truthful and will tell you when they're feeling sick or will tell you when they had back pain. And we certainly need a lot more information about women because there have been very, very few so far who have gone up. We have a few more things to consider now that we didn't previously with Kathy's spacewalk.

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Roberta Bondar

We know that we have to deal with physiological problems developing inside a spacesuit. You have to be thermally cooled the same way men have to be, but certain attachments and whatnot. A different with a spacesuit for women. All of the spacesuits so far have been developed for men. They're sort of off the shelf items, but they're all made by some, I think, a couple of elderly ladies in the south of Tennessee.

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Roberta Bondar

So if any of you can. So we probably so may have a calling here in Canada to be able to fit into one of these suits. Right now, you really have to lift weights to be fairly chunky. And Kathy says that's probably why she got selected to do that particular flight. We're doing more dangerous things now in space, and women are going to be doing this as well as men.

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Roberta Bondar

And here we have a slide showing the capture of one of these satellites on a relatively recent mission. This is one of the satellites that was put into an orbit. The satellite did not work and they had to retrieve it. And you can see that with moving things around. Certainly these things are weightless, but they do have a lot of

mass and it requires a lot to be able to push these things around.

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Roberta Bondar

So you're working with things that may have not been designed for recapture and they may have some rough edges on. So you have to be sure that you even you have to think about what you're doing in space the same way you do have to do down here. And for women, we now have to accept the fact that women are in the program and are going to be able to do this type of construction work in space.

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Roberta Bondar

I don't expect you to read this, but I just want to splatter all those titles on to show you that all of the life sciences have some input in space. This this is just a whole list, including gerontology, which I think Dr. Tripp would be happy to see there. We have to worry about many, many things for the space traveler.

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Roberta Bondar

And all of these things have terrestrial application. Things that we're learning about from our space exploits are helping us understand physiology better down down here. Well, what are we going to what are we doing right now to ensure the health of people in space? I just want to show you this. Instead of a black bag, this one is flown on the shuttle.

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Roberta Bondar

This is the blue bag. And there are two blue bags. One has a red stripe on it, and that's the emergency kit. And inside these kits, there is a hope bunch of medications, various suture materials you can stitch stuff up and small little things that you might need in the kit. That is the kind of medication and bandage kit you have things like could you believe they have

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Roberta Bondar

anusol in that kit, that's if you're sitting down on the job too hard, I guess one of the great problems that is really going to affect all of us. But I think that women perhaps are much more interested in the effects of radiation. I think men are, too. But the whole business about about childbearing comes into play right here on Earth.

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Roberta Bondar

We have a problem with radiation. I'll show you a slide in a minute showing you how much radiation we are getting all the time. But when you go up in space, there are there is radiation around. So far, men or women have not been subjected to too much of this because of very good planning by the Americans when they and the Russians, when they've sent people into space.

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Roberta Bondar

You don't want to have a great big sort of a burst of cosmic gas from the sun that's going to send all kinds of radiation down to down to hit your spaceship, especially if you're outside doing one of the spacewalks around the earth are these little there's belts or called the van Allen Belt named after the physicist who found them.

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Roberta Bondar

And basically they're the trapped bands of radiation. And down in the South Atlantic, there's a band that comes really close to the earth, and this is called the South Atlantic Anomaly. And if you happen to be on a mission that you're walking out and doing a spacewalk through the South Atlantic anomaly, your radiation levels are going to be much higher.

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Roberta Bondar

The shuttle flights have been in what's called low earth orbit so that the radiation hazards are very little because those those radiation belts here are much higher. But as you go up further to make trips to various planets, you can be 18 months away from here. You can't predict when a solar flare is going to occur. And you could have a lot of radiation.

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Roberta Bondar

So we have to be very concerned about shielding. If you look at some of the tissues in the body that are sensitive to radiation. For any of you who've had yourselves, or have friends who've had radiotherapy and know that people can lose their hair. And that's because hair is a very rapidly dividing cell system. And the object of both chemotherapy and radiotherapy is to knock off rapidly dividing cells, which of course are tumor cells.

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Roberta Bondar

If you do this to the normal person, in normal cells, you'll knock off the rapidly dividing ones as well. And at the top, from the top to the bottom. And this ones that are very, very sensitive to radiation and you can see lymphoid tissues at the top. Well, when I go to the next slide, you'll see that it's very, very important that you have a very low dose.

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Roberta Bondar

And it's based on the dose to the bone marrow that people use to see how many more flights you can go up in and down at the bottom, we have things like the brain, the central nervous system, bone and cartilage where you don't have rapidly dividing cells. So the sensitivity to the human for going into space like that is very, very low.

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Roberta Bondar

When you look at your muscle as opposed to looking at your blood system. I know the people at the back can't read this. So I will just tell you what the good things are. Let's look at this. It has the career limit for an astronaut is called 400 REMS. Now, REM is just a way of measuring the absorbed dose of ionizing radiation.

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Roberta Bondar

But if you just see it, say to the number 400, that's the career limit. That does not mean on one flight. So you're allowed to go up in space until you've accumulated that much and then they won't let you go up anymore. And that's based on twice the amount, the twice the dose considered a risk for developing leukemia.

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Roberta Bondar

So that's why everything is based on bone marrow, the sort of the hematology system, if you will. If you look at the 30 day maximum, it says it's 25. Well well, again, this mission limit of 25 is has been decided because of the probability of side effects or effects of having radiation bothering your system and interfering with your your ability to work as an astronaut and bringing the ship back.

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Roberta Bondar

If you had more than that, you might become sick, You might have nausea and diarrhea. So don't want you up there when you have more exposure than that. Now, how does this figure out? How does this put in perspective with what we experienced down here in Earth? Well, if you look at a normal chest X-ray, remember, the crew limits 400 and the mission limit is 25.

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Roberta Bondar

A chest X-ray dose is only 0.010. So you can see. So it's met many magnitudes lower than what you'd have on a career limit or even one mission limit if you were living down in Kerala, India, for one year, the average radiation to your bone marrow is five. Now that's a heck of a lot more. And that's because of the thorium that's present in the sand.

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Roberta Bondar

So you actually have more radiation here on Earth than you do when you're up in space. So I just want to let you know that for the shuttle flights at the moment and possibly for space station in low-Earth orbit, you will not have as great a problem from radiation unless there some big cosmic event. The thing to worry about, of course, is in the future, when we go to other planets.

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Roberta Bondar

Now, I'm sure all of you have seen pictures of people in space. If you haven't seen that before, you may not appreciate the differences here. Once you're in space, you get a very puffy face. Food comes up to your face and you stay that way until after you land within about 24 to 72 hours, the food starts being reabsorbed, but you still have some of the fluid left up towards your head.

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Roberta Bondar

So you don't have the fluid in your legs anymore. And when you come back to Earth, you might have a problem because you'll faint unless you take some precaution because you no longer have that blood volume to have the blood going up to your head. So if any of you have noticed these these people are now descending the orbiter.

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Roberta Bondar

This happens to be on Mark's flight and he's the second from the back coming down the ladder. You notice that Sally Ride is not hanging onto anything. Kathy Sullivan has one arm and a railing. But of all those people there, Cathy and Sally do not have their G suits inflated, the rest do. And the reason for this, this is the g-suit here, is that when you come back to Earth, it's not because of the force of G's, but now that fluid that was up in your head is now going to be brought back to your legs and it'll pool in your legs and you pass out just like if you were standing in church and

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Roberta Bondar

you got very, very hot and all the blood started coming away from your head and you felt faint, you'd pass out. So to prevent this, when the astronauts leave the orbiter, they all inflate their g-suits. Unless people find that they don't really need it. And on Mark's flight, a couple didn't. But basically that's what is used to prevent you from passing out when you come down that ladder.

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Roberta Bondar

So they all look like they're walking clumsily. They've got the big flight suits on with long legs and you can't see. But that's what's underneath. Now, this isn't scary or I just want to put this up to show you that in flight you lose a lot of bone. People say, well, maybe you can change into an amoeba when you're up in space for very long.

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Roberta Bondar

But that, I don't think is going to happen. The problem is that you lose bone from the weight bearing bones of your body. And those are the bones of your legs, the large bones. Now, what happens? What happens to this calcium? Normally don't use it or lose it. You're here and but here, after you go into flight, you get this rapid loss of of urine, calcium.

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Roberta Bondar

But it plateaus after 30 day, 30 days. But you're still losing calcium because you can record it in the fecal material and that still is going way, way up. And you can extrapolate it very high. People have done all kinds of calculations, seeing how much bone you'd really lose. Somebody figured out after one year if you stayed in space and didn't do any countermeasures, you'd probably lose about 25% of your total body mass of bone.

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Roberta Bondar

That's the calcium that's measured. So the problem is how to get around this. And for women going into space, we all know that post-menopausal women have problems and more problems with bone than men do. Other men do have problems later in life, premenopausal women do than premenopausal women do. So what we have to do now is we don't have any experience on post-menopausal women going into space.

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Roberta Bondar

Now we have problems here on Earth. We now we shoot them up in space. We have to know what is it really going to be worse than if we just left somebody here in bed? Now, if you look at the if you look at the postflight when you come back, how quickly is this being replaced? Well, this is the calcium balance, which means the amount that you take in and you put out before you go up, it's up to up to here.

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Roberta Bondar

But as you fly ten days into the flight, you start now getting to negative balance. You're losing more than you're taking in. No matter how much calcium you try to take into your body. Your body is smarter than that, and it's getting rid of it all the time. And you can go down, down, down, down here. And this is based on a Skylab mission that the Americans had, which was about 84 days long post-flight.

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Roberta Bondar

It took this amount of time, 20 days post-flight. They still had not got back up to the preflight levels here. So it takes a long time for the for men, even when they come back. And there are no long term data that we're aware of- the Russians may have some- on women in space. How do we get around this?

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Roberta Bondar

And the business of the cardiovascular problem, your heart size gets smaller and how do we really get around this? Well, one of the ways is to exercise and the what you want to do when you exercise, it's not only exercise your muscle and your heart, but you've got to make your legs feel like they're coming down in gravity again, because otherwise your calcium, if you just ride a bike in space, your bones aren't going to feel your you're weighing anything.

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Roberta Bondar

So they're going to constantly still lose the calcium, but perhaps on a treadmill when you're moving around, you can get rid of- least stop the getting rid of so much calcium. So here, this is the way that in space, of course, you float around unless you're tied down. So this is how you do it. These are the bungee cords and it ties you down onto a treadmill and you make this treadmill move by moving it.

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Roberta Bondar

So you see pictures of people in space on these treadmills. The only problem is probably on the shuttle flight. It's not doing any good. But on space station, that certainly might. And how long do you have to keep this up? Well, a game for the people at the back. I'll just let you know here, if you're on the left at all the physical things that you can measure.

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Roberta Bondar

And if you look at let's see, let's look at leg strength, you'd have to walk 15 to 20 minutes a day, a jog 5 minutes a day. And if you look down here at the blood and fluid redistribution loss, it's 1 to 3 hours a day in order to have the equivalent exercise. So you'd end up having to exercise 3 hours a day in order to keep up your cardiovascular reserve to prevent some bone loss and prevent muscle loss.

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Roberta Bondar

The flights now every flight, including the Russians, have some type of exercise device on there. Now, at this point, I wanted to this is my space station slide. This is for the after the film. I wanted to show you this film to introduce another another slightly different topic, but one that is of great concern to women in the future.

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Roberta Bondar

In the Sciences program, in health program, in medical programs and engineering programs. Women have not traditionally been accepted in a lot of roles. And this is this is getting better now, but it has a great psychological impact and it has a psychological impact upon your fellows as you work. You don't want to be angry because it's taken a long time for you to get into a program.

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Roberta Bondar

You want to be able to work with everybody because it's a team. It's a team thing. And one of the one of the criteria for being accepted into the program is that you are a team, a team worker. And that's one thing that I feel that McMaster was certainly able to help bring out. The best in me is the business of being a team worker.

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Roberta Bondar

So when you when you consider some of these future issues, you have to think about some of the psychological aspects. And there are women who are involved in the space program, not in the role of astronauts, but in in supporting supporting roles. When I say supporting, I don't mean sort of as support systems, but rather developing and designing the the orbiter itself, helping the control systems of the orbiter when it's when it flies and I think would be of some interest to share this movie with you, to show you the kinds of things that women have had to think about before going into a space related field.

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Roberta Bondar

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Roberta Bondar

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Roberta Bondar

finish up talking a bit and this is going to take a few minutes about the space station because that is the next step. And can I have the lights down a bit to to show you this? This is an artist's concept, What the space station is going to be like. It's going to be in low-Earth orbit, as I mentioned before.

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Roberta Bondar

So won't have the same types of problems with radiation at this point. And it will be supposed to be the initial operating configuration, supposed to be up in the about 1992. And if any of you are good at mathematics and you subtract 500, you realize that it's the anniversary of Christopher Columbus visit to the United States. So that's one of the reasons to have it as a flagship of American exploration.



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Roberta Bondar

The problems that that are encountered in health was a reference to space stations, some of them involving, as I mentioned before, women more than men. At the moment, we have things that are not going to be quite the same importance that we had before. Space sickness at the top, although it's a hazard when we get there, is probably going to go away within a few days and you're going to be up there for 90 days.

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Roberta Bondar

Things like loss of pressure is a concern. Any time you're around a spaceship coming back or staying up there. Oxygen is also very important because you're working in a vacuum and require some basic life support systems. Some things that people aren't realizing is that exposure to toxic substances is very critical when you grow up in the shuttle for it with various experiments, they have to pass a very stringent safety review because if any of you have a if a car with vinyl seats, you'll know that even if you don't smoke and you go in there after a while, you're constantly have to clean off the inside window because it has a little film over it.

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Roberta Bondar

And that's because in the sunlight you get evaporation of some of the toxic substances from the seat of the car. Well, because we have a big atmosphere around us, we don't really notice this. But in space we certainly would because we're in a closed system. Infection is very important because in space everything is in gravity. You no gravity, zero gravity, you're working up there and things can float from the floor.

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Roberta Bondar

It's very difficult to keep a sterile field or keep a cut clean. Electric shock, of course, is very important, and these are just lifting a whole pile of other ones that are up there. Things that we really about done on here, here on Earth, embolism, thrombophlebitis, which McMaster has been very strong in research in that area.

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Roberta Bondar

We hopefully will be able to expand our knowledge in the in human physiology by looking at spaceflight, because without the presence of gravity, we're now seeing various things happen to the human body. And it might help us understand how to treat diseases back here on earth. And of course, after space station we're going to go to the moon is thought that there will be moon colony after I think within the first decade of the next century, and there'll be a permanent, permanent man presence on the moon after that time.

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Roberta Bondar

So there are a whole pile of things dealing with the microcosms, dealing with the whole psychology, the psychological aspects of living with with people from various countries. And of course, there's a whole issue of life support system. How do you do surgery in space? How do you do anything up there with the same type of techniques that we have here on Earth?

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Roberta Bondar

And of course, after the moon there are planets out there to be reached. The Russians, because they're extending their experience in space long as Russians put up now 274 days or so, it's thought that they might be anticipating a voyage around at least one of the moons of Mars and back before the Americans managed to do that. But if it if a mission is launched to land on Mars, it raises all kinds of problems as to how do you keep someone healthy when they're landing on a very hostile planet.

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Roberta Bondar

Mars, incidentally, is about the only planet that man could safely beyond and exist. Given the temperatures. It's around -50 is about the average temperature. Now, this brings me to a close, and I wanted to put these

last few slides up. Someone had very generously I mean, very generously compared me in the role of a pioneer to that of Elizabeth Bagshaw.

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Roberta Bondar

And I want to say that I have at least 71 more years to put in before I really feel actually 61 more years. I'm getting older by the day, more years to put in before I feel that I might have come near the accomplishments that this woman has been able to give to so many people. Hopefully I'll have the opportunity to be able to start in space and to be able to bring back some of our knowledge and apply it here to our terrestrial existence.

00:28:02:19 - 00:28:30:18

Roberta Bondar

Elizabeth Bagshaw started out by going around in a horse and buggy and later had cars, but pictures of her, I like to see with her black bag and looking at from this point in our history back in time, looking at the lovely old cars they used to drive and. I must say that when I go to look at some of my slides, I have by the time I hopefully I'm 100, I'm sure that I'll be able to look back and wish I still had my Vaga because I probably a million bucks for it or something.

00:28:30:20 - 00:28:54:10

Roberta Bondar

A message that I'd like to leave with you. There are many issues that we don't even know are issues yet in health care, as in pretty well any other occupation. And the more we go into things, the more we learn, the more new problems, new, more exciting areas for research are developed. And as soon as you have an answer to one question, such as the muscle loss in space or bone metabolism lost in space, you have about ten more that can develop from there.

00:28:54:12 - 00:29:14:03

Roberta Bondar

And we're hoping that some of this research in space will help us understand things like bone loss in postmenopausal women, in paraplegics and bedrest. And I'd also like to say to any of you who have any of you in the audience here, this is not just for the space program. And if you have had children who want to go in the space program, did want to show you this one slide.

00:29:14:05 - 00:29:35:28

Roberta Bondar

It's this in case you don't recognize it, this is me and my sister. And people ask me how long I've wanted to be an astronaut. And here I am sitting on a crescent of the moon in the Detroit Zoo back in 1951 with my sister. And I tell you, at that time I had a dream. And I hope you all have dreams in life and I hope we're able to achieve them.

00:29:35:28 - 00:29:41:08

Roberta Bondar

Because if you want to know what I was dreaming about, then that's it. Thanks very much.