CONVERGENCE

BEYOND EARTH:
EXPLORING OTHER WORLDS

FUELING ACTION WITH CURIOSITY: THE ROBERTA BONDAR WAY

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To say that Roberta Bondar's goal was to reach for the stars is not a metaphor but a fact. Roberta Bondar's keynote address at the 2024 World Affairs Conference was like a meteor shower in the night sky: illuminating, dynamic and impressive. Being the first Canadian woman astronaut in outer space is a magnificent achievement. She broke through barriers, trailblazed a new path, and pursued goals with unwavering passion. Most of all, she inspired generations to come that anything is possible with proper preparation, determination and willingness to pursue your curiosity.

Dr. Bondar's introduction highlighted her achievements:, "Dr. Bondar has been recognized with the NASA Space Medal, been inducted into the Canadian Medical Hall of Fame and the International Women's Forum Hall of Fame, and has her own star on Canada's Walk of Fame. She has 28 Honorary Degrees from many Canadian universities and is a Companion of the Order of Canada and a recipient of the Order of Ontario."

Her resume could fill a room. But awards are merely a reflection of success - not character. They show how far she went, but not the unique path she took to travel there. That's why the most striking thing about her presentation did not revolve around her title, her achievements, or her experiences on her eight day journey among the stars. Instead, it was about the thousands of other days in her eventful life. It was about who she is: a person whose curiosity fueled action.

Any reasonable person would assume her travels to space would be the apex of her life. Growing up in a small town, Bondar explains, she always loved science and the thought of outer space. As a child, she stated that "being a spaceman was the most exciting thing I can imagine". This dream paired well with her interests in science, as she conducted experiments in her basement using a makeshift laboratory her father built.

On January 22, 1992, Bondar launched into space on the STS-42 NASA Space Shuttle Discovery Mission. She worked as a payload specialist conducting experiments on the adaptability of the human nervous system to areas of low gravity and the effects of microgravity on small organisms such as bacteria and fruit flies. She explains that her team of astronauts conducted over forty experiments to learn more and discover more about space medicine.

However, despite this impactful experience, a particularly inspiring feature of her speech was that she never stopped moving. After travelling to space and accomplishing her childhood dream, it would be easy to relax and bask in the glory. But for Bondar, space was just the beginning. Her life began to move in many directions.

Throughout our highschool careers, and especially towards the end, we think about our futures from a practical perspective. What are the jobs of the future? What jobs have a good work-life balance? What jobs offer the best return? But Bondar's presentation has taught us something beyond the practical. Attending more than four different universities, and having more than five different jobs, her curiosities fueled her eventful life.

Something particularly interesting about her career post NASA was her pursuit of photography. Space travel is a precise subject built upon science and calculations that ensure survival. What you see is what you get. On the other hand, photography is an artistic passion used to tell stories and evoke emotion. It takes you beyond what you see. Bondar bridged both subjects and used photography to convey a meaningful message. She travelled all over Canada with her unique perspective on Earth, taking photographs of different animals and nature scenes to convey the importance of protecting our planet. She even mortgaged her house to take part in this journey, which led to her four best-selling photo-essay books.

Although space travel is an incredible experience that begs to be shared at length, perhaps what made Bondar's speech so valuable is the question it provokes in all of us: What makes a life worth living? Is it for the different adventures we go on and experiences we face? Is it the legacy we leave behind and the impact we have on others? Or is it simply the time spent doing something we enjoy?

Bondar presents a notion that whatever our goals are for the future, let our natural curiosity be the launch pad and the sky be the limit.

INTERVIEW WITH DR. ROBERTA BONDAR

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On the day of the World Affairs Conference, Convergence had the chance to interview Roberta Bondar. Below is the exclusive interview with Dr. Bondar where we asked questions that are not commonly asked to astronauts and which are especially relevant to high school students. We hope you enjoy.

Convergence: I appreciate training in preparation for space travel is extensive. What was one of the most surprising things that you experienced in space that you hadn't fully appreciated in training for it?

Dr. Roberta Bondar: We trained for off-nominals which are things that could occur if the equipment went wrong, problem-solving before we actually fly.

We do a lot of this training, but very little of it is useful in space. Problems up there are pretty generic. For example, a screw was missing for an experimenter's camera that had an adapter for a microscope.

So you can't think of everything that's going to go wrong. It's impossible, we're human beings, but once we're in space we think, "why didn't we see that before we flew?"

C: Mental health resiliency is very important on Earth and must be even more so for astronauts in space since you are literally confined to one spot with no exit. What challenges do astronauts face in terms of mental health resiliency in space and how do you manage that in space?

RB: We are in smaller environments and far away from home. However, one thing that is difficult to fix is that we get "brain fog" in space, what we call the "space stupids".

Everything starts floating around and we get disoriented and as a result we lose things very quickly. We all tumble, pens tumble and glasses disappear.

All of it is tedious.

You're a third less efficient from space. Everything that would take an hour in space, would only take 40 minutes on Earth.

When we do timetables for spaceflight, we have to always make sure that we allow enough time to pass between experiments to get new sheets out because everything flows.

People who go to space are usually quite obsessive compulsive and focused on their job but things go wrong quickly.

One cannot train for the mental burden. So the physiological things that happen in spaceflight is when your brain fluids float, it's hard to think your way around.

That's why the people supporting us on the ground are important to keep people safe and think straight.

C: What was your greatest personal challenge in space and how did you deal with it?

RB: Trying to get the work done in the timeframe we were given. We had two twelve hour shifts and they put two missions into one. When you were done your shift, you left the space lab and the next team came in. We then took the experiments out of the Space lab and tried to do them on the flight deck, still awake another two or three hours.

So another challenge is trying to get any sleep. I didn't. I only got two hours of sleep each night because we were so pressed to get this work done.

C: What skill set or attribute best prepares an astronaut for space travel?

RB: Compatibility as a team. Due to the shifting fluids inside the head, you become different and look different. You might be the most handsome or beautiful person in your class but then you get into space and become ugly looking.

You get a big, puffy head and skinny legs - it's called "puffy face and bird leg syndrome".

You can't prepare for this. On Earth, if you're facing someone lying down on a couch and you approach them from their head, their mouth is where their forehead is. That's like looking at someone in space when they walk upside down along the ceiling.

Also, since people can walk on any surface, people become disoriented, feel nauseated and throw up. There is gravity in space but the body's senses are not good enough to sense it.

After 48 hours, many neurological reflexes that we have on Earth are gone. For example how our hands automatically go out when we're falling. When you first come back, you have to remind your body to get these reflexes as they don't come instantly. There's a lot of muscle training and your brain must adapt.

When I was doing space medicine research after my flight, one astronaut was on a table doing tests. The other scientists walked away when they were finished testing and the guy rolls over and starts falling off the table. I'm trying to prop him up and am yelling at everybody to come back and help!

C: Students in our leaving class, including myself, are about to set out on a new journey in our lives, leaving the familiarity of years of high school for something we've never experienced before. Exciting for some, terrifying for others. Having been through many such journeys in your career, any words of advice for students who fall in each category?

RB: I feel that preparation is important. And if it's too late to prepare, then I think one needs to find a safe place in one's head where one can say, "Hey, you know, I'm not going to get rattled about this. I'm going to learn a bit more about this environment or going into learn a bit more about the culture of the institution". Whatever it is preparation is important because changes are nerve racking.

If you're thrown something different at any time, you need to have a foothold.

My advice is to figure out what foothold a person has it safe for them, whether it's playing tennis, going for a walk, taking photographs or whatever it is - hopefully not too technologically oriented, because the brain needs a break from a computer interface.

DIGGING DEEP: HOW TO GET THE MOST DIAMONDS IN MINECRAFT

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Instead of writing about my usual hobby of politics, I decided to write an investigative article on my favourite game: Minecraft.

In this article, I'm mining diamonds in the depths of the Minecraft underground. But of course I'm not just playing for fun; I tested 5 methods of mining, each with its own proponents and detractors, to test for the highest efficiency: strip mining, branch mining, dive-mining, spelunking, and antenna mining. If you don't know what the last one is, that is normal, because I fished out a new method from Minecraft Wiki to freshen things up.

The following is the methodology, and if anybody wants to verify the results, the essential data is here: Version BE 1.20.30, Seed name: 7915051113874874297, Starting point for non-spelunking methods: (0, -59, 0).

For every method except spelunking, I started from the starting point, and I mined for precisely 15 minutes to test each of the methods. I had torches, bread, full iron armor, a water bucket, and an Efficiency V netherite pickaxe. I was in normal-difficulty Survival mode with default settings, and I would have counted it if I had died to mobs or to lava. Below are my test results and a brief introduction of each method.

Strip Mining

Strip Mining is straightforward: you mine a 2 x 1 tunnel in a straight line and collect whatever ores you find on the sides. Due to its simplicity, it is the go-to method for Minecraft beginners, but has faced criticism over its inefficiency.

After fifteen minutes of mining, I obtained the following resources:

Cobbled deepslate: ~10 stacks (640 blocks)
Redstone: ~2 stacks (128 powders)
Tuff: ~ ⅔ stack (42 blocks)
Gravel: ~½ stack (32 blocks)
Diamonds: 4 Diamonds (found in 2 veins)
Gold: 2 ores
*XP Level growth: 0 -> 6
Miscellaneous:
1 flint

* Note: in Minecraft, the experience levels aren't linear: the number of experience needed to reach the next level grows exponentially as your XP level increases, so 0 -> 10 or 6 -> 12 is actually much better than 0 -> 6 than it seems.

I used ½ stacks of torches (32 torches) and overall, I discovered one diamond vein per 357 useless blocks. I encountered lots of lava, and in methods where the height of the tunnels are 2 blocks, it is harder to escape lava or cover it with water than when the tunnel is only one block tall.

Branch Mining

Branch mining is another method of mining, but the essential idea is not dissimilar to strip mining: one mines a two block high tunnel in a straight line. The difference is that one would also mine side tunnels to the main tunnel spaced a few blocks apart. In my methodology, these are 20 blocks long and spaced 8 blocks apart. As a result, most of the resources are exposed, but you will make less ground than strip mining.

After fifteen minutes of mining, I got the following resources:

Cobbled deepslate: ~9 ½ stacks (608 blocks)
Redstone:2 ½ stacks (160 powders)
Tuff: ~1 stack (64 blocks)
Gravel: ~½ stack (32 blocks)
Diamonds: 2 Diamonds (found in 1 vein)
Iron: 1 Ore
XP Level growth: Level 0 -> Level 7

I used 25 torches and discovered 1 vein per 704 useless blocks, nearly double the strip mining method. However, it is within a reasonable range of randomness and is in fact very similar to strip mining in efficiency. Overall, since strip mining is easier, doing branch mining isn't really worth it because you don't actually extract more resources.

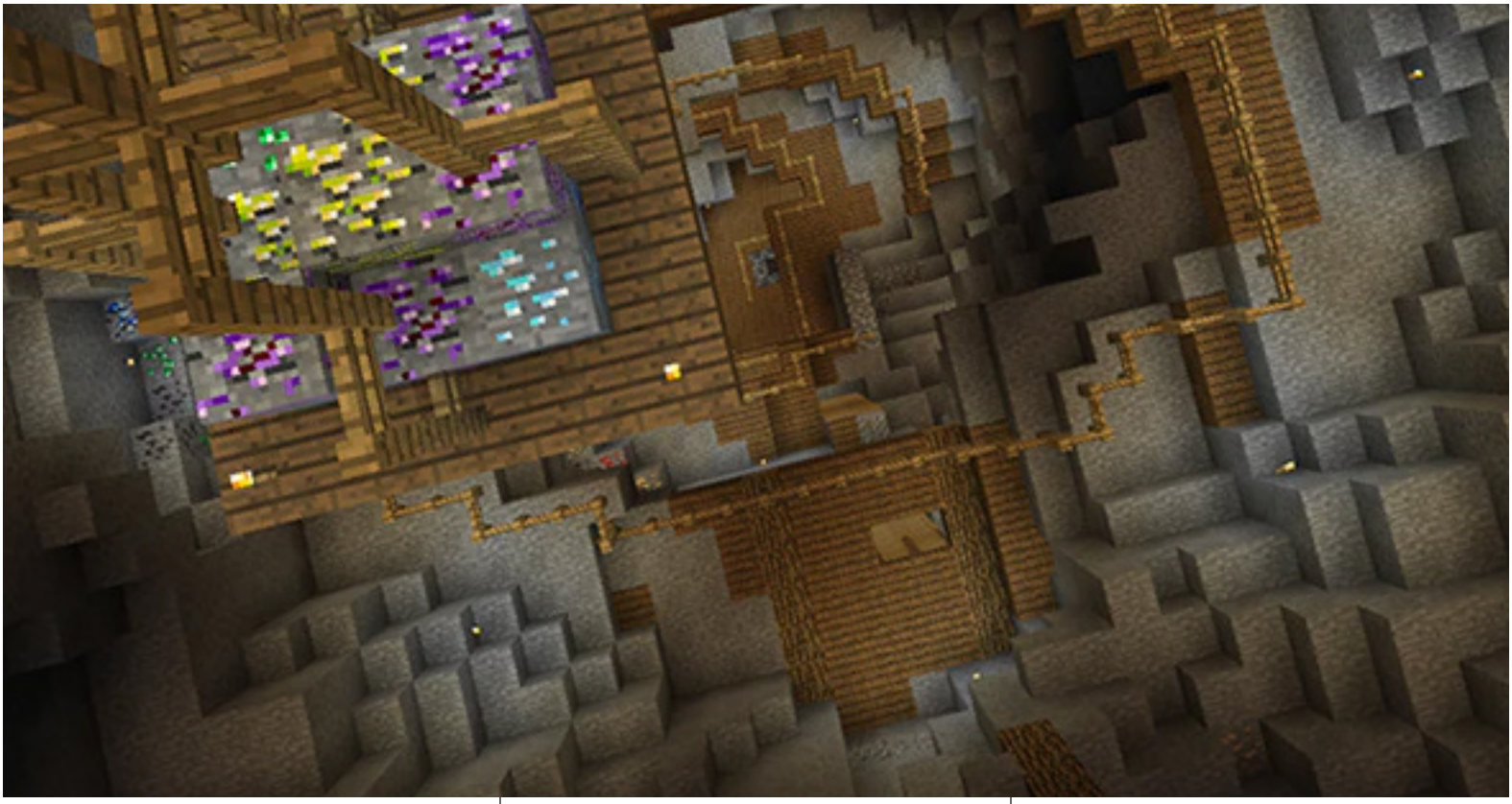
Dive-Mining

Dive mining exploits a bug: if the player has a water bucket in Bedrock or a trapdoor in Java Edition, the player can change into a swimming stance, which means that the player can travel through 1 x 1 tunnels. This is useful because you can expose 6 new blocks per block mined in a 1x1 tunnel but only 4 new blocks per block mined in a 2 x 1 tunnel, which makes dive mining theoretically more efficient than the two methods above.

Otherwise, the way I used dive mining is similar to branch mining: digging a 1x1 tunnel straight ahead and having eight block long side tunnels spaced eight blocks apart. Here's what I got after 15 minutes:

Cobbled deepslate: ~5 stacks (320 blocks)
Redstone: ~1 stack (64 powders)
Diamonds: 20 Diamonds (found in 2 veins!)
Gold: 15 ores (6 burned in lava)
Others: Negligible
XP Level growth: Level 0 -> Level 9

I used 21 torches. Notably, this method is significantly more efficient than the above: You get 1 diamond vein per 160 useless blocks, which is more than four times better than branch mining and two times bet-



ter than strip mining. This means that it is the most efficient method of those that require you to dig tunnels. However, a recent update made the travel speed while swimming in a 1x1 hole much slower, which means you will be able to cover much less ground than previously.

Spelunking

Spelunking is a fancy word for exploring caves, and it is one of the quintessential parts of playing Minecraft in survival mode. However, you are also prone to explosive surprises and death, and indeed, I almost died two times to a witch. After fifteen minutes of barely surviving, here's what I got:

*Important: my cave's Y-coordinates were at around 0 -> -30. Caves higher or lower than that may yield different results.

Diamonds: 2 (from 1 vein)
Iron: 24 ores
Gold: 20 ores
Lapis Lazuli: 20
Redstone: 2 stacks 18 powders (146 powders)
Cobbled deepslate: 32 blocks
XP Level 0 -> 10
Mob Drops:
Spider eyes, sticks, string, rotten flesh, 1 ender pearl

I used up an entire stack of torches and 15 pieces of bread. This method is very good if your goal is just to collect resources and experience points in general, because if you survive caving for 15 minutes, you are probably guaranteed to have enough resources for full iron armor, enough gold for trading in the Nether and maybe a diamond pickaxe & sword. However, there is a significant likelihood of death from mobs and unexpected falls, and you will need lots of coal for torches, and you are not likely to get more than 5 diamonds.

Antenna Mining

I threw in this relatively obscure method to see if it can surprise us. What this method is, and I quote Minecraft Wiki:
Use the staircase method to dig down to bedrock.
Go up 2 blocks and fill any space below they have mined out.
Dig a 3×3 room.
Dig a straight 2×1 tunnel in a straight line then dig out 32 blocks every 4th block.
And after fifteen minutes of using this method, I got these:

Diamonds: 2 (in 1 vein)
Iron: 4 ores
Gold: 8 ores
Redstone: 1 stack (64 powders)
XP Level growth: 0 -> 5
Cobbled deepslate:~ 9 ½ stacks (608 blocks)
Gravel: ½ stack (32 blocks)
Tuff: 1 stack (64 blocks)
3 Flint

I used 18 torches and 2 pieces of bread, and the conclusion is that this method surprised me, in a bad way. This method yielded the least amount of XP and didn't extract more resources or less useless blocks than strip mining or branch mining. It is also the only method involving tunneling that consumes hunger bars.

Conclusion:

After a weighing of options, I have the overall ranking:

1. Spelunking for resources in general
2. Swim mining for diamonds
3. Spelunking for diamonds
T4. Strip Mining
T4. Branch Mining
6. Antenna Mining

The most efficient method is swim mining and it also gives you the most cobbled deepslate. The method that yields the most resources is spelunking but it is also the most dangerous method. Good luck mining!