Bob McDonald's TVO series "HEADS UP" and YES I Can! Science resources

Fall/Winter

Heads Up

Bob McDonald's *Head's Up* is a series of 13 programs which look at various aspects of Space and the Universe in which we live. Related classroom activities are available from the YES I Can! Science website. Some suggested activities are included in this pamphlet.

Some activities are grade specific but most can be tailored to fit the needs of a wide academic audience. Check the TVO website at **www.tvo.org** for broadcast times and program listings.

The list of related classroom activities given here represent only a few of the resources available in the *YES I Can! Science* database. For grade specific resources it is suggested that you use the **Guided Search** feature of the *YES I Can! Science* DataEngine.

1 Where's our Place in Space?

Did you know that you live in a suburb of the Milky Way Galaxy, our city of stars? Just as you might get lost in a big city at night, we climb up to a lookout and survey the entire city below. Then we look up at the stars and try to figure out our place in space. We learn that our Milky Way Galaxy is a stellar metropolis complete with downtown core, suburbs, and city limits. There are more stars in our galaxy than grains of sand on a beach, and to get a sense of how big our home is, we build a model of our solar system inside a giant domed baseball stadium. By the end of our story, youll feel very tiny, right at home in the Milky Way.

1.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/16496

This is an excellent numerical activity in which students get a good "feel" for the size of the solar system by comparing the times required to travel to the planets by various (hypothetical) modes of transportaion such as walking or commercial jet.

2 Is Earth the Only World with Water?

No its not! Earth is the only planet we know of that is covered with liquid water. Thats why its blue. But many other worlds have water too. Unfortunately, its either underground or in the form of ice. We try skiing on the snowy ice caps of Mars and think about a time long ago when you could go swimming there. Our quest for water leads us to a hidden saltwater ocean on a moon 600 million km from Earth and other ice worlds beyond Jupiter. So does that mean if we find water, will we also find life?

2.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/16981

The Fundamentals of Atmospheres, Weather, and Climate. An extensive investigation into the nature of weather and the role of the Sun, water, and the atmosphere in the creation of the phenomena we know as weather. Links to today's weather on Mars.

3 Why are Planets Round?

This is a story about gravity. We learn that gravity is a force that works everywhere, even in space and it always pulls towards the centre of an object. When we point to down we always point to the centre of the Earth, no matter where we are. With gravity pulling towards the centre, the smallest shape anything can be is a ball, so almost all planets have that shape,. but not all. The big ones bulge out in the middle and very tiny worlds, with almost no gravity have odd shapes, like the asteroid that looks like a peanut! We see gravity at work in a gravity well, and fall into the ultimate gravity trap, the black hole!

3.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/17610

More about gravity ... and the apparent lack of gravitational effects. This resource from the YES I Can! Science database contains activities which explore the effects of gravity and micro-gravity. Scientists in orbiting laboratories use the micro-gravity environment created by their orbital motion to perform a wide range of experiments from crystal growth to seed germination.

4 Is Anyone out There?

The part of astronomy in which scientists look for signs of intelligent life among the stars is called the Search for Extraterrestrial Intelligence (SETI). Searching for alien life is like looking for a very small needle in one huge haystack. Yet a few needles have been found: astronomers have indirectly detected planets circling other stars. Without alien planets there can be no alien life, so the new planets are a breakthrough discovery. Our story takes us to these strange worlds and finds out if any of them are a nice enough place for ET to call home. If we do make contact with aliens, what will we say? Talking to beings from other worlds may be the most difficult challenge of all, especially when it comes to choosing a language well both understand.

4.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/17058

Looking for life on other planets in our solar system? Mars seems to offer the best hope of discovering if life has been able to evolve on other worlds. This resource focuses on recent Martian research, discoveries, and the search for extraterrestrial life in our galactic backyard.

5 How Do I Become an Astronaut

Theres more to astronautics than just floating weightless above the Earth. Long before they go into space, prospective astronauts require tons of training with equipment that simulates working conditions in microgravity. We visit the Johnson Space Centre in Houston to meet Canadian astronauts training for their flights into space. We tour the international space station, learn how to make dinner on the space shuttle, find out about blasting off and experience the fun of weightlessness. Kids get a taste of this training by going to Space Camp in Montreal, a place where space simulators give the illusion of being in orbit. Out of this world space vacations are not far off!

5.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/23758

This activity discusses the science of working in extreme environments. Topics include the ideal gas laws and their relevance to space-walks, the speed of sound and it's effect on speech and communications in space, and the optical properties of windows and helmets. The summary unit features some of the work done by Canadian astronauts Dave Williams and Julie Payette.

6 When Can I go to Mars?

You can go there now and see Mars through the eyes of robots. Join the excitement of a Mars landing as we watch two remote control rovers land on the red planet. The robots are much less expensiveand far less riskythan sending humans. Look out over the dusty plains, drive down into deep craters and find out how Mars used to be a planet like Earth, with lakes, rivers and possibly and ocean. We look ahead to future rovers and eventually people who will make the long journey and set up the first up habitats on our neighbour in space. And its not all work, theres terrific skiing at the north polar cap!

6.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/44211

Robots, our exploration partners. This resource is your gateway to robots and the robotic exploration of Mars. Contains activities and resources for grades 4 through 12.

7 Why Do Stars Twinkle?

Surprisingly, the twinkling effect has nothing to do with the stars themselves. The turbulent air above our heads is what distorts starlight. But despite the twinkling, astronomers have found a way to make celestial objects look clear and steady in their huge telescopes. In this episode we learn how those telescopes work. From a fireside star party, where we see how some stars twinkle more than others, we journey to mountain tops where some of the largest telescopes in the world sit high above city lights and the stars dont twinkle so much. We travel into space where orbiting telescopes get the clearest images of the universe and see e future instruments that will look back to the very beginning of time.

7.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/17707

This is a "Heads Down" unit. It shows how the Canadian designed and built *RadarSat* examines the Earth from space. This resource is an excellent introduction to telescopes, image resolution, and remote sensing.

8 How Do We Get Around in Space?

So, you want to send a rocket to a distant planet? Its not as easy as you think. In this episode, we talk about the tricky manoeuvres that mission planners have to work out before launching a space probe to a planet or an asteroid. They include launch windows, gravity slingshots, and other nifty tricks of the trade. Lets try a few rocket tricks, and see where we wind up. Astronauts describe the thrill of a rocket launch while Superman demonstrates how rockets stay in orbit. Then figure skaters show us how easy it is to miss another planet completely! You can experience the thrill of spaceflight yourself by joining a rocket club and flying your own model321

8.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/44133

A detailed analysis of orbital motion and space flight. Two major units dealing with the physics of space flight and the physics of orbital motion. This module contains many illustrations, many transparency masters for photocopying and many student activities and assignments with answer keys.

9 Why is the Sun Hot?

How are stars made, and what makes them so darn hot? We take a short trip around the Sun (being careful not to get too close) so we can answer these questions. In the process we explore dark sunspots, bright solar flares, orangey prominences, and the invisible solar wind. Through the eyes of a space observatory called SOHO, we can view incredibly energetic spots and flares as they actually occur. We peer inside the sun to see how it moves like a giant pot of boiling soup. We can even sail in space on the power of sunlight using a huge plastic sheet as big as a small town. Getting to know the Sun helps us to understand how other stars work, too. We have to understand the sun today because eventually it will burn out, swell up and swallow our entire planet. Enjoy that sunshine while it lasts!

9.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/23744

This resources contains two very "illuminating" activities. The first has students perform an experiment to determine the *solar constant*, that is the amount of energy falling on the Earth's surface per square metre per second. The second experiment allows students to calculate the total energy production of the Sun per second *i.e.* the power of the Sun.

10 What are Shooting Stars?

Rocks from space fall to Earth every day. Called meteoroids, these rocks are mostly very small pebbles that drift our way from the asteroid belt beyond Mars. But every now and then a large

object like a comet or asteroid strikes the Earth causing massive explosions that can wipe out life. We visit meteor crater, a giant hole in the ground created when a house sized object crashed to Earth fifty thousand years ago. We meet the astronomers who are searching the skies for other objects out there that could hit us in the future and look at plans to do something about it if one of them is heading our way. So grab your hard-hat; were taking you outside to see for yourself

10.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/44787

One of the great resources hosted within the *YES I Can! Science* database, linked to the Pan-Canadian Science Curriculum, and developed by NASA. This resource is an introduction to the art and science of meteor watching and meteor research.

11 Why Do Comets have Tails?

Join us as we fly right through the tail of a comet onboard the Stardust spacecraft. The robot was sent on a long journey to pick up bits of dust from the long tail and return them to Earth. The long wispy tails of comets have amazed and frightened people for centuries, and there are lots more of them out there. We meet a modern day comet hunter who has discovered many new ones, including one that crashed into Jupiter. Learn tips on how to find one yourself. If you do, you get to name it! Find out what these mysterious objects are made of by making one in your kitchen and try flying a kite off its low gravity icy surface.

11.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/16626

Want to be a comet hunter? This resource is your key to understanding the coordinates on star charts, your road maps to the skies. It explains the stellar coordinate system (right ascension and declination) used by astronomers. Activities are included to help illustrate the concept of sidereal time and how it relates to astronomical coordinate systems.

12 How Cold is Pluto?

Its colder than you can imagine on Pluto, hundreds of degrees below zero. We visit the observatory where Pluto was discovered to see the unusual machine that spotted the tiny planet. Pluto is the only major body in the solar system not yet explored by a space probe but we get a clue to what it might be like by looking at another interesting place, a frozen moon called Triton, which orbits around Neptune. Ice volcanoes and a super-cold bizarre landscape awaits future explorers. It turns out that Pluto is not the only frozen world out there. Deep in the outermost realm of the solar system, out beyond Neptune, is a whole swarm of ice ballsmost of them small, but some half as big as Pluto is known as the Kuiper Belt. Pluto is the largest member of these ice worlds. But how major is it? Some folks wonder if it deserves to be called a planet at all!

12.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/16493

Cold? How cold is cold? How cold can something become and how does its temperature change? The answers to these, and many more, questions are covered in this resources called *Heat, Temperature and Energy.*

13 Why Do Planets Have Rings?

Fly through the rings of Saturn aboard the Cassini spacecraft and have a snowball fight among the billions of particles circling the most beautiful planet. Saturn is not the only planet with rings, all the giant worlds in our solar system have them and theyre all different. Some rings are thin and black as charcoal, another is orange. The Earth doesnt have a ring today but long ago a brilliant ring did surround our planet. It eventually turned into our moon! Find out how rings form, why only some planets have them and join the search to find other ringed planets around other stars.

13.1 YES I CAN! Science resource

http://de.yesican-science.ca/Resource/16925

Much of the material that forms planetary rings will undergo an impact with other material in space, sometimes eventually impacting the planetary surface itself. The larger chunks of ring material that do not vaporize before impact can cause extensive cratering of the planet's surface. The activities in this resource demonstrate the fundamental principles of impact crater formation. The activities are simulations; true impact or volcanic events take place under conditions different from the classroom. Although some aspects of the simulations do not scale directly, the appearance of the craters formed in these activities closely approximates natural, full size craters. These activities can be used to stimulate discussions of planetary landscapes, terrestrial craters, and the evolution of planetary surfaces.