1. Thank you. It is a big honor for me to be here today, to speak about HUMAN ACTIVITIES SEEN FROM SPACE. I was extremely fortunate recently, when in December 2006 I had the opportunity to in place participate in the assembly of the International Space Station, ISS. Not only was it a fantastic experience, but I also got to see our beautiful world from a unique point of view.

2. ISS is a formidable technological, social and political endeavor, where countries from all over the world participate to create an orbiting laboratory for unique science, ranging from physics to medicine, from studying cosmic particles to observing the Earth with human eyes.

Recently the European laboratory Columbus was added and very soon Japans, even larger, Kibo will be launched and attached here..

3. During my 8 days on ISS, we were 8 men and 2 women onboard, from 4 different countries and even more cultural backgrounds, working hard and intensely together, but never had we any conflict.

We saw gorgeous views of seas, forests, mountains and deserts passing by below us, with a speed of 8 km/s, and what struck us was that “from space you don’t see any borders”. Like here over the Red Sea, the Sinai and the Nile. You think: “Why can’t we live together without any conflicts on Earth as well as in space?!”

4. During nights, one particularly sees human activities. Big cities – lots of lights, small cities - small dots and main roads often lined out as a strings of pearls. I had an almost unrealistic feeling of floating along over a huge map. But it also reminds you that all those lights, all that life down there, it requires a lot of energy which must be provided somehow. (BTW, if you haven't figured it out yet, we are right here now.)

5. With 16 sunsets and sunrises a day, you get many opportunities to take pictures like this one. And you think "Wow, the atmosphere is so thin! It seems so fragile!" And only in the lowest, densest part can we humans live. We better take care of it and not change it so much that we risk run-away effects. Of climate change or other bad things.

6. Space is really an ideal place for studying weather, climate and human influence on Earth. The following slides will give but a few examples of this.

7. Pollution. A photo from a space shuttle in 1994 over the industrial city of Omsk. The ground is covered by snow, but see how dirty it is in this area, mainly downwind of industries.

8. Human activities tend to create a lot of particles and emissions of gases that escape up into the atmosphere. Look at this thick haze of aerosol particles over the Ganges valley and Bangladesh! Compare it with the clean air over Tibet, where very few people live.

This photo is from an Earth observation satellite, which there are many of, typically orbiting from pole to pole about 700 km up.

9. The theme of our symposium is Sustainable Urban Development. Photos over the same area from different times, tell us a lot about urban development. Here is one of the fastest growing cities in US, Las Vegas, 1973 and 27 years later. What is interesting is not only that it is some 4 times bigger in area, but there are so much more green areas also, in the middle of a desert. This is possible due to irrigation. That is often good, but we must be aware of irresponsible irrigation, as for example has happened along the rivers feeding the Aral sea which has shrunk to only a fraction of what it was 50 years ago. Fresh water is becoming a rare commodity on Earth.

10. Burning rain forests photographed from ISS and deforestation areas in Brazil measured by an earth observation satellite. Not only does the burning produce CO2, but - even more important – the forests are huge absorbers of CO2 from the atmosphere, which we need to preserve.

11. Increase of CO2 in the atmosphere is the main suspect for Earth warming and a possible destructive climate change. Here are monthly data of CO2. Two very interesting effects can be seen. First, the concentration varies over the year. It is less during summer on the northern hemisphere, due to the growing season. The growth of trees and plants absorbs the CO2 and there is more of vegetation on the northern than the southern hemisphere. It's like the Earth itself is breathing!

However, second effect, if we compare the same month from year to year, we see a clear and steady increase of CO2 concentration. For example, August 2003, a lot of blue, i.e. relatively low concentration. Same month a year later: almost no blue… and in August 2005 only green. A couple of percent increase in only two years' time. These data are from ESA's Environmental satellite ENVISAT, and within a year Japan will launch GOSAT to further study CO2 emissions. ppmv = parts per million by volume.

12. Temperatures are rising and even faster lately. Perhaps a surprise to many, also sea temperatures can be measured from space.

13. The rising temperatures lead to decreasing glaciers and ice shelfs. The changes are monitored from space. Here we see how the Larsen ice shelf in Antarctica is rapidly disappearing. The dates…and the ice edge as it was in 1992, 95, 2000 and 2002. The scale here is about 100 km.

14. If glaciers are melting, the sea level can rise and that has been measured – also with contributions from satellites. The trend over the last 15 years is about 3.5 mm/yr.

15. There are other environmental dangers with using fossil fuels. Oil tankers spilling huge quantities of oil, for example. This picture from Envisat shows oil leaking from the ship Prestige which sank outside Spain a couple of years ago.

16. I often get the question: “Did you see the ozone hole up there”. But no, you can not see it with your eyes. One needs special instruments, ideally placed on satellites. One such is Sweden’s *Odin*, and here are data from it showing decreased ozone in the atmosphere above the Arctic. Greenland, Sweden, Japan.

17. The ozone hole over the South Pole is more famous (or infamous) and bigger. Ozone is needed in the top atmosphere to protect us from dangerous UV-light from the sun. Once the hole was discovered and accepted as a fact, intense global discussions started, which eventually led to agreements to stop emissions of ozone-destroying gases. What is encouraging is that the size of the hole is more or less stable since the last 10-12 years. So WORLD WIDE COOPERATION MAKES A DIFFERENCE!

18. Here is my conclusion, and showing me and my space walking colleague Bob Curbeam, working on the International Space Station while enjoying a fantastic view over New Zealand. By utilizing Space we will better understand the climate and environment and we can find the solutions we need to achieve a sustainable development of Earth in the future. THANK YOU.