Alexander Gerst Interview:
The Blue Dot Mission - Preliminary Scientific Results.

After Alexander Gerst's return to Earth after 166 days in orbit on 10th November 2014, I as editor for SpaceOps News tried to get an e-mail interview about Alexander's assessment of the scientific results of his "blue dot" ("The Earth") mission. Beyond the tremendous public success for European/German human spaceflight activities on the international space station (ISS) I had four questions which I e-mailed to Alexander Gerst:

1. It was reported that you conducted over a hundred experiments - what were the three most interesting for you?
2. What were the most unexpected results from your point of view and how do they fit in with results from previous flights (Spacelab, Mir, ISS)?
3. What experiment has the most promising (scientific/technical) potential and shall be pursued in the future according to your judgement?
4. Your own message?

Unfortunately those questions could not be answered due to other obligations, however Alexander Gerst agreed recently to an interview with the Bavarian TV (alphaforum: Alexander Gerst, Astronaut, im Gespräch mit Andreas Bönte) on 11th March 2015 where most of the questions above were discussed.
As a courtesy of the Bavarian TV we got the permission to translate the relevant portions of the transcript of the interview to English - for the benefit of the "Journal-" readers (the complete interview can be streamed from alphaforum):

1. What were the most important Experiments?

Bönte: What were the most impressive experiments? You had to carry out over a 100 experiments according to an elaborated flight plan. Was there one most important or impressive experiment? Or were those 100 experiments equal in their importance for you?

Gerst: All experiments are important because there exists an incredible number of scientists which are competing for having their experiment flown on the space station. There are much more experiments that we have time and space for to perform. Scientists therefore must show that their experiment firstly is relevant and secondly definitely could not be performed on Earth. This means that an experiment selected to be flown really must have it all: a unique justification and it must be very beneficial for us. But of course for some experiments their usefulness can be explained better

than for others. Some are dealing just with very abstract basic research. But important - they all are! For example we had several "material science" experiments on board with the purpose of developing and testing new alloys for aircraft engines, car engines, etc. Even for the next generation of smartphones such alloys will be needed. But we are also researching new semiconductor materials. If in space ...

Bönte: May I ask briefly interrupt here because that is a question repeatedly asked by myself and by colleagues: "They now test new alloys on board of the space station. Does this mean that in the future this new alloy can only be produced in space? "

Gerst: No, fortunately that is not the case. But we have in space the opportunity to test alloys in a completely different way than on Earth. These alloys are heated until liquefied i.e., red-hot glowing: We can investigate the alloys in this state because in weightlessness we can suspend the liquids in a vessel without the liquid alloy touching the walls of the vessel. As a result, we are able to elicit basic secrets that we can use back home to feed our computer models to accurately fill in missing parameters thus improving our models.

Once we have obtained those data we can run better simulations on Earth and might be able to design brand-new alloys by using our computer models. To do so, we urgently need this information which no scientist will be able to derive in our gravitational environment on Earth. That means, if in space we only once successfully obtain those characteristic data we have what we need to continue in the laboratories on Earth. This is true for many scientific fields, like in physics, materials science, biology, etc. We only need some key information derived from our experiments onboard and take it back to Earth and continue there.

2. What were the most unexpected results from your point of view and how do they fit in with results from previous flights (Spacelab, Mir, ISS)?

The original intention of my question was to find out whether there would be some continuity between previous human spaceflights and other missions or even the coordination of previous results between different science groups perhaps even between different national enterprises like US spacelab flights or Russian experiments on the MIR station. This was not addressed during the interview however, as can be seen under answer #3 below, it obviously takes a very long time to evaluate the science results and the experiment results are highly guarded out of academic interest or against competitors. However the editor has the feeling that the "non-invented-here" syndrome plays a role also as can be illustrated by a little example. The scientific results of the German D-2 spacelab mission (1993) were presented at the WPF Symposium in March 1994 ("Scientific Results of the German Spacelab Mission D-2", Norderney, March 14-18). The proceedings list shows under the topic "Solidification" (material science experiments) a total of 22 different experiments, covering "nucleation", " front dynamics", "composites" and "crystal growth". One "composites" presentation deals with "Re-melting and Solidification of Turbine Blade Samples Consisting of Ni-Base Alloys with an Oxide Dispersion". Since the creation of high efficient turbine blades and alloys is still an issue after 20 years of research, I was wondering whether the information exchange might not to be improved. (This comment was inserted by the Editor J. Kehr).

3. What experiment(s) has the most promising (scientific/technical) potential and shall be pursued in the future according to your judgement?

Bönte: When can we learn more about the results of the experiments? The evaluation probably will take a couple of months – but will we hear about the results in reasonable time?

Gerst: There are a few experiments which yielded already clear results. Of course, also those are not yet fully evaluated because thorough scientific work takes a while. But we have produced a good flow of data, and since my mission was not the first to the ISS, all the data of previous missions are being published right now. That means, there is a steady flow of documentation being published. But we also already detected a few amazing things with our experiments. For example, we have made an attempt to determine how the human skin ages in weightlessness. It is about the theoretical assumption that the skin will age faster in weightlessness. Now, what we can do up there against this aging effect of course also can help people on Earth – so, it ultimately affects all of us. However in my case we have seen that for some reason - we are not able to explain exactly why - the ratio of specific skin substances even improved: That means, in principle, my skin became younger while I was in space. This is a different result than previously collected data have shown. Now we need to explain why this happened.

Bönte: Are these experiments also conducted in view of a possible Mars mission?

Gerst: These experiments are of course useful in several respects – as always. If for example we investigate the phenomena of bone loss in space, then this knowledge naturally helps us in terms of planning a future Mars mission or long-duration space missions. This enables us to prohibit the loss of bone mass in astronauts. This was quite successful in my case: my bone mass almost remained constant by applying a strict training regime and other preventive actions. But this also helps people on Earth suffering from osteoporosis. Using this gained knowledge, counter measures can be applied more efficiently. We can test those measures better in space because the osteoporosis occurring in space is reversible. However, the osteoporosis afflicting us on board is progressing much faster than on Earth, so we are able to judge the applied remedies much better. Up there we can take more experimental chances without risking - as on Earth – that the situation for a patient might deteriorate. That means, we astronauts in this case are virtually the guinea pigs in orbit. And that really helps the patients on the Earth because osteoporosis therapies from our experiments have been developed and are already commercially available.

Bönte: I think it is very important to spread such results to the public. Because if you ask people what they think they might gain from space activities you still can hear the story about the Teflon pan.
Gerst: Which even wasn't a result of space research.

Bönte: Exactly, that even exacerbates the problem.
Gerst: The reason is the yielded results….

Bönte: ….simply are basic research results.

Gerst: … and are even not visible in all cases: If during a bypass heart surgery a "stent" is placed, then space developed material is used. Usually that is not known and it is probably also not that

important – but it shows that our daily life is influenced by space derived results without being obvious. Every smart phone uses materials derived by space research – but I know that not everybody is aware of that fact.

4. Your own message?

Bönte: What was your most surprising impression when looking down to the Earth? Was there ever such a thing as a surprise or were you prepared so well that this never happened? Was there something that really touched you?

Gerst: Definitely! Of course as a geoscientist I had an idea on how the earth looks like, I knew how thin the atmosphere is etc., I had all these numbers in my mind, I was prepared for everything - but not for this magnificent view. I believe there is nobody looking out up there who is not overwhelmed by what he sees. Seeing the Earth from "outside", aroused the feeling in me that the Earth actually might be a pretty small planet. If you look at the Earth from up there you actually can see that it is not large but quite small. And the atmosphere is not only incredibly thin but also volatile: the atmosphere looks like a vail of mist, layered on the surface of the Earth as if you could blow it away with a deep breath. That really was impressive, because I came to the realization how very fragile our planet is.
And at the same time you can see fires burning everywhere on Earth. Fires are virtually everywhere. Flying over Africa sometimes you can see several hundreds of fires burning at a time. Above the Amazon area as well! They use slash and burn in large style. These images are very peculiar in combination with this tangible fragility of our Earth and it really looks grotesque from the outside. Although this was known to me beforehand I really was deeply impressed to see how much of the Amazon rain forest is already gone and that it is vanishing unabated – and this triggered a very uneasy feeling. Because this is not a process we have realized it got to be stopped. No, this environmental destruction always continues.
It can also be seen from up there how people fight with each other, we were able to see the actual wars from above.

Bönte: Yes, I've read about it. You could see the war in Gaza. I would have never thought it possible that one can see something like that from above. What did you actually see?

Gerst: That was new for us also and we discovered it accidentally. One really can see the firing of the rockets and the subsequent bomb strikes. It can be seen as bright dots flying from right to left and left to right. But this was not restricted to the Gaza conflict, we could see it in the many conflict areas around the world. Watching from above this really looks bizarre - because the earth definitely is too small to fight each other: This can be seen from the outside very clearly.
On the other hand the conflicts are not so far away from us. If one flies above Israel and the Gaza Strip or other acute trouble spots often one can see Europe at the same time. So – Europe is not so far away as we imagine.
The same is true for the environment. The slash and burn activities cause smoke plumes spreading clearly visible over hundreds and thousands of kilometers. It becomes absolutely clear that whatever happens on our Earth always impacts the whole system. We must assume that we can do nothing on one continent not affecting another continent. In other words, we cannot assume that what affects China, would not have an influence on us. This is definitely not so, because this influence is

completely obvious. If you watch a hurricane from up there you are able to observe the huge weather system it is part of. Those weather systems are so huge that they can spread across a quarter of the globe. It is clear: Everything we do at one end of the planet has also an effect on the other end. This cannot be ignored!

Bönte: Now that you are back to Earth, you see it as your mission to spread the message in the coming months and years? Like: "Dear “earthlings”, I have seen the whole thing from above! Be aware this is a very fragile planet! "

Gerst: Yes, by all means. I planned this from the outset as part of my mission, just to spread my insights. Only human spaceflight activities enable us to get an outside perspective of our planet and see it with our own eyes.

March 2015, Joachim J. Kehr (Editor SpaceOps News, http://opsjournal.org)