

## Follow-up on the Geoengineering SCoPEX Experiment

Although the climate change discussions have been overshadowed by the Ukrainian invasion in February 2022, the global heating problem has not gone away and is intensifying. Therefore the motivation for the SCoPEX Experiment expressed in the first article [1] in May 2021 is as valid as ever.

*“If we implement all currently planned climate protection measures, we will run towards a global warming of at least 2.40° C degrees. We know the havoc this wreaks. So the question is not whether we should hurry - we have to release the brakes in all areas”.*

(Janine Wissler, Party Leader, Germany, in “Der Spiegel” Nr. 20/15.5.2021)

In May 2021 the Journal of SpaceOperations & Communicator (JSOC) reported about the geoengineering SCoPEX experiment as a possible meaningful research contribution to fight the global climate change, however with yet unknown harmful side effects. [1]

### *SCoPEX: Stratospheric Controlled Perturbation Experiment*

SCoPEX is a scientific experiment to advance understanding of stratospheric aerosols that could be relevant to solar geoengineering. It aims to improve the fidelity of simulations (computer models) of solar geoengineering by providing modelers with experimental results vital to addressing specific science questions. Such simulations are the primary tool for estimating the risks and benefits of solar geoengineering, but current limitations may make the simulations look *too* good. SCoPEX will make quantitative measurements of aspects of the aerosol microphysics and atmospheric chemistry that are currently highly uncertain in the simulations. It is not a test of solar geoengineering per se. Instead, it will observe how particles interact with one another, with the background stratospheric air, and with solar and infrared radiation. Improved understanding of these processes will help answer applied questions such as, is it possible to find aerosols that can reduce or eliminate ozone loss, without increasing other physical risks?

At the heart of SCoPEX is a scientific balloon, fitted with repurposed off-the-shelf airboat propellers. The repurposed propellers serve two functions. First, the propeller wake forms a well mixed volume (roughly 1 km long and 100 meters in diameter) that serves as an experimental ‘beaker’ in which we can add gasses or particles. Second, the propellers allow us to reposition the gondola to different locations within the volume to measure the properties of the perturbed air. The payload can achieve speeds of a few meters per second (walking speed) relative to the surrounding air, generally for about ten minutes at a time.



The advantage of the SCoPEX propelled balloon is that it allows us to create a small controlled volume of stratospheric air and observe its evolution for (we hope) over 24 hours. Hence the acronym, Stratospheric Controlled Perturbation Experiment. If we used an aircraft instead of a balloon, we would not be able to use such a small perturbed volume nor would we be able to observe it for such long durations. SCoPEX builds on four decades of research on the environmental chemistry of the ozone layer in the Anderson/Keith/Keutsch groups.

SCoPEX will use or adapt many of the high-performance sensors and flight-system engineering experience developed for this ozone research. Analyzing these experiments will improve our knowledge beyond what is currently available within computer models or is measurable with confidence under laboratory conditions. [2]

### *Status as of March 2023*

The first technical test flight for SCoPEX from the Swedish sounding rocket range Esrange as planned for June of 2021 was cancelled and is still pending as of today (March 2023) because of concerns of the Swedish Space Corporation (SSC).

“Climate change and its consequences is one of the greatest challenges we face on our planet. Research within this field is therefore important, and many of the experiments that are being conducted onboard balloons and rockets from Esrange Space Center contribute to such research.

To that end, the purpose of the SCoPEX project as such fits well into SSC services and mission to help earth benefit from Space.

However, the scientific community is divided regarding geoengineering, including any related technology tests such as the planned technical balloon test flight from Esrange this summer [June 2021]. SSC has had dialogues this spring with both leading experts on geoengineering and with other stakeholders, as well as with the SCoPEX Advisory Board. As a result of these dialogues and in agreement with Harvard, SSC has decided not to conduct the technical test flight planned for this summer”.

Whether or not research on geoengineering should be conducted is an important discussion that should continue within the scientific community, as well as with other stakeholders and the general public. SSC welcomes such a broad societal discussion on this important matter. [3]

On March 1, 2021 the following update was issued by the SCoPEX Advisory Committee:

“The SCoPEX research team fully supports the Advisory Committee’s recommendation that any equipment test flights in Sweden need to be suspended until the committee can make a final recommendation about those flights based on robust public engagement in Sweden that is broadly inclusive of indigenous populations. Our research team intends to listen closely to this public engagement process to inform the experiment moving forward. We also appreciate the close technical collaboration with the Swedish Space Corporation (SSC) and the thoughtful way SSC has approached this topic.” [4]

*It's important to note that even if the experiment is carried out in the future, the results may not be conclusive or final, and any potential implementation of geoengineering strategies would need to be approached with caution and careful consideration of the potential risks and benefits. [5]*

### References

- [1] May 2021, Joachim J. Kehr Journal of Space Operations & Communicator [https://opsjournal.org/DocumentLibrary/Uploads/Diamonds%20in%20the%20Sky\\_final.pdf](https://opsjournal.org/DocumentLibrary/Uploads/Diamonds%20in%20the%20Sky_final.pdf)
- [2] SCoPEX <https://www.keutschgroup.com/scopex>
- [3] <https://sscspace.com/no-technical-test-flight-for-scopex-from-esrange/>
- [4] Statement <https://www.keutschgroup.com/scopex/statements>
- [5] Final statement by AI chatGPT to which I fully agree.