

Celestial Objects and Aeriform Masses: Resident Space Object Near-atmospheric Edge Reconnaissance

Grace Grothaus, PhD student

*Department of Digital Media, York University, Toronto, Canada
www.gracegrothaus.com, ggrothau@yorku.ca*

Kieran Maraj, PhD student

*Department of Digital Media, York University, Toronto, Canada
https://kieran.earth, kmaraj@yorku.ca*

Dr Joel Ong, BSc, PhD.

*School of the Arts, Media, Performance & Design, York University, Toronto, Canada
www.arcfrequencies.com, joelong@yorku.ca*

York University Nanosatellite Lab led by Dr Regina Lee, PEng, PhD.

*Lassonde School of Engineering, York University, Toronto, Canada
Nanosatellite.lab.yorku.ca, reginal@yorku.ca*



Portrait of first author, Grace Grothaus.

Abstract

The new era of space exploration and its accompanying technologies have illuminated the farthest reaches of the cosmos, inspiring visions of future terraforming and celestial elevation. Space is now increasingly seen as the

forefront of curiosity-driven research, with boundaries continuously expanding thanks to increasingly powerful telescopes and image reading machines that catalogue and identify new discoveries. The intensive foraging through the firmament promises new and profound revelations about us and the universes around us. As we continue to venture into the celestial realm, navigating the passage of light through the darkness and blending myth with technology, it is inevitable to question: have we, in our quests and ambitions, become celestial objects ourselves?

"Celestial Objects and Aeriform Masses" is a generative animation, drawing from data collected by researchers across various disciplines and backgrounds in York Nanosatellite Lab, led by Regina

Lee.[1] Acknowledging that access to space is not uniform, this artwork is part of a broader project directed by Joel Ong in collaboration with her lab that examines the involvement of marginalized groups, including Indigenous, racialized, gendered individuals, and those often considered amateurs by Western science.[2]

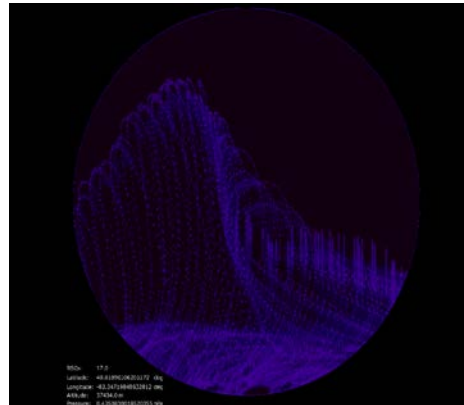
Utilizing data from a Resident Space Object Near-Atmospheric Edge Reconnaissance (RSOnar) nanosatellite, specifically latitude, longitude, altitude, and pressure, Grothaus has created an endlessly generative visualization in TouchDesigner that evolves through periodic rhythms: depicting atmospheric swirls and evolving colours in the form of a lunar scape. Iterative loops are formed out of a time-based generative algorithm with motion influenced by RSONar latitude and longitude readings, while altitude and pressure determine the values of red and blue channels combined to reveal shifting hues of purple. Inspired by astronomers' use of redshift and blueshift to gauge an object's distance from Earth, Grothaus attempts a poetic interpretation of the Space Situational Awareness (SSA) data collection and astronomy's reliance on analysis of the colour shifts in charting the universe's expansion which she views as deriving from an unending quest to learn more about matter's collective origins.[3]

1. "Celestial Objects and Aeriform Masses"

"Celestial Objects and Aeriform Masses" is a generative animation created by Grace Grothaus, drawing from generative time-based algorithms and the dataset

collected by Lee's Nanosatellite Research Laboratory via the Resident Space Object Near-Atmospheric Edge Reconnaissance (RSOnar) CubeSat aboard CSA Stratos balloon Gondola.[4]

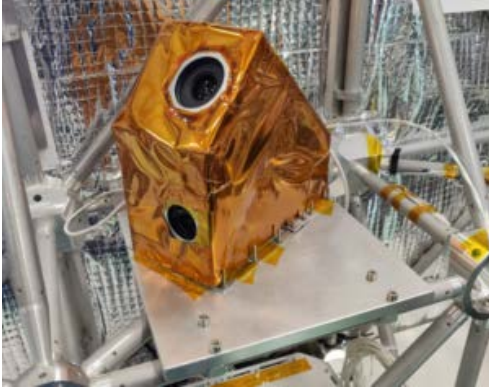
Grothaus' generative visualization designed in software TouchDesigner, evolves circularly through periodic rhythms, referencing atmospheric currents and a lunar landscape. Taking an approach of interpretation rather than direct analysis of the dataset, Grothaus is interested in the data's poetic possibilities and manifold expressions.[5]



"Celestial Objects and Aeriform Masses," 2023 by Grace Grothaus.

In the artwork, iterative loops arise from a time-based generative algorithm influenced by RSONar latitude and longitude readings, while altitude and pressure determine the values of red and blue channels, inspired by astronomers' use of redshift and blueshift. Grothaus attempts a poetic interpretation of the Space Situational Awareness (SSA) data collection and astronomy's reliance on analysis of colour shifts in star field images for the purpose of charting the universe's expansion. She views this line

of scientific inquiry as deriving from humanity's unending quest to learn more about matter's collective origins.

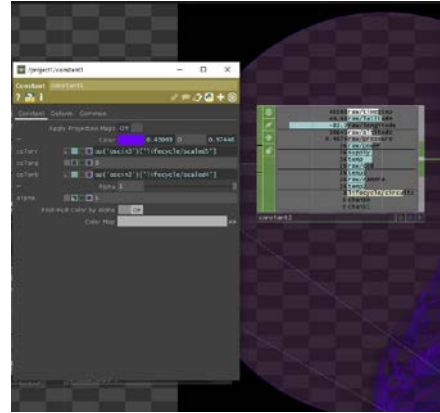


RSONAR Payload Integrated onto Stratospheric Balloon Gondola.

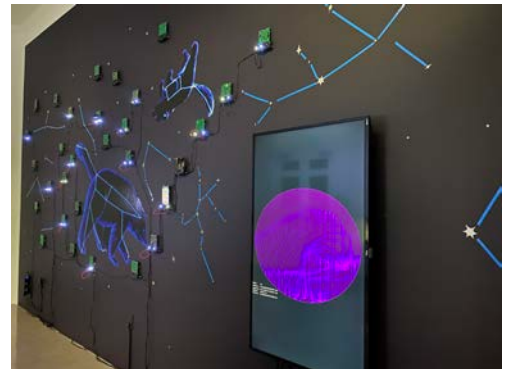
Grothaus is a computational media artist whose research questions center around planetary concerns in relation to the present global climate crisis and speculative futures. She endeavours to make invisible phenomena experienceable for the purpose of revitalizing our connections to our environments, engaging participants in thinking of holistic ecologies, and interrogating questions about the supposed separation of planetary built and natural systems. Frequently collaborative, Grace works with scientists, engineers, musicians and other visual and performing artists, as she has done in the development of this generative artwork.

"Celestial Objects and Aeriform Masses," was created using Derivative's software TouchDesigner for its strengths in realtime rendering, evolving out of her longer trajectory of work in visualization of environmental data and early

experiments in Processing and Isadora.[6]



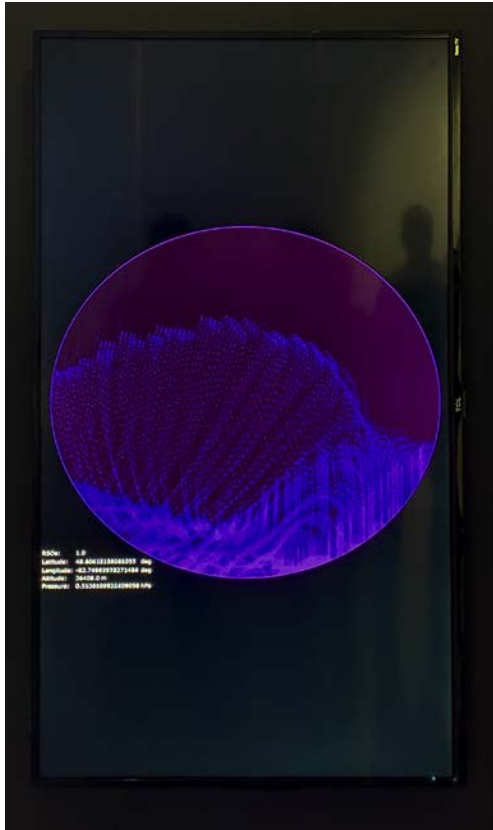
Altitude and pressure data in Touch Designer.



The Life Cycle of Celestial Objects Pt. 2 installation view.

The artwork, premiered at Western University's McIntosh Gallery as part of The Life Cycle of Celestial Objects Pts. 1 & 2, curated by Helen Gregory and Joel Ong from September to December 2023, as part of a larger installation incorporating decommissioned satellite parts and prototype builds displayed as

constellations on a backdrop of the night sky.[7] For the 26th Generative Art Conference, Grothaus proposes the standalone temporary installation of "Celestial Objects and Aeriform Masses" as either a projection or monitor display:



"Celestial Objects and Aeriform Masses," installed on monitor.

2. "Space Situational Awareness and Us"

"Celestial Objects and Aeriform Masses," was created out of data collected by researchers across various disciplines and backgrounds in the York University Nanosatellite Research Lab within the

Earth and Space Science and Engineering (ESSE) department at York University led by Professor Regina Lee, a strong advocate for gender equality and diverse systems of knowledge in the engineering fields. Her group's research centres on next generation satellite technologies for Space Situational Awareness (SSA), and microphotonic payloads for small satellites.

Increasingly, Regina Lee's work has taken the lab towards innovative scientific presentations and community science communication activities including talks at the Ontario Science Centre as well as creative work around the CSA Stratos balloon launch in Timmins August 2023. In this project, nanosatellite RSONar was launched aboard stratospheric balloon Gondola equipped with an integrated payload collecting data for subsequent analysis.

Since 2021, her lab has been working with faculty and students from the School of the Arts, Media Performance and Design on maximizing interdisciplinary expertise. Regina is co-PI on a SSHRC NFRF-E with Professor Joel Ong entitled "Space Situational Awareness and Us". Joel Ong and his research team (comprising Grace Grothaus, Luca Cherpillod, and Kieran Maraj) have made artistic use of data collected by RSONar, including latitude, longitude, altitude, and pressure, contributed to the development of this larger SSA initiative in collaboration with. Their collective effort seeks to illuminate the work of Regina Lee's lab while situating it within broader contexts centered on the material artifacts and social engagement of satellites and engineers engaged in the burgeoning field of SSA through RSO observation/recognition.

Collectively their approaches encompass various forms of media art, scientific models, interactive projects, and a comprehensive series of science engagement events endeavouring to uncover diverse, decentralized narratives surrounding space exploration, proposing collaborative approaches to cosmic futures. In an era marked by unprecedented accessibility and the democratization of tools, their projects challenge the notion of space as merely a 'new frontier' ripe for appropriation and extraction. Instead, they frame space as a pivotal domain for collective participation in pioneering explorations above our planet.

Their mission aligns with the quest described by Gregory Cajete as a "participatory consciousness to the conception of the heavens." [8] It delves into themes of community science, citizen engagement, and education while scrutinizing the concept of wonder as an unbiased ideology in the realm of space exploration. This work has received support from Sensorium: Centre for Digital Arts and Technology, the School of the Arts, Media, Performance & Design, CRSH-SSHRC, the Ontario Arts Council, and the Canada Council for the Arts.

3. References

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