IAF EARTH OBSERVATION SYMPOSIUM (B1)
Mitigating the Climate Crisis from Space (6)

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DEVELOPING A SMALL SATELLITE MISSION TO MONITOR OCEAN ACIDIFICATION WITHIN THE POLAR SEAS

Abstract

About a quarter of the carbon dioxide (CO2) released into the atmosphere is reabsorbed by the oceans every year thus decreasing the global ocean's pH level. Seawater acidification presents a serious threat to a variety of marine species in terms of biotic potential, survival rates, and mobility. Specifically, the polar seas are acidifying more rapidly in comparison to the global ocean, making this region an area of interest to monitor the latest effects of climate change.

Earth observation (EO) payloads offer unique imaging benefits, such as wide, unobtrusive observations, uniformity, near real-time data collection, and much more. They can be used to map changes occurring in the planet's atmosphere as well as in the complex water network. The hostile nature of the polar seas makes it difficult to perform repeated and timely in-situ measurements and thus, earth-orbiting satellites are capable of remotely imaging difficult to reach areas, making them particularly suitable for monitoring this region.

This approach presented in this paper takes advantage of small satellites' cost efficiency to test newer payloads and technologies in such regions. The objectives of this paper are three-fold; firstly, it highlights the current state of Ocean Acidification (OA), within the sensitive polar regions of our planet. Secondly, it proposes a constellation of small satellites for the dedicated monitoring of these effects on the planet's cryosphere. In particular, it addresses essential mission parameters to achieve these objectives, including payload selection, orbit design, mass and power budgeting, data handling and communication, and end-of-life disposal. Lastly, the benefits of this increased monitoring are addressed, including the socio-economic impacts on immediately-affected regions.

Additionally, this mission provides a framework for the development of future EO missions within and beyond the polar regions. The proposed mission parameters, which specifically tackle the challenges of hostile regions, and selection methodology can be adapted for various geographical areas of interest. The thorough design process outlined in this paper targets more precise areas and issues, setting the

foundation for the implementation of small satellite missions within new and existing constellation systems. The development of this mission has been conducted by a multinational and multi-disciplinary team of students and young professionals, on behalf of the Small Satellite Project Group (SSPG), a subset of the Space Generation Advisory Council (SGAC).