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Keynote Speaker

Jakob van Zyl

Co-founder and CEO - Hydrosat Inc

Speaking Topic: **System Engineering of Low-Cost Earth Observing Systems**

Biography. As a Principal for Physical Sciences, Jakob oversees the diverse portfolio of investments across the spectrum of physical science disciplines; each holding the promise of providing fundamental advancements to everyday life. His responsibilities include the end-to-end cycle of technology development and transition–from the identification of cutting-edge, new technologies with high impact potential to working daily with new companies as they transition from a possible incubation to a Series A investment.

Prior to joining Kairos, Jakob spent 33 years at the Jet Propulsion Laboratory in Pasadena, California where he started as a researcher in 1986. He joined the JPL Executive Council in 2002 where he served as the Director for Astronomy, Physics and Space Technology, the Associate Director of JPL responsible for Project Formulation and Strategy, and the Director for Solar System Exploration. He was instrumental in the development of innovative technologies during his time as Associate Director, including the first deep space small satellites to launch and operate all the way to Mars (2018) and the demonstration of a small helicopter for increased mobility on Mars, to be launched in 2020. He concluded his career at JPL with the spectacularly successful landing of the Insight lander on Mars in November 2018.

Jakob is the coauthor of the texts Introduction to the Physics and Techniques of Remote Sensing: Second Edition and Synthetic Aperture Radar Polarimetry. He has contributed to eighteen other books and published more than 60 papers in peer-reviewed journals and gave numerous keynote speeches at technical conferences. Besides being a Principal, Physical Sciences at Kairos Ventures Investments, he is also the CEO and co-founder of Hydrosat, a data analytics and space remote sensing startup company and a Senior Faculty Associate at Caltech where he teaches the graduate course Physics and Techniques of Remote Sensing and an Extraordinary Professor at the University of Stellenbosch in South Africa.

Abstract. Remote sensing of the Earth as a system has long been the exclusive domain of large government programs. These investments have created a wealth of scientific knowledge and led to significant advances in technologies that could simplify the implementation of future space missions. But there is an inherent mismatch in expectations between broad scientific missions and focused commercial efforts. In the former, performance is of paramount importance, while in the latter cost plays an outsized role.

In the last decade, several start-up companies have emerged to provide some of the data that these government satellites used to provide. In most cases, these commercial satellites are very low cost, partly because either they do not provide the same exquisite quality of the scientific satellites, or they provide only a small subset of the data either in their spatial or spectral coverage. A key difference of course is the fact that commercial satellites have to have a business case that closes. As a result, non-essential observations are eliminated. In addition, often these commercial systems built on decades of government investment in technology.

n this talk we shall examine these differences and focus on the systems engineering behind the Hydrosat constellation of low-cost thermal infrared satellites. It is well established that the difference between the land surface temperature (LST) and the ambient air temperature provides a direct measurement of plant water stress. Today, the best available resolution for daily LST is 750 meters to 1 km; far too coarse a resolution for global agricultural applications. Hydrosat will launch a constellation of small satellites to image the entire globe in the thermal infrared to provide a global map of LST every day at a spatial resolution of 70 meters. We shall discuss how these parameters came about and discuss the system engineering that translates these parameters into a space constellation.