

Reflections

Friedemann Freund and Hisako Matsubara

It is not easy to write about one's own son whose life was cut short in the prime of his life. Mino was the Director of the Center for Nanotechnology at the NASA Ames Research Center in California, when – at age 46 – he started to experience extreme headaches that just would not go away. When he went to see a doctor, he was given the devastating news that a glioblastoma multiforme, GBM, had developed in the frontal lobe of his brain.

Mino was such an extraordinary person that even we as parents have to admit that we did not grasp the depth of his personality and range of his abilities. We failed to recognize his full potential. We are now left with a nagging feeling that we should have done more and could have done more.

Mino had come to the NASA Ames Research Center in 2006 after a long journey from his alma mater, the Federal Institute of Technology in Zürich, Switzerland, known as ETH, to the University of California in Berkeley, the California Institute of Technology at the Jet Propulsion Laboratory in Pasadena, the Japanese Space Research Institute, ISAS, the NASA Goddard Space Flight Center, and the Air Force Research Laboratories. His journey had taken him from low-temperature physics to cosmology to the new field of nanotechnology, of which he was one of the founders.

Supported by many who were drawn in by his contagious optimism and quick mind, Mino embarked at NASA Ames on a suite of ambitious projects from basic science to new satellite design. He promoted ideas, which others had not yet even started dreaming about, such as fleets of hundreds of nanosatellites, fully capable despite their diminutive size, flying in formation, and communicating with each other and the ground by lasers. He built prototypes of these nanosats, 10 x 10 x 10 centimeter cube, miniaturizing all electronic components so that they could fit into the limited dimensions of his nanosats yet powerful enough to carry out their mission in space. Mino worked tirelessly on this complex project and on the challenges posed by the need of cross-communication among so many nanosats travelling on different orbits around the Earth.

Mino was a trailblazer. He faced resistance from those in the established satellite community and at NASA Headquarters, who could not imagine how such a complex mission involving hundreds of nanosatellite would work.

Today, years after Mino has passed away, his ideas are very much alive. As Pete Worden, the former Director of the NASA Ames Research Center put it: *“Mino was – in his congenial way – quite an activist, a zealot, and a visionary. At first, we laughed a bit in disbelief, coining the word MinoSats. Today, Mino’s vision is being pursued around the world. MinoSats have become a reality”*.

Cosmology had filled Mino with awe for the vastness of the universe and its continuing expansion. Nanotechnology had given him a glimpse of the smallest dimensions, where the laws of classical physics no longer apply. His greatest pleasure derived from his love for Nature, watching the sun set over the Pacific Ocean or hiking among the giant redwood trees in Big Basin. Recognizing Nature's vast expanse and seemingly endless diversity filled him with gratitude and humility.