

Three Frontiers to Challenge our Imagination

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If asked the question: where is *the unknown* on Earth in 2018, you have to think carefully before answering. While there may remain a few peaks yet un-scaled or a few jungle areas yet un-trodden by modern people, they are rare, diminishing, and unimportant. The true terrestrial exploration challenges are done. Antarctica was the last stand of heroic surface exploration. Today tourist flights land at the South Pole three times a week in the austral summers. Everest is climbed by hundreds a year, all pampered by patient guides, most of whom are no longer of the Sherpa tribe – the latter own the lucrative tourist hostels in the high Himalaya. The ocean floors, while still not a place for common visitation, are mapped, known, and accessible with modern technology. And while there is talk of space exploration, in fact there is no space exploration¹, only a scarce few humans circling the Earth in pressurized spacecraft. Exploration is the process of placing your boot in territory never before seen by humans. It has been 45 years since any human did any true exploration in space.

The last holdout of truly unexplored land on Earth is underground – deep inside natural voids of unknown extent and depth inside the Earth, in places that remain so remote, so technically difficult to assault, so physically and psychologically taxing, that they represent both the last terrestrial frontier and currently the only place where true physical exploration is taking place by humans in the classical sense. These places are demanding, uncomfortable, existentially threatening, and yet taunting in a way that, to a true explorer, is irresistible. Scott and Shackleton would be expedition cave explorers if they were alive today. Sistema Cheve, in southern Mexico is, as of 2018, perhaps the quintessential place where all of these factors come together, and it attracts – as did Antarctica in the late 1890s and for 20 years after – an extraordinary and rare type of individual. There is one significant difference: to participate at the highest levels of cave exploration in 2018 requires being an extraordinary multi-disciplinarian: combining the skills of cartographer, photographer and videographer, rope-access specialist, big wall climber, technical diver, and field logistics tactician. And, they must be comfortable doing that in complete, sustained darkness for months. There are only a handful of such individuals on the planet and they come from diverse backgrounds, which is why the organization of a major push on Sistema Cheve means canvassing the world to build a team.

This talk will discuss the upcoming 2018 international expedition to Sistema Cheve and will then branch into the cutting edge technological world of planetary robotics, and specifically progress that has been made since 2007 in developing systems to search for the first signs of life off Earth. Extraordinary and unusual robotic systems have been developed to penetrate tens of kilometers of cryogenic ice and then deploy an ocean exploring under-ice autonomous vehicle that is designed to detect and classify microbial life. Details of field deployments to glaciers in Alaska and three expeditions comprising a year of work in Antarctica will be presented. The talk will close with a brief discussion of the future of human space exploration and ways by which we could change the current paradigm of space access.

¹ This is in reference to exploration by humans in the classical sense. There is, of course, an entirely new paradigm (beginning in 1957) involving exploration by remote robotic systems, and indeed since 1973 the only new knowledge of the Solar System has come from such probes.