

# The Era of Human-Robot Collaboration: Deep-Sea Robotic Exploration

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## Abstract

The promise of oceanic discovery has intrigued scientists and explorers, whether to study underwater ecology and climate change, or to uncover natural resources and historic secrets buried deep at archaeological sites. This quest to explore the oceans requires expert human access, but much of the oceans is inaccessible to humans. Reaching these depths is imperative for understanding the ecology, maintaining, and repairing underwater structures, and working in archaeological sites over this immensely unknown part of our planet. This challenge demands human-level abilities at depths where humans cannot or should not be. Ocean One was conceived to create a robotic diver with a high degree of autonomy for physical interaction with the environment while connected to a human expert through an intuitive interface. The robot was deployed in an expedition in the Mediterranean to King Louis XIV's flagship Lune, lying off the coast of Toulon at ninety-one meters. The discussion focuses on the development of a new prototype, OceanOne<sup>K</sup>, with the ability to reach 1000 meters. Distancing humans physically from dangerous and unreachable spaces while connecting their skills, intuition, and experience to the task promises to fundamentally alter remote work. These development show how human-robot collaboration induced synergy can expand our abilities to reach new resources, build and maintain infrastructure, and perform disaster prevention and recovery operations - be it deep in oceans and mines, at mountain tops, or in space.

## Biography of Oussama Khatib

Oussama Khatib received his PhD from Sup'Aero, Toulouse, France, in 1980. He is Professor of Computer Science and Director of the Robotics Laboratory at Stanford University. His research focuses on methodologies and technologies in human-centered robotics, haptic interactions, artificial intelligence, human motion synthesis and animation. He is President of the International Foundation of Robotics Research (IFRR) and a Fellow of the Institute of Electrical and Electronic Engineers (IEEE). He is Editor of the Springer Tracts in Advanced Robotics (STAR) series, and the Springer Handbook of Robotics, awarded the American Publishers Award for Excellence in Physical Sciences and Mathematics. He is recipient of the IEEE Robotics and Automation (IEEE/RAS) Pioneering Award (for his fundamental contributions in robotics research, visionary leadership and life-long commitment to the field), the IEEE/RAS George Saridis Leadership Award, the Distinguished Service Award, the Japan Robot Association (JARA) Award, the Rudolf Kalman Award, and the IEEE Technical Field Award. Professor Khatib is a member of the National Academy of Engineering