

# Reactive Reefs

Telling the story of how the world's reefs are changing and adapting using UAV Fluid Lensing and underwater giga-pixel imagery

By: Ved Chirayath, NASA Ames Research Scientist, PhD Candidate, Stanford University

[www.vedphoto.com/reactive-reefs](http://www.vedphoto.com/reactive-reefs)

Reactive Reefs is the highest-resolution underwater mapping effort in history. An interdisciplinary reef imaging and mapping project, Reactive Reefs combines a novel remote sensing technology on unmanned aerial vehicles, Fluid Lensing, and underwater giga-pixel panoramas to provide the first immersive, three-dimensional, *sub-centimeter-scale* optical aerial maps of at-risk reef ecosystems over areas as large as 15 square kilometers including the coral reefs of Ofu Island, American Samoa and the stromatolite reefs of Hamelin Pool, Shark Bay, Western Australia.

In addition, Reactive Reefs is a community-supported immersive photography exhibition that aims to transport the audience beneath the ocean's surface to discover firsthand how the world's coral reefs change as a result of both natural and human pressures. My primary objective is to communicate how our planet's reefs are changing and motivate conservation and protection for reef ecosystems around the world through remote sensing and monitoring.

Increasing ocean temperature and pollution cause "bleaching", whereby the corals or anemones lose the algae from their tissues and thus their coloration. Without these symbiotic organisms the host animal struggles to survive, and, unless the process is reversed, will die.

Corals and anemones live in mutualistic symbioses with single-celled algae in which the algae provide nutrients produced by photosynthesis to the host in exchange for both shelter and certain chemicals that they need. The algae live within coral and anemone cells and they are what give them their colors.

The exhibition consists of five components to immerse the viewer in the 3D reef ecosystem: 1. Two

3D-printed projection mapped dioramas of Ofu and Stromatolite reefs (40 cm x 20 cm x 15 cm, mockup on left). 2. 3D flythrough display with active 3D projection (1.2 m, mockup on right). 3. Dye sublimation aluminum prints of high-resolution gigapixel underwater imagery synthesized from thousands of high-dynamic-range photographs (90 cm x 90 cm on easels, bottom image). 4. iPad kiosk with video walkthrough and explanation of project. 5. Reactive Reefs brochures with links to free online content to download and explore the reefs virtually.

