



AMERICAN MUSEUM OF NATURAL HISTORY

Media Inquiries:

Kendra Snyder, Department of Communications
212-496-3419; ksnyder@amnh.org
www.amnh.org

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NEXT-GENERATION DEEP-DIVING EXOSUIT ON RARE PUBLIC DISPLAY AT AMERICAN MUSEUM OF NATURAL HISTORY

**ATMOSPHERIC DIVING SYSTEM ALLOWS PILOT TO PLUNGE 1,000 FEET,
EXPLORE MARINE BIODIVERSITY WITH DEXTERITY**

ON DISPLAY FEBRUARY 27-MARCH 5, 2014

The “Exosuit,” a next-generation atmospheric diving system capable of taking a diver down 1,000 feet at surface pressure, will be on temporary display at the American Museum of Natural History from February 27 to March 5 in the Irma and Paul Milstein Family Hall of Ocean Life. Measuring about 6.5-feet tall and weighing more than 530 pounds, the hard-metal suit offers divers protection from the ocean’s pressure, which at 1,000 feet is 30 times the surface pressure, while allowing them to maintain the dexterity and maneuverability to perform delicate tasks, such as sampling and imaging marine biodiversity with high-resolution underwater cameras. Owned by the J.F. White Contracting Company in Framingham, Massachusetts, the first-production Exosuit – currently the only suit in existence – will be tested as a scientific tool this July on the Stephen J. Barlow Bluewater Expedition.

“Our access to these deeper open water and reef habitats has been limited, which has restricted our ability to investigate the behavior and flashing patterns of bioluminescent organisms, or to effectively collect fishes and invertebrates from deep reefs,” said John Sparks, a curator in the Museum’s Department of Ichthyology who has led a series of marine expeditions across the globe, most recently the Museum’s Explore21 Solomon Islands Expedition. “The Exosuit could get us one step closer to achieving these goals.”

This July, about 100 miles off of the New England coast, a team of researchers and dive experts will use the Exosuit to investigate an area called “The Canyons.” This

underwater geographic region marks a precipitous drop from the continental shelf to depths of more than 10,000 feet. The Exosuit will allow the science team to conduct studies at depths up to 1,000 feet in the mid-water, or mesopelagic, zone. Many animals, including those that bioluminesce – that is, generate visible light through a chemical reaction – migrate vertically through this zone at night as they move from the abyss to shallower waters. Previously, these organisms have primarily been studied after coming up in trawl nets or via remote instruments.

Researchers plan to use the Exosuit together with a custom-made remotely operated vehicle (DeepReef-ROV), recently developed with National Science Foundation support (Grant No. 1040321 to Baruch College) and designed specifically to study bioluminescence and biofluorescence by taking high-resolution images of marine animals in their natural habitat. The Barlow Bluewater Expedition, which is supported by the J.F. White Contracting Company, will be the first effort to directly study the mesopelagic habitat off of New England by using robotics together with a human diver in an atmospheric dive suit. The goal is to record luminescent flashing patterns from a variety of mid-water organisms and to identify new bioluminescent proteins that could be valuable in biomedical research for cancer cell tagging and the development of brain activity probes.

“Bioluminescent proteins can be used to translate invisible processes in cells into flashes of light, allowing scientists to open new doors into cell function and dysfunction. Modern optical methods to monitor and manipulate cellular function have dramatically advanced the field of experimental biology,” said chief scientist Vincent Pieribone, a researcher at the John B. Pierce Laboratory at Yale University and a research associate at the Museum. “Currently there are only a few bioluminescent proteins in use by scientists, but the deep ocean is full of glowing organisms and offers the richest hunting grounds for new discoveries.”

Pieribone was one of several researchers on the Museum’s Explore21 Solomon Islands Expedition in September 2013. On that trip, Pieribone, along with Sparks and David Gruber, a marine biologist at Baruch College, City University of New York, and a research associate at the Museum – both of whom are also collaborators on the upcoming Barlow expedition – looked for novel occurrences of bioluminescence and biofluorescence in fishes, corals, and other marine organisms using submersibles, custom-built underwater low-light

cameras, novel collecting methods, and on-board genomic sequencing tools. This work contributed to the [first report](#) of widespread biofluorescence, a phenomenon in which organisms absorb light, transform it, and eject it as a different color, in the tree of life of fishes (Sparks *et al.*, 2014).

Researchers expect that the Exosuit could be a powerful new tool for marine explorations in areas previously difficult to explore. Conventional no-compression SCUBA diving only affords routine excursions to the first hundred feet of depth. Advanced techniques allow for diving to several hundred feet, but human physiology sets practical limits for the type of work and amount of time at that depth. The Exosuit is the latest advance in atmospheric diving systems, which keep the pilot protected from the effects of pressure. Atmospheric diving suits have evolved since the early 18th century and have provided a number of groundbreaking moments in human ocean exploration, most notably oceanographer Sylvia Earle's untethered dive in 1979 to 1,250 feet in an earlier atmospheric diving system called the "JIM suit." The Exosuit, which incorporates 35 years of technological advances since that historical dive, is poised to broaden the capabilities of researchers to conduct scientific work in unexplored underwater habitats.

Designed and constructed by Nuytco Research Ltd., in North Vancouver, Canada, the Exosuit can help its pilot sustain hours of underwater work in environments where a wet diver would only have minutes. It is driven with four 1.6-horsepower foot-controlled thrusters and has 18 rotary joints in the arms and legs to allow movement and articulation of specialized accessories. Its predecessor, the "Newtsuit," was recently used by divers to complete repairs on aqueduct shafts supplying freshwater to New York City.

The temporary display of the Exosuit at the Museum will culminate on March 5 with a SciCafe led by Sparks, Gruber, and Pieribone called "[Into the Abyss: New Frontiers in Deep Sea Exploration](#)." The program is free and open to the public.

Additional collaborators on this project include researchers from the University of Rhode Island and Arizona State University.

The Museum greatly acknowledges the Dalio Foundation for its generous support of the inaugural Explore21 expedition.

The Museum's SciCafe series is proudly sponsored by Judy and Josh Weston.

AMERICAN MUSEUM OF NATURAL HISTORY (AMNH.ORG)

The American Museum of Natural History, founded in 1869, is one of the world's preeminent scientific, educational, and cultural institutions. The Museum encompasses 45 permanent exhibition halls, including the Rose Center for Earth and Space and the Hayden Planetarium, as well as galleries for temporary exhibitions. It is home to the Theodore Roosevelt Memorial, New York State's official memorial to its 33rd governor and the nation's 26th president, and a tribute to Roosevelt's enduring legacy of conservation. The Museum's five active research divisions and three cross-disciplinary centers support 200 scientists, whose work draws on a world-class permanent collection of more than 32 million specimens and artifacts, as well as specialized collections for frozen tissue and genomic and astrophysical data, and one of the largest natural history libraries in the world. Through its Richard Gilder Graduate School, it is the only American museum authorized to grant the Ph.D. degree. In 2012, the Museum began offering a pilot Master of Arts in Teaching program with a specialization in Earth science. Approximately 5 million visitors from around the world came to the Museum last year, and its exhibitions and Space Shows can be seen in venues on five continents. The Museum's website and collection of apps for mobile devices extend its collections, exhibitions, and educational programs to millions more beyond its walls. Visit amnh.org for more information.

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