

Media Brief

Embargo: August 22, 2017

A Digital Expedition into an Active Volcano

The Future of Volcanic Early Warning Systems - Searching for Extreme Insights

Qwake and General Electric will launch a multi-media interactive web experience showcasing technological volcanic expedition into Nicaragua's Masaya Volcano. This groundbreaking expeditionary endeavor was a proof of concept to explore the role that A.I. and big data could play in early warning systems of the future.

Check it out at: www.ge.com/digitalvolcano

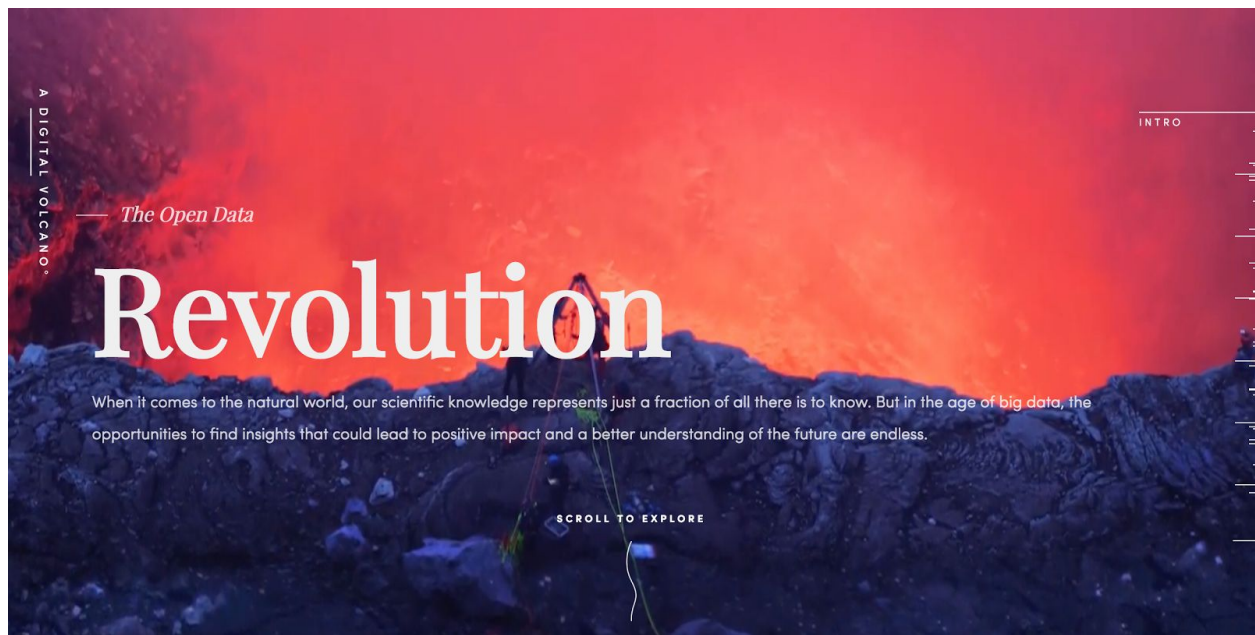


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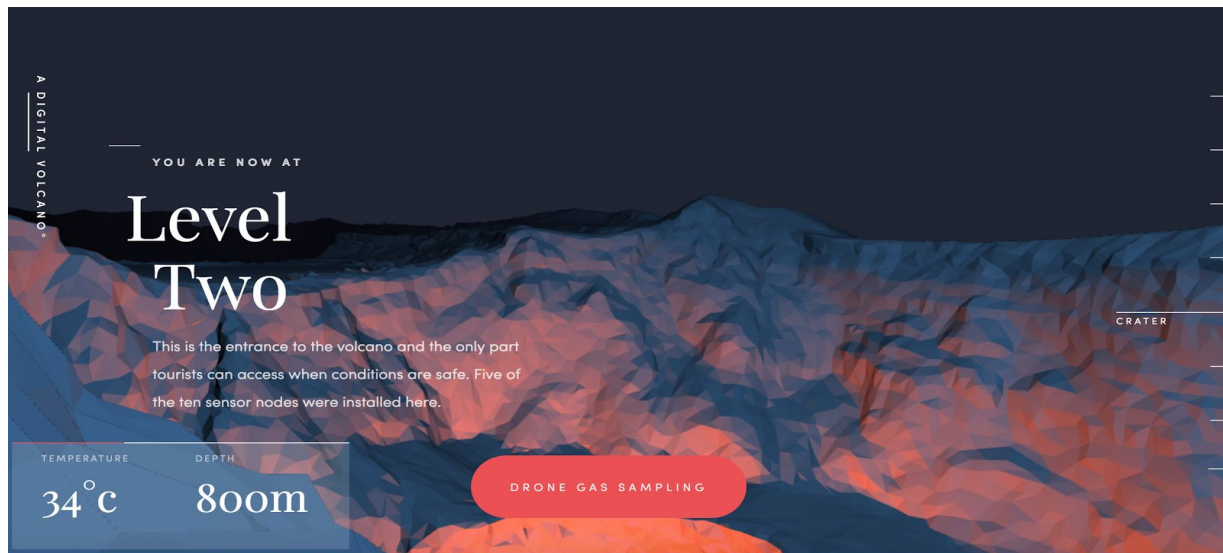
1) NEWS

This multi-national expedition initiated by tech explorer, Sam Cossman in partnership with GE and in close collaboration with the Government of Nicaragua fostered international diplomacy through scientific and technological endeavor for the greater good. The long-form narrative website created by Gin Lane provides an interactive experience which allows users to journey into the heart of an active volcano through interactive content at each level inside the crater. The experience also visualizes patterns in complex volcanic data revealing predictive insights about dangerous activity discovered through GE's Predix platform. With rapid advancements in artificial intelligence and machine learning, the next wave of earth science innovations has the potential to fundamentally expand our understanding of the volcanic process and our rapidly changing planet in its entirety. This expedition aimed to inspire the next generation of developers, scientists, engineers, explorers, and catalysts to solve global problems at scale through innovation.

2) QUICK FACTS

- GE / Qwake to launch an interactive website on August 22, 2017, featuring the Masaya volcanic expedition
- Rare lava lake (one of only 7 in the world) emerged inside Nicaragua's Masaya Volcano in 2016
- A cross disciplinary team of 60 innovators (explorers, scientists, engineers, hackers, astronauts, firefighters), organizations, and governments united to bring a volcano online to think about the future of early warning systems
- Team implemented first of its kind volcanic zipline into a crater the vertical height of the empire state building
- Explored the role A.I. and cloud-based analytics could play in the future for better predicting volcanic activity
- The initiative was driven by a collective desire to better protect the 800 million people around the world living exposed to volcanic threats
- Tested data-driven proof of concept early warning capability by installing 50 sensors in and around crater and identified complex patterns within multiple data sets
- Through low cost sensors and scalable cloud based computing, the expedition explored the potential for democratizing data collection and analysis
- Using five different types of sensors, the expedition team gathered volcanic data consistently for six weeks, including atmospheric pressure, gas emissions, temperature and humidity.
- Working closely with INETER, the Nicaraguan Institute of Territorial Studies, the team was also given access to seismic data from existing sensors.
- With this technology, the team closely tracked environmental data when a volcanic vent opened and then closed, providing key insights — and a large set of data for developers that can be used to help predict future volcanic activity.
- The project was powered by GE's Predix platform, designed for the industrial internet
- Leveraged UAVs equipped with Lidar and thermal cameras to map the crater with mm precision
- Created 3D models and the first complete radiometric images of a lava lake to identify new hazards and more effectively plan the mission
- Sampled volcanic plume with drones using drone mounted air collection systems

- Conducted first Facebook Live descent into active volcano (viewed by half a million ppl)
- Snapchat produced a featured story which also reached millions of viewers
- Project was in partnership with Qwake, GE, Government of Nicaragua (INETER)



3) BACKGROUND

A large number of volcanoes around the world are poorly monitored, with remote sensing often being the only tool to record changes in activity. In 2016, a sleeping volcano sprung to life in Nicaragua, forming the Earth's newest lava lake, one of only seven in the world. While this anomaly was cause for concern to the more than two million people living less than 10 miles away in the capital city of Managua, its accessibility provided a unique opportunity to conduct a groundbreaking volcanic expedition. In July 2016, Sam Cossman, tech explorer and founder of Qwake, an expeditionary innovation company, orchestrated a scientific endeavor with General Electric to bring the first volcano online with big data and predictive analytics. This proof of concept was a step towards developing next generation early warning capabilities for the many at-risk communities who live in constant fear of eruptions in Nicaragua and beyond. To access the remote shores of Masaya's active lava lake 1200 ft inside the crater, a team of scientists, engineers, explorers, and astronauts rode a first of its kind zipline which had been custom designed and implemented. After descending to the depths of one of the world's most active craters, the team installed a network of various sensors to identify new insights about the inner workings of volcanoes. The project was driven by a collective desire to improve the livelihoods of the 800 million people around the world exposed to volcanic threats. Through the use of low cost sensors, GE's cloud based analytics platform, Predix, and cross-disciplinary thinking, the goal of this expedition was to identify patterns within complex volcanic datasets to gain a better view of the big picture. Supported by Nicaragua's President Daniel Ortega and in partnership with General Electric, this proof of concept project was designed to expand understanding of the volcanic process at one volcano. The results of this experiment make clear the opportunity to develop full warning systems based on sensor networks measuring dynamic datasets, human observation and predictive analytics. This expedition brought one volcano online in order to extract previously unknown insights, imagine the possibilities of

connecting the worlds 1500 active volcanoes. In the future, real-time sensor networks and (A.I.) machine learning algorithms could set a new precedent for more accurately predicting volcanic eruptions through a connected worldwide volcanic web.

4) CORE TEAM

Comandante Daniel Ortega - President of Nicaragua
Wilfried Strauch - Lead Scientist, Seismologist, INETER
Sam Cossman - Expedition Leader - Catalyst, Volcanic Explorer
Hugo Nordell - Chief Technical Officer - Physicist, Machine Learning Software Engineer
Guillermo Carravantes - Chief Scientist, Volcanologist
Scott Parazynski - Mission Director, Former Nasa Astronaut, Physician
Michael Thompson - Chief Zipline Architect
Radley Angelo - Drone Pilot and Innovator
Sam Olstein - Director of Innovation, GE

5) COLLABORATORS / SUPPORTERS

Government of Nicaragua /INETER
Qwake / Qwake Technologies
General Electric / GE Digital / [Predix](#)
Scott Safety (a 3M company)
Mountain Hardware
Libellium
3DR
Newtex
Petzel

QWAKE

<https://www.qwake.com/>

Qwake is a global brand that merges ground-breaking expeditions with the development of cutting edge technology. Through cross-disciplinary collaboration, its team of engineers, scientists, astronauts, and explorers innovate out of necessity to solve global problems at scale. We operate on the belief that ideas with the greatest potential for addressing global challenges arise from cross pollinating, co-creating from inception. In partnership with GE, NASA, Lockheed Martin, and other fortune 100 companies and organizations, Qwake is re-defining exploration in the digital age while providing a new lens through which to view our planet. Currently focused on A.I. driven volcanic early warning systems and anti-poaching technology, we believe that true innovation takes place at intersections. The Qwake team is driven by a collective desire to drive positive impact while inspiring the next generation of scientists, technologists, and catalysts.

QWAKE TECHNOLOGIES

<https://www.qwake.tech/>

Qwake Technologies was originally formed as Qwake's Skunk Works on the belief that exploration is the engine that drives innovation. Out of volcanic exploration, C-THRU was forged as a next generation vision platform designed to save lives. By combining machine learning algorithms, high-speed thermal cameras, and augmented reality optics, C-thru provides firefighters with enhanced situational awareness in zero visibility conditions and seeks to redefine the future of firefighting through computer vision and augmented reality. Qwake Technologies builds products that move the needle for humanity.

SAM COSSMAN

<http://www.samcossman.com/>

Sam Cossman is an explorer and catalyst with a passion for scaling positive impact through technological expeditions. Driven by an ethos of multidisciplinary collaboration, his endeavors have captivated global audiences and lead to a greater understanding of our planet. With an appetite for projects just beyond the realm of possibility, Sam has ventured into some of the world's most extreme locations to peel back layers to the unknown. The founder of Qwake, an expeditionary innovation company that addresses challenges related to our rapidly changing planet, he has partnered with prominent influencers including Presidents of nations, leading organizations, and experts from NASA, MIT, National Geographic, Lockheed Martin, and others on disruptive projects ranging from space to deep sea.

6) [MEDIA DROPBOX FOLDER](#)

1. [EXPEDITION PHOTOS](#)
2. [BIO PHOTOS](#)
3. [VIDEOS](#)
4. [MOTION GRAPHICS](#)
5. [FACEBOOK LIVESTREAM](#)
6. [WEBSITE ASSETS](#)
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8. [LOGOS & MISSION PATCH](#)

Appendix

SCIENTIFIC METHODOLOGIES

Multi-sensor network: by installing a sensor network at the volcano that connects to a cloud-based data platform the possibility to store, analyze and identify meaningful patterns in the data collected from Masaya becomes more cost effective and effortless for researchers to access. A range of gas and atmospheric sensors were installed in order to test the feasibility of this approach. Over the course of 2 weeks data was collected and several new volcanic insights from unique data driven correlations were gained validating the usefulness of such a system as a powerful complement to existing methodologies.

Microgravity measurements: back in March 2016 a very unusual process was observed inside Masaya's Santiago crater (main crater). A pressurized directional jet of lava travelled within the main vent, and eventually the pressure decreased and the flow gradually disappeared. As this might be an indication of magma transfer processes within the volcano plumbing system, gravity experiments were designed to test this hypothesis and expand the currently installed microgravity monitoring network, we aim to continue the work that has allowed a continuous cycle of lava lake activity to be characterized, hopefully providing an insight on the physical processes taking place in depth.

Thermal mapping of the crater: using UAV-mounted FLIR thermal imaging cameras, a radiometric thermal map of the Santiago crater has been created and to better understand the hydrothermal and magma plumbing system in the pit crater area.

Photogrammetry: by stitching together a large number of high resolution photos of the volcano the geometry was determined in order to build a realistic 3D model that was used for structural interpretation, risk mitigation, and scientific outreach.

LIDAR imaging: by collecting a 1 cm resolution map built with Light Detection and Ranging technologies, a more precise understanding of the crater morphology was obtained that can be revisited to detect changes caused by volcanic activity over time.